

Theoretical Connotation and Quantitative Measurement of Common Prosperity

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It is of great importance to fully understand the connotation of and identify a quantitative method to measure common prosperity in China. This paper starts with a theoretical framework of fairness, efficiency, development, and shared prosperity, draws upon the proper understanding of common prosperity with Chinese characteristics, and explores a globally quantitative measurement of common prosperity, with a focus on the outcomes of national prosperity and prosperity for all. Furthermore, this paper discusses the assumptions and mathematical expressions of the quantitative function and analyzes the structural implications of indicator dimensions, functional relations, and variable standardization to ultimately provide a solid quantitative foundation for promoting common prosperity. The findings show that the quantitative measurement of common prosperity proposed in this paper performs stably in terms of weights, thresholds, and indicator settings. Based on the data of 162 economies collected between 1990 and 2020, this paper finds that China has made great progress in promoting common prosperity, which showcases the strengths of the country's socialist system.

Keywords: common prosperity, per capita GNI, Gini coefficient, Human Development Index (HDI), quantitative method

1. Introduction

The Fifth Plenary Session of the 19th Central Committee of the Communist Party of China proposed that by 2035, more notable and substantial progress would be achieved in promoting common prosperity for everyone. The Outline of the 14th Five-Year Plan (2021–2025) for National Economic and Social Development further called for an action plan for promoting common prosperity, marking the formal transition from a conceptual goal to a concrete requirement. In the spirit of achieving substantial progress, we can no longer consider common prosperity as a concept, but should take concrete actions to promote its realization, which may include enacting

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policies, defining approaches, and developing specific plans. The first question to address is defining common prosperity, and the circumstances under which common prosperity can be said to have been achieved or notable and substantial progress to have been made. On 20 May 2021, the *Opinions of the Central Committee of the Communist Party of China and the State Council on Supporting Zhejiang in Building a Demonstration Zone for Achieving Common Prosperity through High-Quality Development* was released to specify the general requirements and working principles of achieving common prosperity, without mentioning the specific method to quantify common prosperity for the time being. The definition of key indicators of common prosperity together with the subsequent policy evaluation is indispensable for applying policy measures, monitoring the progress and outcomes, and assessing the effectiveness of policies. Therefore, it is of important significance to accurately understand the connotation of common prosperity and identify a quantitative method of measurement at the initial stage of striving for substantial progress towards common prosperity.

While common prosperity is an essential feature of socialism, it is not uncommon for a similar concept like shared development to be proposed across the globe. At the new development stage, the Central Committee of the Communist Party of China has made it clear that more notable and substantial progress will be achieved in promoting common prosperity by 2035 and an action plan will be developed. This is the first time globally that a country has specified common prosperity as a long-range objective and applied concrete actions for its gradual realization. Therefore, it is necessary to develop a quantitative measurement method of common prosperity with Chinese characteristics which enables horizontal comparison and reflects historical trends. It not only allows China to objectively monitor the direction and progress of its policy path towards 2035, discover issues, and address challenges, but also helps the country to draw upon the experiences and lessons of promoting shared prosperity around the world. Therefore, it bears both practical significance and application value.

This paper starts with a clear definition of the connotation, direction, and tasks of achieving the goal of common prosperity, draws on the construction of the Human Development Index, explores the dimensions of connotation and standards of definition, and designs a quantitative method which allows both horizontal and vertical comparisons. Moreover, the paper adopts a result-oriented approach and validates the method from the perspectives of theoretical quantification, indicator dimensions, function construction, and weight selection and standardization. This paper proceeds to identify the differences between the quantitative method of common prosperity and the Human Development Index and the Shared Prosperity Index and capture the degree and evolution of global common prosperity from 1990 to 2020 by income and regional groupings.

