



HAL
open science

Fast and Sustainable Development Space: An Integrated Approach

Ly Dai Hung

► **To cite this version:**

Ly Dai Hung. Fast and Sustainable Development Space: An Integrated Approach. 2021. hal-03408272

HAL Id: hal-03408272

<https://hal.science/hal-03408272>

Preprint submitted on 29 Oct 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Fast and Sustainable Development Space: An Integrated Approach

Ly Dai Hung

Vietnam Institute of Economics, Hanoi

Abstract

Objective:

The paper investigates the fast and sustainable development, then, discusses some policy implications to enhance the development process. The fast development is based on the economic growth rate combined with income distribution, while the sustainable development is based on the genuine savings per GDP and the biocapacity reserve.

Methodology:

The research method employs a quantitative analysis on a data sample of 172 economies over the 1992-2016 period. The empirical evidence is based on both a cross-section regression with each variable is average over time and a panel-data fixed-effect regression which captures the constant heterogeneity across countries.

Findings:

The empirical evidence records that the impact of economic growth rate on the income inequality follows an inverted-U-shaped curve or Kuznet curve, while its impact on the genuine savings per GDP and biocapacity reserve follows a linear increasing line. Based on this evidence, we also show that only 27/172 economies have available space to raise its economic growth rate over the fast and weak sustainable development path. And only 15/172 economies have available space to raise its economic growth rate along the fast and strong sustainable development path.

Implications:

The results suggest that an economy can first attain the objective of fast and weak sustainable development, then, the fast and strong sustainable development. The transmission from fast and weak sustainable development to the fast and strong sustainable development is difficult, thus, needs the appropriated public policy architecture.

Keywords: Fast and Sustainable Development; Cross-Section Analysis; Public Policy.

1. Introduction

The fast and sustainable development is important for both academic research and policy architecture. For the academia, the fast development is relevant for the neoclassical growth model, in which, an economy can grow with an exogenous rate determined by the technology progress (Solow, 1956; Swan, 1956). For the policy making process, the sustainable development is realized in the Sustainable Development Goals (SGDs) by the United Nations (1987) as the priority for the development process. And the combination of fast and sustainable development lays a ground for an economy to achieve a balanced-growth path as implied by the neoclassical growth model while still ensuring the sustainability. But this combination can impose new challenges for both academic and policy making. This also opens a research gap in the current literature. And the paper aims to fill in this gap.

The paper analyzes the fast and sustainable development space in the advanced as well as emerging and developing economies.

The paper investigates the fast and sustainable development in a sample of 172 economies over the 1992-2016 period. The fast development is based on the combination of economic growth rate with the income distribution, while the sustainable development is based on the genuine savings per GDP and by the biocapacity reserve. By these concepts, an economy achieves a fast and weak sustainable development when its economic growth rate being higher than the turning point of Kuznetz curve, for which the income inequality reduces for a higher economic growth, and positive genuine savings per GDP ratio. And an economy attains a fast and strong sustainable development when its economic growth rate being higher than the world average combined with stable income distribution and biocapacity reserve.

The research method employs an empirical cross-section model to examines the evidence in one cross-section data sample of 172 economies over the 1992-2016 period. Each variable is average over the time period, thus, is suitable to focus on the long-run equilibrium of the fast and sustainable development. Moreover, the cross-section method together with the fixed-effect panel regression stress the change of sustainable development indicators, including the genuine savings per GDP and biocapacity reserve, for an incremental increase of economic growth rate.

The empirical evidence records that there is only a small sample of 41 economies which has achieved a higher economic growth rate than the turning point of Kuznets curve, and weak sustainable development. Thus, these economies have achieved a fast economic development. Among these economies, only 27/41 economies have available space to raise its economic

growth rate over the fast and weak sustainable development path. And only 17 economies satisfying the fast and strong sustainable development, in which, 15/17 economies have available space to raise its economic growth rate along the fast and strong sustainable development path.

The paper makes contribution on two related lines of research on the economic growth and the sustainable development.

For the economic growth, the neoclassical growth model (Solow, 1956; Swan, 1956) show that, at the long-run equilibrium, the output grows with the rate of technology progress and labor force. The source of technology progress can be explained by the accumulation of physical capital (Frankel, 1962), the diversification of product categories (Romer, 1990) or by the innovation of new technology (Aghion and Howitt, 1992). Then, the economic growth can exert various social impacts. Kuznets (1955) projects that the income inequality first increases then decreases on the income growth rate. Thus, there exist an inverted-U-shaped curve on the dependence pattern of income inequality on the economic growth. From this seminal paper, there is a dynamic line of research testing the Kuznets curve with both supporting and rejecting evidence (Gallup, 2012; Piketty, 2006).

The current paper complements the literature on economic growth by an evidence confirming the Kuznetz curve that there exists an inverted-U-shaped dependence pattern of income inequality on the economic growth rate. In particular, the income inequality first goes up then goes down for an increase of economic growth rate. Using this evidence, we combine the income distribution of economic growth process with the sustainable development. Thus, it can be considered as an extension of Kuznet curve for the inter-relationship between the economic growth, income inequality and sustainable development.

For the sustainable development, the concept of sustainability is originated from the economic of exhaustible resources and ecology. Hotelling (1931) considers the sustainability of an economic development process. An economy can attain a sustainable development state when the price of exhaustible resource raises with a rate equal to the interest rate. From this idea, a various lines of research extended to different contexts (Devarajan and Fisher, 1981). Along this sustainable development path, the exploitation of natural resource is replaced by the creation of physical capital. Extending this principle, the ecology (Daly, 1990) proposes that the natural resource can only be replaced partially by the physical capital. Thus, the sustainable development requires the achievement of environmental reserve at each stage of economic development. Then, the ecology labels this type of development as a strong sustainability to

differ the weak sustainability as traditionally cited by the economics of exhaustible resources literature.