2. Literature Review of Quantitative Measurement of Common Prosperity

2.1. Two Dimensions of Common Prosperity: Development and Sharing

The concept of gongtong fuyu (共同富裕) in Chinese is literally translated as common prosperity in English. Its meaning is similar to concepts such as shared prosperity, inclusive growth, and shared development for the purpose of research. In general, the quantitative basis for common prosperity consists of the two dimensions of development and sharing. For example, Basu (2000) believes that instead of equating social progress with development in general, we should look at the improvement of economic conditions of the poorest 20 percent of the population in line with Rawls' theory of justice which advocates benefits for groups at the lowest levels. The World Bank defines shared prosperity as the growth rate of the per capita income of the poorest 40 percent of the population in each economy and shared prosperity premium as the difference between the growth of the poorest 40 percent and the average of the entire population (Lakner *et al.*, 2014). The Asian Development Bank defines inclusive growth as a type of growth that ensures equal access to the opportunities created for all segments of society, which depends on two factors: (1) average opportunities available to the population, and (2) how opportunities are shared among the population and gives greater weight to the opportunities shared among the population as the manifestation of inclusive growth (Ali and Son, 2007; Anand *et al.*, 2013). The United Nations Human Development Report claims that human development needs to capture the many dimensions of average development and equitable development (UNDP, 1990). That is why income equality is later introduced to the indicators to modify the Human Development Index, and income, health, education, and inequality are all considered to reflect the relationship between development and sharing (Klugman *et al.*, 2011).

2.2. Incomplete Substitution Relationship between Overall Prosperity and Shared Prosperity

Common prosperity can be understood either from the two dimensions of development and sharing, or from the two dimensions of prosperity and commonness (hereinafter respectively referred to as overall prosperity and shared prosperity). To analyze common prosperity, one first needs to understand the relationship between overall prosperity and shared prosperity. If economic growth automatically leads to equal distribution, or if equal distribution gradually fosters overall prosperity, common prosperity will be a one-dimensional indicator and there is no need to identify substitution or complementary relationship between the two indicators (Ravallion, 1997). However, neither theory nor empirical evidence has provided a clear-cut

answer to the nature of the relationship (Barro, 2000). For China, achieving substantial progress towards common prosperity means realizing shared prosperity through development. It is a process of joint contribution and shared benefits for all people. It requires the hard work of all people and is by no means a type of “robbing the rich to aid the poor”. Therefore, we are not dealing with an either-or situation.

If one-to-one correspondence does not exist between overall prosperity and shared prosperity, one must turn to functional relations between the two for quantitative measurement of common prosperity (Ravallion, 1997). In terms of the design of multidimensional indices, some indices on poverty and inequality merely combine indicators in the multiple dimensions, a construction method that assumes complete substitution relationship between the two indicators (Ravallion, 2012). Take the Human Development Index, or HDI, for example. The HDI had been defined as a simple arithmetic average of indicators in the dimensions of income, education, and health, which means that an increase of per capita GDP by one unit and an increase of years of schooling by one unit generate exactly the same changes in HDI. Therefore, one may increase HDI by improving the performance of one indicator alone, which obviously goes against the original intention of designing HDI based on the development of multidimensional capabilities (Klugman *et al.*, 2011). Moreover, quantifying common prosperity requires the consideration of the two dimensions of development and sharing, but does not require the complete synchronization of the two. For example, allowing some people and regions to get rich first will help latecomers to become rich and help achieve the ultimate goal of common prosperity. This points to incomplete complementary relationship between overall prosperity and shared prosperity (Ferreira *et al.*, 2018). Therefore, a functional form of incomplete substitution should replace the extremes of complete substitution relationship and complete complementary relationship between overall prosperity and shared prosperity (Klugman *et al.*, 2011).

The new HDI introduced in 2020 shifts to a geometric multiplication method in order to aggregate dimensional indices of income, education, and health (Klugman *et al.*, 2011). The Shared Prosperity Index and the Inclusive Growth Index are similarly constructed by multiplying the income per capita growth and the shared prosperity growth (Rosenblatt and McGavock, 2013). The choice of the functional form of multiplication rather than addition points to incomplete substitution relationship as well a diminishing marginal rate of substitution. Take HDI for example. The income replacement ratio to health will continue to drop as income further rises, i.e., the price of health as measured by income will rise (Ravallion, 2011). Therefore, in order to reflect incomplete substitution between overall prosperity and shared prosperity in reality, the quantitative measure of common prosperity cannot simply add up several indicators, which violates incomplete substitution relationship between development and sharing.

2.3. Selection of Quantitative Indicators for Measuring Common Prosperity

The selection of indicators plays a key part in index construction and directly determines the rationality of the quantitative method of common prosperity. Some studies have used multilevel and multidimensional indicators to reflect the level of balanced development or shared economic growth. For example, Xu *et al.* (2019) use 49 indicators to construct the balanced development index and Han and Zou (2020) use 26 three-tier indicators to construct the shared economic development index. These indicators cover economic, political, cultural, social, ecological, and other areas and are added up to form composite indicators. It seems that the more indicators one uses, the closer one gets to the connotation and logic of development. However, good intentions alone do not make for good measurement (Ravallion, 2012). Too many indicators in the functional equation create complex relationships, make it difficult to meet such axiomatic criteria as monotonicity and consistency, and ultimately violate the logic of reality (Ravallion, 2011). This is why the Human Development Index uses only 3 simplest indicators (Klugman *et al.*, 2011).

Common prosperity has a rich connotation that covers the two broad dimensions of development and sharing. However, when it comes to select secondary indicators respectively for development and sharing, there is more room for discussion. The dimension of development is generally represented by the level of economic development. However, development itself is a multidimensional indicator. Besides wellbeing, education and health are equally important (UNDP, 1990). In the dimension of sharing, the income Gini coefficient is generally used to reflect how welfare is distributed in a country. However, income only captures the flow of money or goods or the ability to pay. In existing literature, property is often introduced as an indicator. Consumption is quite common in welfare research. Despite the multiple connotations of development and sharing, it is unrealistic to try to include them all. From a practical point of view, the selection of indicators should prioritize the availability of data, the comparability of results, and the operability of the method. Indicators should be easily identifiable and preferably capture the most important aspects of a problem in an easy-to-understand manner. A review of policy research and academic discussion reveals many controversies on the proper indicators of development and sharing. However, the most recognized approach of the highest comparability remains using per capita GNI for development and income Gini coefficient for sharing (Klugman *et al.*, 2011; UNDP, 1990).

3. Theoretical Connotation and Quantitative Measurement of Common Prosperity

3.1. Theoretical Assumptions of Common Prosperity

A review of the past 40 years of reform and opening up in China shows that

common prosperity represents the perfect combination of fairness and efficiency. The country's development policy has been likened to a pendulum that shifts between fairness and efficiency through the various phases of history. Generally speaking, it is appropriate to approach the concept of common prosperity using a theoretical framework based on fairness and efficiency, or sharing and development. Efficiency mainly corresponds to overall prosperity which is realized through economic growth, and fairness to shared prosperity secured via income distribution. To achieve efficiency and fairness, one need to have stable economic growth and equitable income distribution respectively. China's experience of development in the past few decades tells us that common prosperity requires equal access to opportunities and benefits sharing. However, common prosperity is by no means egalitarianism or common poverty. The connotation of common prosperity covers prosperity of all, prosperity in all aspects, joint contribution, and step-by-step realization. It emphasizes both progress of all and a gradual process. In order to achieve the ultimate goal of common prosperity, it allows people to get rich first and faster or later and slower (Central Committee of the Communist Party of China and State Council, 2021).

A review of historical discussions and central policy expressions of the theoretical connotation of common prosperity leads to the identification of three consensus baselines (Dong, 2001). First, egalitarian poverty is not common prosperity (S_1). Second, polarized prosperity is not common prosperity (S_2). Third, common prosperity is not about everyone getting rich at the same time to the same degree (S_3). This paper cites these three consensus baselines as the basic theoretical assumptions and draws on the theory of consumer choice from the study of economics to reflect the incomplete substitution relationship between development and sharing and between overall prosperity and shared prosperity as well as to analyze the economic implications contained herein.

3.2. Functional Relations of Common Prosperity

There is no one-to-one correspondence between overall prosperity and shared prosperity, both major goals of policy makers. Due to the relative scarcity of factors, this paper draws on the consumer choice theory in economics and assumes that policy makers, in order to achieve utility maximization, or maximization of common prosperity in the present case, have to choose between overall prosperity and shared prosperity. In Figure 1, a two-dimensional quadrant chart is used to represent common prosperity. The indifference curve depicts the relationship between overall prosperity and shared prosperity, with the x -axis covering the dimension of overall prosperity (e.g., per capita GNI) and the y -axis the dimension of shared prosperity (e.g., Gini coefficient of per capita disposable income). With limited resources, overall prosperity and shared prosperity are both major goals of policy makers. Therefore, the farther out

the indifference curve is from the origin, the higher the level of common prosperity it indicates. In this case, three types of relationships are possible between overall prosperity and shared prosperity.