Our paper differs these aforementioned papers by analyzing the dependence of natural resource stock on the economic growth. Following Barua and Khataniar (2015), we consider the genuine savings per GDP ratio as a proxy for weak sustainability, and the biocapacity reserve as a proxy for strong sustainability. The empirical evidence records that for a higher economic growth rate, the genuine savings and biocapacity reserve tend to increase. Thus, an economy can have potential way to achieve both weak and strong sustainability.

Based on this empirical evidence, we also go further by investigating the combination of sustainability with the fast economic growth. An economy achieves a fast and weak sustainable development when its economic growth rate is higher than the world average and its genuine savings per GDP ratio is positive. And an economy has a fast and strong sustainable development for a higher growth rate than world average combined with biocapacity reserve. From this concept, we show that there are only several economies, 17/172, achieving the fast and strong sustainable development, while more economies, 41/172, attaining the fast and weak sustainable development.

The paper is structured as following. The first section on Introduction discusses the main ideas of the paper. The second section on Literature review records the research results on the fast and sustainable development. Then, the third section on Analysis framework shows the data description and associated empirical model. The third section on Empirical evidence investigates the fast and sustainable development space, then, is followed by the fourth section on Conclusion.

2. Literature Review

The fast and sustainable development is a dynamic literature, which attracts many papers both on the academic and policy aspects.

The fast and sustainable development is an optimal point which combines the economic growth rate with the socio-economic development. And this concept is discussed more in policy than in academia. The sustainable development has been widely analyzed, such as in documents by international institutions such as the World Bank and the United Nations. And the fast development can be understood as the economic state with higher economic growth rate than the world average growth rate. In brief, the fast and sustainable development is relevant to both contemporary theoretical foundations and practice of policy making.

Regarding the fast development, the process of economic development includes economic growth accompanied by stable income distribution (Rauniyar & Kanbur, 2010). The

growth process focuses on the level of income, while the development pays attention to the welfare level of the people, such as the ability to enjoy health services, education and income distribution. Thus, the fast growth can be decomposed into a high economic growth with an improvement or stability of the income distribution. In particular, the implications of fast growth need further clarification. When placing an economy in the world economy, the fast growth has two dimensions, including the state of being fast in time and being fast in space. The fast growth rate over time means that an economy has a faster growth rate than the growth rate of the same economy in the past. And the spatially fast growth rate is faster than other economies at the time of comparison. For example, the growth rate of Vietnam's gross domestic product (GDP) in 2020 reach 2.9% (Vietnam General Statistic Office, 2021). Compared to 2019's growth rate of 7.02%, the economic growth has not been fast over time. If compared with the average growth rate of the world economy reaching (-3.5%) according to the World Bank (2021), the economic growth is fast in space. In brief, the fast economic growth is based on the level of growth rate, whether in terms of time or space.

The economic growth has been studied intensively in the theories and experiments of growth. According to neoclassical growth theory (Solow, 1956; Swan, 1956), the ratio of total output to total effective unites of labor, which is measured by the level of technology multiplied by the labor force, is constant at the long-run equilibrium. So the total output will grow at the rate of technological progress plus the rate of population growth. This theory was later tested by the experimental evidence in Mankiw et al (1992). The evidence shows that, when the neoclassical model adds human capital, which is reflected in the knowledge level of workers, it can more closely reflect the current reality of economic growth around the world. Later endogenous growth theories clarified the origins of technological progress. Technological progress can be attributed to the accumulation of capital under the AK model (Frankel, 1962) or to the diversification of product categories according to the product variety model (Romer, 1990). Typically, according to the growth theory of Aghion and Howitt (1992), based on the idea of creative destruction (Schumpeter, 1947), technological progress is determined by research and development activities, which result in new technology being created, and completely replacing old technology. In short, economic growth depends on the rate of technological innovation and growth of the labor force.

Regarding sustainable development, researchers and policy makers have a fairly high consensus on dividing two types, including weak sustainability and strong sustainability. In particular, the weak sustainability concept is weakly based on the view of substitutability

between natural capital and physical capital created by human. The economic process exploits the natural capital such as mineral resources, thereby, losing this amount of capital. And the economic process also entails the construction of physical capital such as machines and factories. Since the natural capital and physical capital are substituted, the economic development is still sustainable as long as the total amount of capital, including natural capital and physical capital, is stable in the economy. Next, the strong sustainability concept is based on the complementarity, but not inter-changability, between the natural capital and physical capital. In particular, there are components of natural capital that cannot be replaced by the physical capital. Then, the economic development needs to ensure the stability of these components by preserving them, which cannot be compensated by the increase of physical capital. In brief, by these concepts, the weak sustainability is still easier to achieve than the strong sustainability.

The theory and practice of sustainable development are developed based on the intersection of two branches of research, including the environmental economics and the ecological science. The original principle of sustainable development is originated on the a seminal paper by Hotelling (1931) on "Economics of exhaustible resources". Accordingly, Hotelling's rule states that the price of a depleted resource must rise at a rate equal to the interest rate, under conditions of efficient exploitation and a perfectly competitive resource market. This rule is based on the substitution of natural and physical capital, thus starting the discussion of weak sustainable development that many economists then go on to study, such as Solow (1974). The science of economic ecology has expanded the connotation of weak sustainable development with the view that natural capital has not been completely replaced by human-made physical capital (Daly, 1990). Accordingly, the strong sustainable development focuses on the allocation of total capital between natural capital and physical capital in the process of economic development. This point makes a fundamental difference compared to the weak sustainable development, when only the stability of the total capital is taken into account in the development process. Currently, the concept of strong sustainable development has been integrated in the index on the genuine savings that the World Bank (2021), for which the aggregate savings eliminates the environmental damage caused by the economic process. Currently, the weak sustainable development continues to be used, directly reflected in the Sustainable Development Goals (SDGs) of the United Nations (Shi et al., 2019).