The first is complete substitution, as represented by Line S_1 in Figure 1, which can be expressed as equation (1). All points on the S_1 indifference curve indicate the same degree of common prosperity, and policy makers will have the same result whether choosing a position on the upper left or the lower right. However, all the resources on the upper left are used to meet the requirement of sharing with hardly anything left for prosperity, which makes a typical case of egalitarian poverty; and all resources on the lower right are used to achieve prosperity with almost nothing for sharing, indicating a typical scenario of polarized prosperity. Therefore, line S_1 violates previous assumptions.

$$C + P = S_1 \quad (1)$$

$$C \times P = S_2 \quad (2)$$

$$\min(C, P) = S_3 \quad (3)$$

The second is complete complementarity, as represented by Line S_3 in Figure 1, which can be expressed as equation (3). All points on Line S_3 indicate the same degree of common prosperity, and no improvement in overall prosperity or shared prosperity alone will contribute towards common prosperity. Only a rise in both overall prosperity and shared prosperity can increase the degree of common prosperity. This is a typical case of simultaneous prosperity, and Line S_3 also violates the previous assumption.

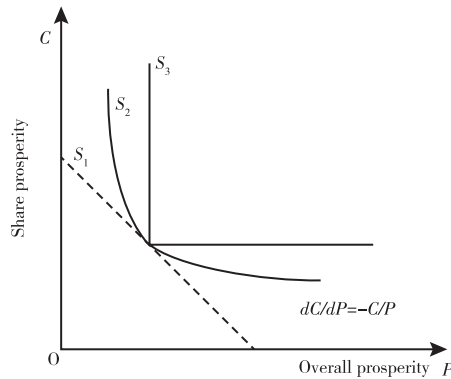


Figure 1. Functional Relation between Overall Prosperity and Shared Prosperity

The third is incomplete substitution, as represented by Line S_2 in Figure 1, which can be expressed as equation (2). Line S_2 reflects the typical tradeoff faced by

policymakers between “common” and “prosperity”. However, this tradeoff will not result in an extreme corner solution as in the case of complete substitution, and the improvement in a single dimension can lead to a higher degree of common prosperity. In this way, all three assumptions listed above are satisfied. In summary, Figure 1 readily shows that when factors are relatively scarce, the relationship between overall prosperity and shared prosperity is neither complete substitution nor complete complementarity, but incomplete substitution as captured by equation (2).

It is worth noting that there are several ways to construct functional relations of incomplete substitution. In constructing an index, one should strive to use simple functional forms and present them in an easy-to-understand way. According to Klugman *et al.* (2011), the two most commonly used measurement systems are the arithmetic mean (additive mean) and the geometric mean (multiplicative mean). Arithmetic mean indicates a relationship of complete equivalent substitution, and therefore is inadequate to capture the connotation of common prosperity. From a practicable point of view, a functional relation that multiplies the dimension of development and the dimension of sharing is a more reliable option, which also accords with the original design of the Human Development Index (Klugman *et al.*, 2011).

3.3. Economic Implications of Incomplete Substitution

The construction of a multiplicative index has important economic assumptions behind it. The derivation of the S_2 indifference curve on both sides gives us the marginal rate of substitution between the dimension of overall prosperity and that of shared prosperity, as shown in equation (4). If we use P to measure the indicator of overall prosperity and C to measure the indicator of shared prosperity, the absolute value of the marginal rate of substitution dC/dP will continue to decline, as P continues to increase. In other words, if the degree of common prosperity remains unchanged, the addition of one unit of P (overall prosperity) will yield decreased C (shared prosperity). If we reverse the marginal rate of substitution, as shown in equation (5), and use P (overall prosperity) to measures the price of C (shared prosperity), i.e., VLC , we will find that if the degree of CP (common prosperity) remains unchanged, VLC (price of C , or price of shared prosperity) will rise with P (overall prosperity).

$$MRS = \frac{dC}{dP} = -\frac{C}{P} = -\frac{CP}{P^2} \quad (4)$$

$$VLC = \frac{1}{MRS} = -\frac{P^2}{CP} \quad (5)$$

Equation (5) shows that as the degree of overall prosperity increases, the importance of shared prosperity will rise. A country with a high income and a large income gap will have to pay a high price if it decides to narrow the income gap by sacrificing the income. In the Human Development Index, this assumption is also used to discuss the price of health at different development levels (Ravallion, 2012). Klugman *et al.* (2011) argue that from a realistic point of view, this relationship reflects the differences in the relative importance of non-income dimensions between rich and poor societies.

4. Data Source and Processing

4.1. Data Source

The Gini coefficients cited in this paper to measure income gap are mainly obtained from the World Wealth and Income Database (WID). This database provides access to data over long periods of time (for most countries 1980–2020) and has adjusted the definition of income, allowing a horizontal comparison of Gini coefficients across countries and regions (Piketty *et al.*, 2018). However, WID's multi-period panel data only cover 37 economies, most of which are developed economies. That is why the United Nations University World Institute for Development Economics Research (UNU-WIDER) database is also consulted. The UNU-WIDER database provides access to income gap data of most countries and regions in the world and covers income distribution indicators of 217 economies from 1951 to 2020, but the definition of income and the calculation of Gini coefficient vary hugely across economies. In order to enhance cross-country data comparability, this paper uniformly applies the concept of the disposable per capita income of all members of the household and excludes unofficial and unreliable sources of Gini coefficients.¹

The per capita GNI of the countries are obtained from the World Bank's World Development Indicators (WDI), which covers 264 countries and regions from 1960 to 2020 and promises strong comparability both horizontally and vertically. It is worth noting that due to the impact of COVID-19 in 2020, the indicators of many countries and regions jumped significantly. Moreover, data released by countries in 2020 tended to be incomplete. Therefore, data in 2019 are used as substitutes.

4.2. Data Processing

One approach is adopted each for the horizontal and vertical comparisons of

¹ To improve global comparability, we have included in our database countries with no statistics on disposable income indicators but the Gini coefficient of equivalent income. These countries are predominantly high-income and low-income gap economies, and their exclusion would not have made a significant impact on the overall results.

common prosperity levels. For horizontal comparison, it is necessary to include as many as countries and regions in the cross-sectional sample as possible to achieve global representativeness. Therefore, for countries and regions whose Gini coefficient in 2020 is missing, their Gini coefficient in a most recent year, but no earlier than 2015, will be used as a substitute. In this way, we get a sample of 162 countries and regions (including 50 high-income economies, 42 upper-middle-income economies, 44 lower-middle-income economies, and 26 lower-income economies) and on its basis, construct a cross-sectional database of common prosperity in 2020. For an understanding of the evolution of China's common prosperity level in recent decades, the time period 1990–2020 is selected and divided into 7 phases to allow an examination of changes by 5-year intervals. For years when Gini coefficient is missing, the Gini coefficient in a most recent year, but within a range of two years, will be used as a substitute. In this way, we get the balanced panel data of 67 countries and regions across 7 phases. Applying the 1990 standards for classifying countries by income, we get 14 high-income economies, 22 upper-middle-income economies, 7 lower-middle-income economies, and 24 low-income economies.

5. Functional Form of the Quantitative Measurement Method of Common Prosperity

On the basis of previous discussions, we draw on the construction of the new Human Development Index in 2010 and construct the quantitative function of common prosperity, using a result-oriented approach with fewer indicators and considering such axiomatic criteria as monotonicity, consistency, and homogeneity. As mentioned earlier, common prosperity can be divided into the two dimensions of overall prosperity and shared prosperity. For the dimension of overall prosperity, per capital GNI ($PGNI$) is quoted to measure the level of development; and for the dimension of shared prosperity, the Gini coefficient of per capita disposable income ($Gini$) is used to reflect level of social distribution. We then take the logarithm of per capital GNI in the dimension of development and standardize indicators in both dimensions. The geometric mean of multiplying the two dimensions leads to the construction of the equally-weighted common prosperity equation (CP), as shown in equation (6). In the following, we will discuss the technical aspects of the function from multiple angles.