Corresponding to the lively discussion at the international level, rapid and sustainable development has also been intensively studied in Vietnam. Pham Van Linh (2011) analyzed the perspective of rapid and sustainable development in the 10-year socio-economic

development strategy 2011-2020. To develop quickly to shorten the level of development between our country and other countries in the world. And the fast and sustainable development is defined by the stable economic development associated with ensuring social security and protecting the ecological environment. And Nguyen Hong Son (2018), based on the classification of weak and strong sustainable development, analyzes that the fast and sustainable development is reasonable when looking at the economy and society. and the environment as a unified whole. Accordingly, the economy lies in society, and society lies in the environment. From there, technological and institutional progress will promote rapid economic development. When each step of economic development is closely and rationally combined with social justice and environmental conservation, rapid and sustainable development will also be achieved.

Phung Huu Phu (2019) mentioned that it is necessary to have the most comprehensive and comprehensive theoretical thinking about the fast and sustainable development. And among the three strategic breakthroughs within the long-term social-economic development strategy in Vietnam, including institutions, human resources and infrastructure, the institutions create the only and most important space to create new impetus for the country's development in the new period. This idea has also been further analyzed by Tran Quoc Toan (2018), pointing out that a fast and sustainable development institution needs to ensure eight important criteria, of which the first characteristic is high compatibility. Recently, Ta Ngoc Tan (2021) discusses that the institutions for sustainable development are an important condition for the realization of the fast and sustainable development in Vietnam. In particular, in its new development orientation, the political institutions play the central, decisive and dominant role for the institutions of the remaining fields.

In summary, the fast and sustainable development reflects the combination of economic growth rate with various stages of development, including the weak and strong sustainable development path.

3. Analysis Framework

3.1. Concepts

We consider the fast and sustainable development as the combination of high economic growth rate and the weak or strong sustainability. In Table 1, we propose that the fast development means that an economy has a higher economic growth rate than the turning point of Kuznets curve. The income inequality tends to reduce when the economic growth rate is

higher than this turning point (Kuznets, 1955; Piketty, 2006). Thus, an increase of economic growth can be associated with a reduction of income inequality.

For the sustainable development, we define two types of sustainability, following the literature on the economics of exhaustible resources and ecology. The weak sustainability means that an economy has a positive genuine savings. And the strong sustainability means that an economy has biocapacity reserve, which requires a positive biocapacity value.

Table 1: Fast and Sustainable Development Concepts

Criteria	Weak Sustainability (Positive Genuine Savings)	Strong Sustainability (Biocapacity Reserve)
Fast Development (Higher Growth Rate than Turning Point of Kuznets Curve)	Fast and Weak Sustainable Development	Fast and Strong Sustainable Development

Using these criteria, we classify two main concepts, including (i) the fast and weak sustainable development, (ii) the fast and strong sustainable development. In particular, an economy with both higher economic growth than the turning point of Kuznets curve and positive genuine savings per GDP would attain the fast and weak sustainable development path. And an economy with both higher economic growth than the turning point of Kuznets curve and the biocapacity reserve would attain the fast and strong sustainable development path.

3.2. Data Description

The dataset is a cross-section sample of 172 economies. Each variable has a value averaged over the years for the 1990-2019 period. The averaged value over time is convenient to capture the long-run equilibrium value, since a long time period of the sample, about 30 years, is enough to absorb the fluctuation of variables over time.

The central variable is the economic growth rate, denoted by (*GDPgrowth*), which is measured by the growth rate of gross national product (GDP) at constant prices for 2011, in US dollars. The GDP is taken from the Penn World Table (PWT) 9.1 (Feenstra et al, 2015).

The representative indicators of sustainable development includes three key variables.

First, the gini index, denoted by (*Gini*), captures the income distribution of an economy. This variable is published by the World Bank's dataset of World Development Indicators annually. This variable captures the economic development which, by definition, covers the

equality of income distribution for each stage of economic growth process (Rauniyar & Kanbur, 2010).

Second, the genuine savings, denoted by (*GenSav*), is the ratio of aggregate savings over GDP on percentage. Accordingly, the savings are adjusted to exclude the cost of environment damage induced by the economic activities. This variable is taken from the dataset of World Development Indicators by World Bank (2021).

Third, the biology capacity, denoted by (*BioCap*), accounts for the relative comparison of the demand by human and the supply by nature. If the biocapacity is positive, we have biocapacity reserve, which implies that the economy attains a strong sustainability. If the biocapacity index is negative, we have biocapacity deficit, which implies that the economy does not attain a strong sustainability. This data is constructed by the Global Footprint Network (2021).

The selection of data meets the requirements, including: (i) a set of indicators reflecting the content of sustainable development; (ii) a set of indicators for comparability across economies; and (iii) a set of indicators with data available, fully published.

Table 2: Descriptive Statistics

Variables	Observations	Mean	Standard Deviation	Min	Max
Economic Growth Rate (<i>aGDPgrowth</i> ,%)	172	3.43	2.04	-1.31	16.66
Income Inequality (<i>aGini</i>)	149	39.36	8.07	24.86	61.71
Genuine Savings per GDP (<i>aGenSav</i> ,%)	153	8.60	11.14	-63.92	34.10
Biocapacity Reserve(+)/ Deficit(-)	171	1.55	10.68	-11.67	90.38

Table 2 shows the descriptive statistics for the data sample of 172 economies over the 1992-2016 period. The economic growth rate has a mean of 3.43%, with a standard deviation of 2.04. Compared with this variable, the genuine savings per GDP ratio has a higher mean at 8.60 and larger standard deviation at 11.14. Moreover, the income inequality has a mean at 39.36 and the biocapacity reserve has a mean at 1.55. Thus, the data sample offers a large variation, which enhances the analysis of the fast and sustainable development.