$$CP_j = 100 \times (H_{PGNI} \times H_{Gini})^{1/2} = 100 \times \left[\frac{\ln(PGNI_j) - \ln(PGNI_{\min})}{\ln(PGNI_{\max}) - \ln(PGNI_{\min})} \right]^{1/2} \times \left[\frac{Gini_{\max} - Gini_j}{Gini_{\max} - Gini_{\min}} \right]^{1/2} \quad (6)$$

5.1. Selection of Dimensions and Indicators

Unlike existing studies that tend to construct with multi-level indicators (Xu *et al.*, 2019; Han and Zou, 2020), equation (6) only selects one outcome indicator each for the dimension of overall prosperity and that of shared prosperity. In the dimension of overall prosperity, the indicator is per capita GNI. Although health, education, and environment, etc. are all aspects to consider when measuring development, it is impossible to exhaust all the “capabilities” in the development dimension in reality (UNDP, 1990; Ravallion, 2011). Therefore, we need an indicator that is most representative, can easily be accepted, and best reflects the level of development. The indicator of per capita GNI, which is used by the World Bank to classify economies into income groups, stands out as the best choice. In the dimension of shared prosperity, only the Gini coefficient of per capita disposable income is chosen as the indicator, although many other indicators exist. However, internationally comparable data sets on disparity are scarce and statistics of the Gini coefficient have only become complete recently (Klugman *et al.*, 2011). Among the possible indicators, only the income Gini coefficient has the most complete and comparable data sets for global analysis. It is also a most popular and recognized indicator.

Admittedly there are many indicators for development and sharing. It is absolutely possible to add more dimensions, more indicators, and more layers of meaning to equation (6). However, more indicators require more assumptions about the relationship between indicators (UNDP, 1990). For example, if we add the dimension of education, how should characterize the relationship between education and development, and that between education and sharing? Is it one of incomplete substitution, just like the relationship between development and sharing? More indicators do not make for good measurement (Ravallion, 2012). This paper will not boast that per capita GNI and income Gini coefficient fully capture and represent development and sharing. However, the construction of an index considers not only the comprehensiveness of the data, but also more importantly, the availability and comparability of the data. Compared with other available indicators, per capita GNI and income Gini coefficient are the most recognized. It is difficult to say that the present design takes into account all the possible connotations of common prosperity. That is why this paper will proceed to adjust and test the approach using a variety of definition indicators in the following parts. However, our findings will show that the selection of different indicators do not significantly affect the final evaluation results of common prosperity.

5.2. Discussion of Standardization and Thresholds

In equation (6), both the per capita GNI and the Gini coefficient are standardized.

That is because the definition of a range is important for quantification, without which a specific value cannot be measured. The standardization of per capita GNI and Gini coefficient, therefore, enable horizontal and vertical comparisons of the results of quantification. Standardization requires a maximum value, a minimum value, and possibly a threshold. Without a threshold, the yearly cross-sectional minimum and maximum values will always be changing and it will be difficult to identify an evolution trajectory of the index over time (Li *et al.*, 2019). If we seek to set a threshold, the acceptable one should be static and unchanging. For example, the Human Development Index used to identify an interval between shortest and longest years of schooling and another between shortest and longest life expectancies. Despite its advantages, setting a static threshold involves certain subjective judgment. The original Human Development Index identified the survival line as the minimum threshold and the per capita GNI of USD 40000 as the maximum threshold. However, studies point to significant substitution across dimensions after truncation (Ravallion, 2011). That explains why the new Human Development Index adopts the minimum and maximum values in the sampling period as thresholds (Klugman *et al.*, 2011). This approach is followed in this paper to allow for horizontal and vertical comparisons of the quantification results of common prosperity.

5.3. Scale-Free Index Assumption

Equation (6) uses the Cobb-Douglas production function instead of other functions of incomplete substitution (e.g., constant elasticity of substitution) because the geometric mean is easy to understand and satisfies the scale-free assumption. Equations (7) and (8) are listed below to illustrate what happens if the unit of measurement of per capita GNI changes, e.g., expressed as a product of a constant k . In equation (7), only the value of common prosperity is multiplied by a constant. As the relative weights of the per capita GNI and Gini coefficient remain unchanged, so will be the relative order of economies. In equation (8), however, as the constant k cannot be extracted as a common factor, the relative weights of the per capita GNI and Gini coefficient will be affected. That means the relative order of economies will be impacted because of changes in the unit of measurement alone, which violates the scale-free assumption. This seems resolvable by standardization, but standardization itself involves changes to relative weights triggered by changes in the unit of the minimum and maximum values. Klugman *et al.* (2011) proved that of the many functional relations, those with a constant elasticity of substitution other than 1 cannot satisfy the scale-free assumption, which can only be satisfied by the geometric mean.