3.3. Estimation Model

We employ a cross-section empirical model to account for the fast and sustainable development in a sample of 172 economies.

For the fast development, we carry out the following regression equation to access the income distribution along with the economic growth process:

$$aGini^j = \alpha + \beta^{Growth} aGDPgrowth^j + \beta^{Growth,2} (aGDPgrowth^j)^2 + u^j \quad (1)$$

The significant estimated coefficients (β^{Growth} , $\beta^{Growth,2}$) if any would prove the existence of the Kuznets curve. Kuznets (1955) suggests that when the economic growth rate is low, an increase of economic growth rate is associated with more income inequality. But when the economic growth rate is high, an increase of economic growth rate is associated with less income inequality. As an implication, when an economy has a higher economic growth rate than the threshold, an increase of economic growth is associated with less income inequality. Then, we can choose the turning point of the Kuznets curve to set up a threshold so that an economy achieves a fast development if its economic growth is higher the threshold.

For the sustainable development, each variable proxy for sustainable development (denoted by Y^j) is regressed on the economic growth rate (denoted by $aGDPgrowth^j$), by the following empirical model:

$$Y^j = \alpha + \beta^{Growth} aGDPgrowth^j + u^j \quad (2)$$

whereby the error term (u^j) captures the impact of unknown variables.

The coefficient (β^{Growth}) captures the relationship between the economic growth rate and other sustainable development indicators. When this variable is positive, an increase of economic growth rate is associated with an improvement of sustainable development, by an increase of genuine savings per GDP, or an increase of biocapacity reserve.

Base on this coefficients, the model can build up an optimal combination point of these indicators with economic growth rate. Then, the residual is the difference between the realized and optimal values.

For an economy, when the residual of genuine savings per GDP is positive, that economy has attained a better performance of weak sustainability than the prediction by the empirical model. Then, there is still available space for this economy to raises both economic growth and genuine savings, leading to an improvement of fast and weak sustainable development.

For an economy, when the residual of biocapacity is positive, that economy has achieved a greater performance than the prediction by the empirical model. Then, there is still available space for this economy to raise both economic growth and biocapacity reserve, leading to an improvement of fast and strong sustainable development state.

Moreover, in order to check the robustness of cross-section evidence, we also carry out the panel data regression of the genuine savings per GDP ratio and the biocapacity reserve on the economic growth rate. The method uses fixed-effect regression which accounts for the constant unobserved heterogeneity across countries. The regression equation is for country (j) with year (t) as following:

$$Y^{j,t} = \alpha^j + \beta^{Growth} aGDPgrowth^{j,t} + u^{j,t} \quad (3)$$

whereby (α^j) is the unobserved time-invariant country effect, and the error term (u^j) captures the impact of unknown variables.

4. Empirical Evidence

We first analyze the fast and development in the data sample of 172 economies, which covers the whole world economy including both advanced and developing economies. Then, we focus on the three economies including United States, China and Vietnam.

4.1. Fast and Sustainable Development Classification

Table 3 shows the regression results of the indicators of sustainable development on the economic growth rate. In column 1, the income inequality follows a quadratic function of the economic growth. The estimated coefficients establish an inverted-U-shaped pattern: for a higher economic growth rate, the income inequality tends to rise for a low growth rate but decrease for a high enough growth rate. This pattern is well-known as the Kuznets curve in the income inequality literature.

In column 2, the genuine savings per GDP increases for a higher economic growth rate. This implies that on average across countries, the increase of economic growth is associated with an improvement of environment. And in column 3, the biocapacity index also goes up for a higher economic growth rate. Thus, the economic growth exerts a positive impact on the biocapacity reserve by the nature.

Therefore, the empirical evidence records that a higher economic growth rate is associated with an improvement of social aspect with lower income inequality only with a high enough growth rate, and is associated with an improvement of environmental aspect with both higher genuine savings per GDP ratio and greater biocapacity reserve.

Table 3: Cross-Section Regression Results of Income Distribution (*aGini*), Genuine Savings per GDP (*aGenSav*) and Biocapacity Reserve(+)/Deficit(-) (*aBioCap*) on Economic Growth Rate

	(1)	(2)	(3)
VARIABLES	aGini	aGenSav	aBioCap
Economic Growth Rate (<i>aGDPgrowth</i>)	3.051** (1.188)	1.524*** (0.508)	0.307*** (0.101)
Squared Value of <i>aGDPgrowth</i> (<i>aGDPgrowth2</i>)	-0.356** (0.144)		
Constant	34.18*** (2.247)	3.463* (1.925)	-1.565*** (0.389)
Observations	149	153	146
R-squared	0.043	0.056	0.060

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4 illustrates the panel-data regression results of genuine savings per GDP and the biocapacity reserve on the economic growth rate. In column 1, an increase of economic growth rate is associated with a greater genuine savings per GDP ratio. And in column 2, this increase is also associated with more biocapacity reserve. Thus, the result supports the cross-section evidence that a higher economic growth rate is associated with an improvement of genuine savings per GDP and biocapacity reserve.