$$CP = C^a \times P^b \Rightarrow CP' = C^a \times (kP)^b = k^b \times CP \quad (7)$$

$$CP = (C^r + P^r)^{1/r} \Rightarrow CP' = (C^r + (kP)^r)^{1/r} = (C^r + k^r P^r)^{1/r} \quad (8)$$

5.4. Equal Weight Setting

The multiplicative mean which satisfies the scale-free assumption does not require exactly equal settings of weights. In equation (7), therefore, the per capita GNI and Gini coefficient may not follow the equal-weight form of $a=b=1/2$. However, it is essentially a qualitative judgment. Some people believe that for low-income regions, it is acceptable to trade a widening income gap for economic development, thus giving development more weight than sharing. Others argue that for those higher-income regions, sharing is more important because the large income gap has become a hindrance to economic development. Unless the issue of a large income gap is solved, these regions will fall into a growth trap. We cannot say which argument is truer. In reality, the relative weights of development and sharing need to be decided upon in accordance with local conditions. China is now at the new stage of development, when development and sharing are deemed equally important. Because of our people-centered philosophy, development and sharing are given an equal weight.

We now examine the stability and economic implications of the quantitative methods of common prosperity as we change the weight settings. First, different weights ($a=0.8, b=0.2$ or $a=0.2, b=0.8$) are set for the dimension of development in equation (7). Figure 2a shows the relation between the results of common prosperity using these two weight settings and that using the setting of this paper ($a=0.5, b=0.5$). It is found that whether we set the weight higher or lower for per capita GNI, the results are significantly positively correlated with that under the equal-weight setting. Second, we examine the price of inequality. Per capita GNI is chosen as the unit of measurement. It is found that the price of inequality increases with income. We again change the weight settings. Figure 2b shows that the greater the value of a (weight of Gini coefficient), the more drastically the price of inequality changes; the smaller the value of a , the smaller the price change; and the price stays in the middle under the equal weight setting. The price of inequality is directly proportional to the weight of Gini coefficient.

Calculations show that when the weights are set as follows: $a=0.8, b=0.2$, Switzerland, a country with a relatively high per capita GNI in 2020, had to pay USD 69805 as the price of inequality per year, which was as high as 82% of its annual per capita GNI. In Malawi, a country with a relatively low per capita GNI, the price of inequality was only USD 22 per year, accounting for only 6% of its per capita GNI. We can accept that the price of inequality for poverty-stricken countries may not be as high as that for developed countries. However, it is shocking to see that for a decrease in the income gap by one unit, Switzerland has to suffer a loss of 82% of its per capita GNI. We apparently have laid too much emphasis on inequality in developed countries.

Similarly, when the weights are set as follows: $a=0.2$, $b=0.8$, the price of inequality accounts for only 5% of Switzerland's per capita GNI. For Malawi, the ratio further drops to 0.4%. Under this setting, the price of inequality for poverty-stricken countries seems overly cheap.

It is worth noting that behind each weight setting lies a subjective judgment and it is difficult to say which one is better. However, in terms of the stability and rationality of the measurement method, we should refrain from using unusually high or low results, which tend to deviate from the reality. Therefore, the median path may be a more plausible choice (Ravallion, 2012). For this reason, we start with the theoretical assumption that development and sharing are equally important to the realization of common prosperity with Chinese characteristics and arrive at the rational and proper choice of an equal weight setting ($a=b=0.5$) for constructing the function. Under this setting, economies with a higher income will have to pay a price of inequality that accounts for a larger portion of their per capita GNI. For Switzerland, a country with the highest income, the price of inequality is 20% of the per capita GNI, which is not unusually high. For Malawi, the price of inequality is 1.4 % of the per capita GNI, which is not overly low. Both scenarios accord with common sense and economic intuition (see Figure 2c).