Table 4: Panel-Data Regression Results of Genuine Savings per GDP (*aGenSav*) and Biocapacity Reserve(+)/Deficit(-) (*aBioCap*) on Economic Growth Rate

	(1)	(2)
VARIABLES	GenSav	BioCap
Economic Growth Rate (<i>GDPgrowth</i>)	0.271*** (0.0329)	0.0163*** (0.00419)
Constant	7.490***	4.212***

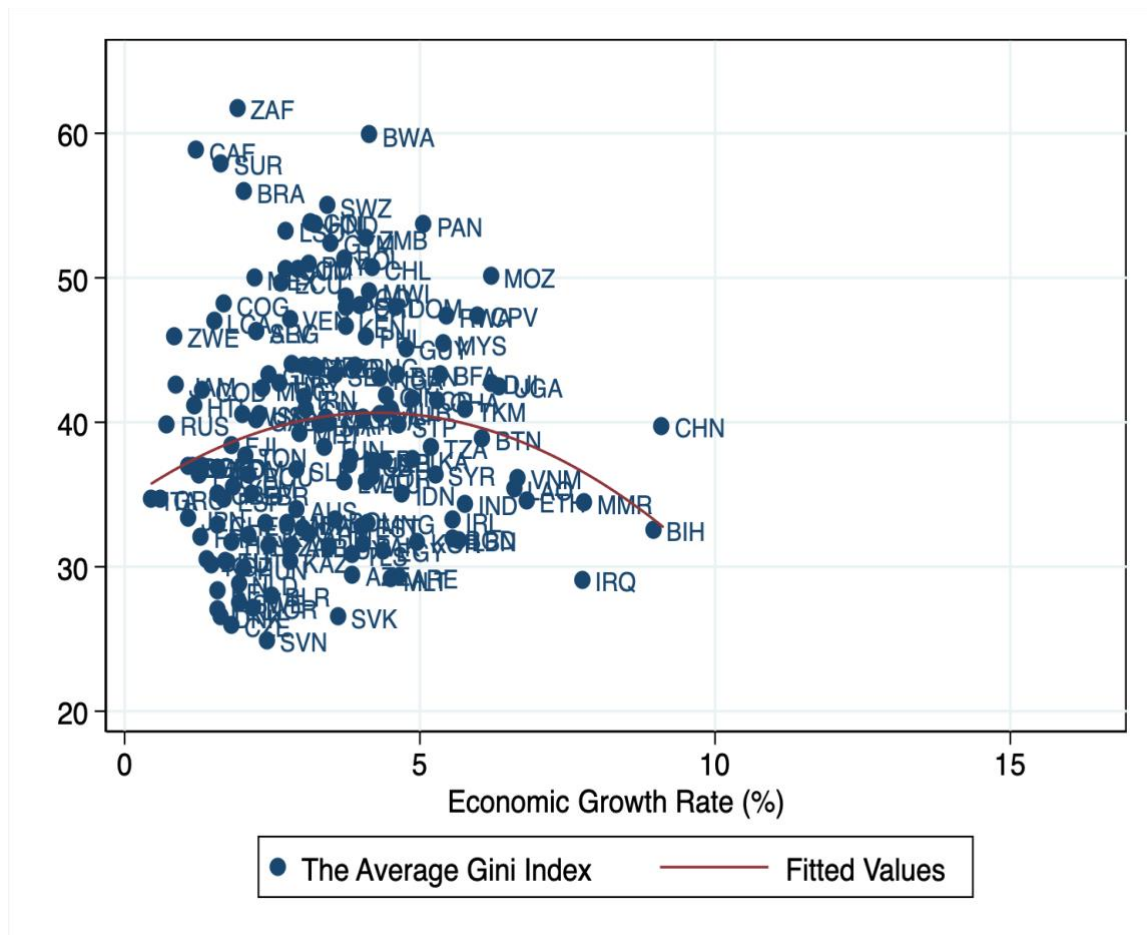
(0.172) (0.0295)

Observations	3,331	6,645
R-squared	0.021	0.002
Number of Countries	158	179

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 1 illustrates the Kuznets curve: for a higher economic growth rate, the income inequality tends to increase for low growth rate, then, decrease for high growth rate. The regression result in column 1 of table 2 implies that the turning point of the Kuznets curve is at the economic growth rate of 4.28 %. With this turning point, we form a group of fast development economies with higher economic growth rate than 4.28.

Figure 1: Kuznets Curve on Income Inequality



Notes: Income inequality is measured by the Gini index, for which, a higher index means more inequality, from World Bank World Development Indicators. Economic growth rate is the growth rate of GDP at constant national 2011 price, from Penn World Table 9.1 (2020).

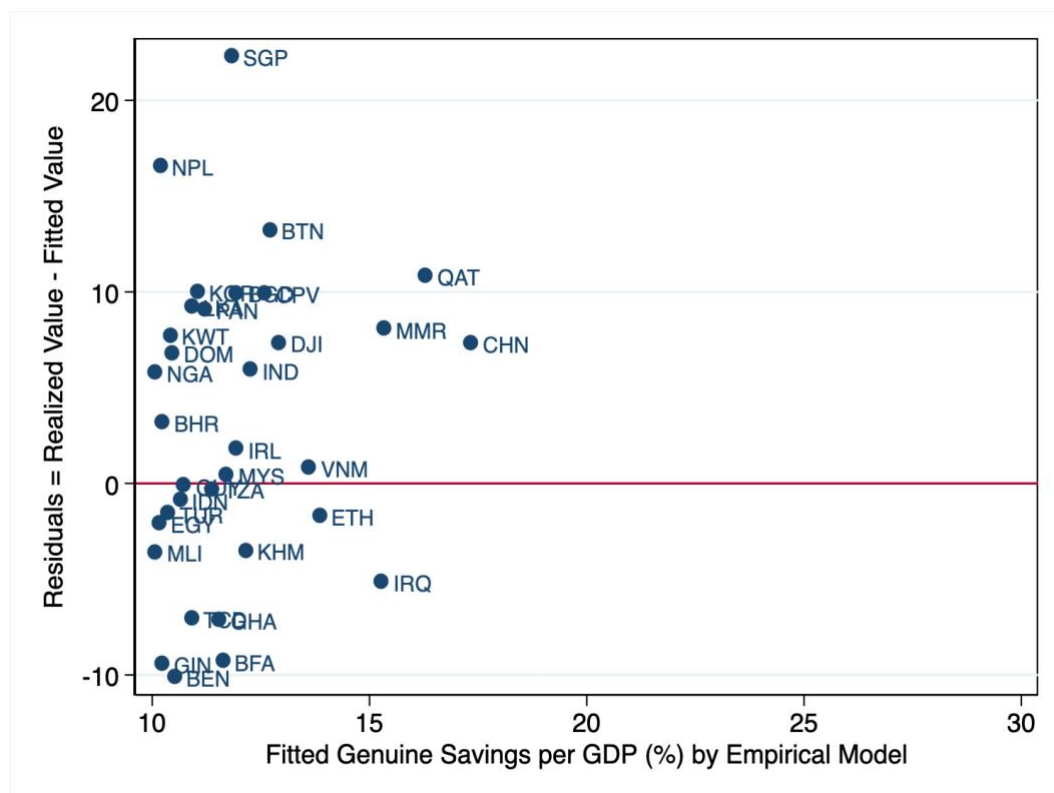
Next, we apply the empirical results to account for the fast and sustainable development space in the economies around the world.

4.2. Fast and Sustainable Development Space

Figure 2 shows the fast and weak sustainable development space. In this figure, we account for only the sample of economies with higher growth rate than world average and positive genuine savings per GDP. By definition, these economies satisfies the criteria of fast and weak sustainable development. In total, there are 41 economies belonging to this group.

In particular, the horizontal axis is the fitted value of genuine savings per GDP based on the empirical model, while the vertical axis is the residuals which are equal the realized value subtracting the fitted value of genuine savings per GDP. The horizontal line is at the value of zero residuals. A positive residual means that an economy has a higher genuine savings per GDP ratio than the predicted value by the empirical model. Given its economic growth rate, that economy has achieved a better performance than the predicted value by the model. Thus, that economy still has additional space to raise its economic growth rate along its fast and weak sustainable development.

Figure 2: Fast and Weak Sustainable Development



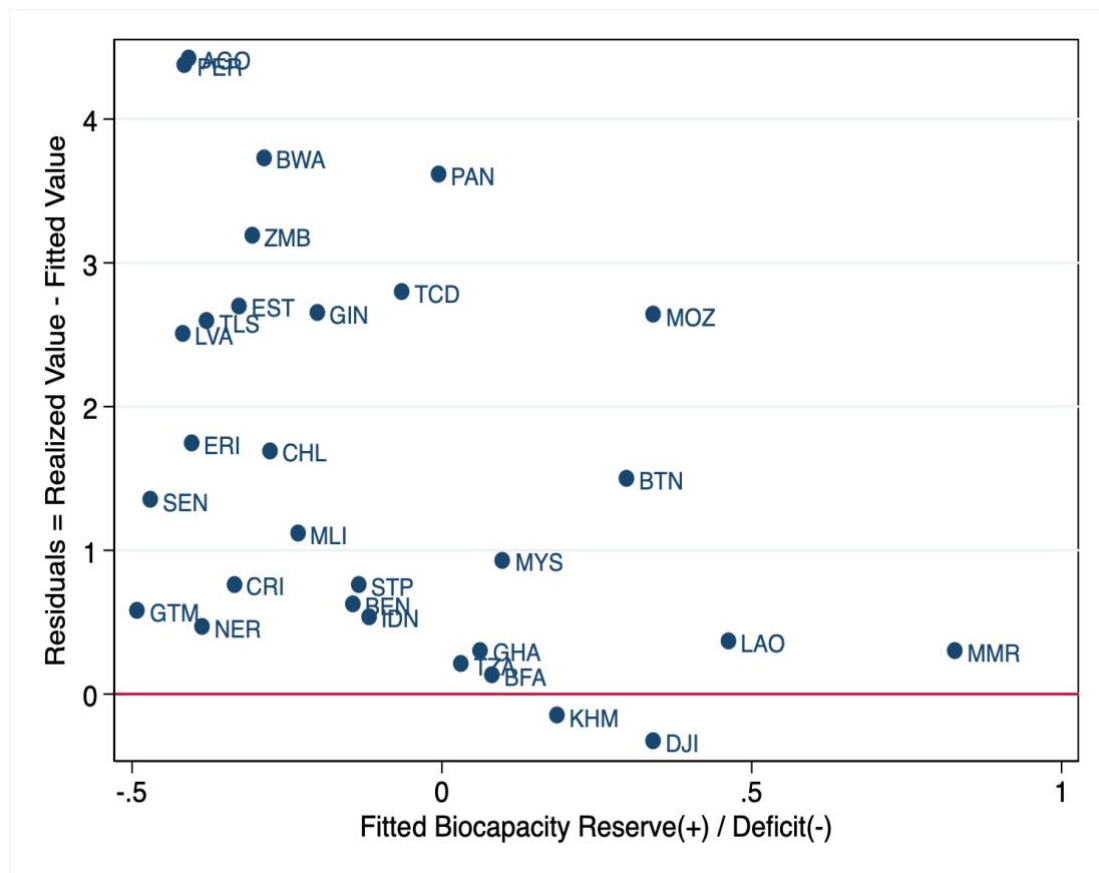
Notes: Economic growth rate is the growth of GDP on percentage, from Penn World Table 9.1 (2020). Genuine savings per GDP on percentage is the aggregate savings adjusted by the environmental damage, from World Bank Development Indicators.

As Figure 2 shows, there are several economies with a positive residuals and positive genuine savings. There are 27/41 economies satisfying these criteria, so that, they still have

available space to raise the economic growth rate along the fast and weak sustainable development path. For example, this group contains Republic of Korea (KOR), China (CHN), Singapore (SGP) and Vietnam (VNM).

Figure 3 shows the fast and strong sustainable development space for a sample of economies with strong sustainable development. In this figure, we account for only the sample of economies with higher growth rate than world average and biocapacity reserve. By definition, these economies satisfies the criteria of fast and strong sustainable development. In total, there are 17 economies belonging to this group.

Figure 3: Fast and Strong Sustainable Development



Notes: Economic growth rate is the growth of GDP on percentage, from Penn World Table 9.1 (2020). Biocapacity reserve (+)/ deficit (-) is the biology supply by nature subtracting the demand by human, from the Global Footprint Network (2021).

In particular, the horizontal axis is the fitted value of biocapacity index based on the empirical model, while the vertical axis is the residuals which are equal the realized value subtracting the fitted value of biocapacity index. A positive residual means that an economy has a higher biocapacity than the predicted value by the empirical model. Given its economic growth rate, that economy has achieved a better performance than the predicted value by the

model. Thus, that economy still has additional space to raise its economic growth rate along its fast and strong sustainable development.

As Figure 3 shows, there are some economies with a positive residuals and biocapacity reserve. There are 15/17 economies satisfying these criteria, so that, they still have available space to raise the economic growth rate along the fast and strong sustainable development path. For example, this group contains Chile (CHL), Malaysia (MYS), and Indonesia (IDN).

In summary, we have a group of 43 economies with available space for fast and weak sustainable development in Figure 2, and another group of 28 economies with available space for fast and strong sustainable development in Figure 3. There are 15 economies which can have potential to upgrade from the former to latter group, such as China (CHN) and Vietnam (VNM). On the next subsection, we will focus on the fast and sustainable development space of these three economies.

4.3. Case Study: United States, China and Vietnam

Table 5 shows the fast and sustainable development in United States, China and Vietnam. Each economy illustrates one development stage: United States are an advanced economy, China is an emerging economy and Vietnam is a developing economy. Thus, the case study can shed a new light on the fast and sustainable development at various development stages.

Table 5: Case Study in Fast and Sustainable Development Space

Country	Economic Growth	Income Inequality	Genuine Savings	Biocapacity Reserve (+) / Deficit (-)	Residuals		
					Income Inequality	Genuine Savings	Biocapacity
United States	2.28	40.47	6.35	-5.48	1.17	-0.59	-4.62
China	9.11	39.72	24.67	-0.92	7.27	7.31	-2.15
Vietnam	6.66	36.09	14.42	-0.05	-2.62	0.79	-0.53

Notes: Economic growth is the growth rate of GDP at constant 2011 national price, from Penn World Table 9.1(2020). Income inequality is the Gini index and genuine savings are the aggregate savings adjusted by the environmental damage by economic process, from World Development Indicators by World Bank (2021). Biocapacity is the difference between the biology supply by nature and demand by human, from Global Footprint Network (2021).

Each economy has different combination of economic growth and sustainability. For the United States economy, the economic growth is 2.23%, lower than the world average (3.43%). And the residuals of income inequality is 1.17, then, the income inequality is higher

than the predicted value by the empirical model. Thus, this economy does not attain the fast development. Moreover, the value of genuine savings is positive and the biocapacity is negative, implying that this economy attains the weak sustainable development but does not achieve the strong sustainable development. Finally, the residuals of genuine savings and biocapacity are all negative. Thus, there is also no available space to improve the weak and strong sustainable development.

For the China economy, the economic growth is 9.11%, higher than the world average (3.43%). And the residuals of income inequality is 7.27, then, the income inequality is higher than the predicted value by the empirical model. Thus, this economy does not attain the fast development. Moreover, the value of genuine savings is positive and the biocapacity is negative, implying that this economy attains the weak sustainable development but does not achieve the strong sustainable development. Finally, the residuals of genuine savings are positive, and the residuals of biocapacity are negative. Thus, there is only still available space to improve the weak sustainable development, but limited space for the strong sustainable development.

For the Vietnam economy, the economic growth is 6.66%, higher than the world average (3.43%). And the residuals of income inequality is (-2.62), then, the income inequality is lower than the predicted value by the empirical model. Thus, this economy attains the fast development. Moreover, the value of genuine savings is positive and the biocapacity is negative, implying that this economy attains the weak sustainable development but does not achieve the strong sustainable development. Finally, the residuals of genuine savings are positive, and the residuals of biocapacity are negative. Thus, there is only still available space to improve the weak sustainable development, but limited space for the strong sustainable development. Combined with the fact that this economy having attained the fast development, the empirical evidence suggests that the Vietnam economy has available space to improve the fast and weak sustainable development.

The case study uncovers that the United States economy can attain the weak sustainable development by raising the genuine savings per GDP ratio, then achieve the strong sustainable development by a higher biocapacity reserve. Moreover, the China economy can move from the weak sustainable development stage to the strong sustainable development by raising the biocapacity reserve. And the Vietnam economy with its status of fast and weak sustainable development can upgrade to fast and strong sustainable development by pushing up the biocapacity reserve.

5. Conclusion

The paper investigates the fast and sustainable development space, then, discusses some policy implications to enhance the development process in the future. The fast development is based on the economic growth rate combined with income distribution, while the sustainable development is based on the genuine savings per GDP and by the biocapacity reserve.

The research method employs a quantitative method which examines an empirical evidence in the whole world economy by one cross-section data sample of 172 economies over the 1992-2016 period. The economic growth rate exerts an inverted-U-shaped impact on the income inequality, and positive effect on the genuine savings per GDP and biocapacity reserve. Then, the evidence implies that for a small sample of economies, 15/172, there still exists available space to raise the economic growth along the fast and strong sustainable development, while about 27/172 economies has available space for the fast and weak sustainable development.

The results suggest that an economy can first attain the objective of fast and weak sustainable development, then, the fast and strong sustainable development. The transmission from fast and weak sustainable development to the fast and strong sustainable development is difficult, thus, needs the appropriated public policy architecture. Given the economic growth rate, an economy can reduce the environmental damage along with the economic process to raise the genuine savings per GDP. Then, it can improve the biological supply by nature to push up the biocapacity reserve.

References

- Aghion, P., & Howitt, P. (1992). A Model of Growth Through Creative Destruction. *Econometrica: Journal of the Econometric Society*, 323-351.
- Barua, A., & Khataniar, B. (2015). Strong or weak sustainability: a case study of emerging Asia. *Asia-Pacific Development Journal*, 22(1), 1-31.
- Daly, H. E. (1990). Sustainable development: from concept and theory to operational principles. *Population and Development Review*, 16, 25-43.
- Frankel, M. (1962). The production function in allocation and growth: a synthesis. *The American Economic Review*, 996-1022.
- Feenstra, R. C., Inklaar, R., & Timmer, M. P. (2015). The next generation of the Penn World Table. *American economic review*, 105(10), 3150-82.
- Gallup, J. L. (2012). Is there a Kuznets curve. Portland State University, 575-603.

Global Footprint Network (2021). Online databases. <https://www.footprintnetwork.org/our-work/ecological-footprint/>.

Hotelling, H. (1931). The economics of exhaustible resources. *Journal of Political Economy*, 39(2), 137-175.

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics*, 107(2), 407-437.

Nguyen Hong Son (2018). Refreshing ideas on sustainable development: two approaches to sustainability. *Vietnam Central Council for Theoretical Research*. <http://hdl.vn/vi/tin-tuc---su-kien/doi-moi-tu-duy-ve-phan-trien-ben-vungnhin-tu-hai-cach-tiep-can-phan-trien-ben-vung.html>.

Piketty, T. (2006). The Kuznets curve. in Abhijit Banerjee, Roland Benabou, and Dilip Mookerjee, eds., *Understanding Poverty*. Oxford: Oxford University Press, 63-72.

Phung Huu Phu (2019). Some key issues on building the institution for fast and sustainable development. *Vietnam Central Council for Theoretical Research*. <http://hdl.vn/vi/nghien-cuu---trao-doi/mot-so-van-de-cot-yeu-xay-dung-the-che-phan-trien-nhanh-ben-vung.html>.

Pham Van Linh (2011). Fast development combined with sustainable development in implementing the social-economic development strategy 2011-2020. *National Defense Online Journal*. <http://tapchiquptd.vn/vi/dua-nghi-quyet-cua-dang-vao-cuoc-song/phan-trien-nhanh-gan-voi-phan-trien-ben-vung-trong-thuc-hien-chien-luoc-phan-trien-kinh-te/694.html>.

Kuznets, S. (1955). Economic growth and income inequality. *The American Economic Review* 45(1):1-28.

Rauniar, G. P., & Kanbur, R. (2010). Inclusive development: Two papers on conceptualization, application, and the ADB perspective. Truy cập ngày 15/06/2021 từ <https://ecommons.cornell.edu/handle/1813/57951>.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, 98(5, Part 2), S71-S102.

Shi, L., Han, L., Yang, F., & Gao, L. (2019). The evolution of sustainable development theory: Types, goals, and research prospects. *Sustainability*, 11(24), 7158.

Shumpeter, J. (1942). *Capitalism, socialism and democracy*. New York.

Solow, R. M. (1974). The economics of resources or the resources of economics. *In Classic Papers in Natural Resource Economics* (pp. 257-276). Palgrave Macmillan, London.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, 70(1), 65-94.

Swan, T. W. (1956). Economic growth and capital accumulation. *Economic Record*, 32(2), 334-361.

United Nations (1987). Report of the world commission on environment and development. *Brundtland Commission*.
<https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>.

Tran Nguyen Tuyen (2021). Fast and sustainable development according to the social-orientation in Vietnam. Vietnam Central Council of Theoretical Research.
<http://hdl.vn/vi/nghien-cuu---trao-doi/phat-trien-nhanh-va-ben-vung-theo--dinh-huong-xa-hoi-chu-nghia-o-viet-nam.html>.

Ta Ngoc Tan (2021). New viewpoints on developments strategy. *Vietnam Central Council for Theoretical Research*. <https://www.tapchiconsan.org.vn/web/guest/thong-tin-ly-luan/-/2018/821908/nhung-nhan-thuc-moi-ve-dinh-huong-phat-trien-trong-van-kien-dai-hoi-xiii-cua-dang.aspx>.

Tran Quoc Toan (2018). Institution for fast and sustainable development, and key issues for Vietnam economy in new area. *Vietnam Central Council for Theoretical Research*.
<http://hdl.vn/vi/nghien-cuu---trao-doi/the-che-phat-trien-nhanh-ben-vung-va-nhung-van-de-dat-ra-doi-voi-viet-nam-trong-giai-doan-moi.html>.

World Bank (2021). World Development Indicators.
<https://databank.worldbank.org/source/world-development-indicators>.