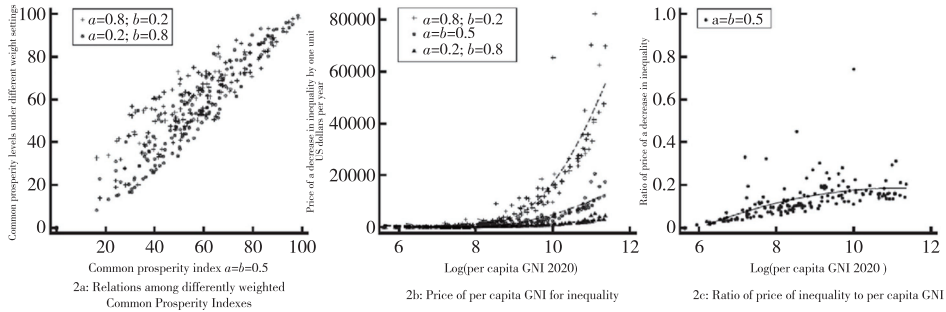


Figure 2. The Common Prosperity Index and Choice of Weights

Note: The price of inequality is calculated using the formula proposed by Ravallion (2012):

$$VLE = \frac{Y(\ln Y - \ln Y^{\min})}{LE - LE^{\min}} (LE > LE^{\min}), \text{ with } Y \text{ for per capita GNI and } LE \text{ for health and other indicators of}$$

non-income dimensions, here substituted by the Gini coefficient as indicator of sharing.

5.5. Functional Form

Our discussion above has revealed the relationship between indicator weights and qualitative assessments. In reality, developed countries indeed pay a much higher price for inequality than poverty-stricken countries. Under equal weights, the absolute price of inequality for Switzerland is USD 17451 per year, while that for Malawi is

only USD 5.57 per year. In other words, Switzerland has to pay an absolute price 3133 times higher than Malawi, while its per capita GNI is only 225 times that of the latter. This means that in constructing the quantitative method of common prosperity, we assume that for developed countries the dimension of sharing is more important, while for under developed countries the dimension of development is more important. This difference can be attributed to the two concave functions in the dimension of income. We first take the logarithm of the dimension of income and then get the geometric mean between the two dimensions, which together magnify the price difference in changes in non-income dimensions. This shows that the functional form has an important impact on the relationship between indicators.

Some scholars have criticized the double-log functional form of income in the design of the Human Development Index, arguing that it neglects the importance of non-income dimensions to underdeveloped regions. Ravallion (2012) proposed an exponential dimension of income to construct the functional equation, which narrows the price difference among countries in non-income dimensions. Ravallion (2011) also suggested using a continuous, increasing, and strictly concave function $f(x)$, which satisfies the following properties: $f(0)=0$, $f(1)=1$. In the meantime, Chakravarty (2011) proposed using the functional form $f(x)=x^r (0 < r < 1)$, which strictly satisfies multiple axiomatic properties such as monotonicity, additive consistency, and symmetry (Alkire and Foster, 2011). Based on all these propositions, we construct the quantitative method of common prosperity represented by equation (9). H_{PGNI} and H_{Gini} stand for standardized per capita GNI and negative Gini coefficient respectively, both of which are included in the function of common prosperity through exponentiation. Equation (10) gives the price of inequality (VLC) through derivation.

$$CP^c = [f(C) + f(P)] / 2 = (H_{pgni}^r + H_{gini}^r) / 2 \quad (9)$$

$$VLC = \left(\frac{H_{pgni}}{H_{gini}} \right)^{1-r} \times \left(\frac{pgni_{\max} - pgni_{\min}}{gini_{\max} - gini_{\min}} \right) \quad (10)$$

In the exponential function, Figure 3a shows a weak correlation between the measurement results of common prosperity under assumptions of different weights, indicating that the selection of different values of the parameter r results in significant inconsistency in the relative orders of common prosperity. Moreover, Figure 3b shows that the price of inequality increases with income. Finally, Figure 3c shows that the price of inequality decreases as per capita GNI increases. For example, in order to cut the Gini coefficient by one unit, Malawi with the per capita GNI of USD 380 has to spend 27% of its annual per capita GNI, while the United States with the per capita GNI as high as USD 65850 only has to spend 3.7%. This may have reversed

the relative importance of development and sharing for economies at different development stages, and thus may not be plausible.

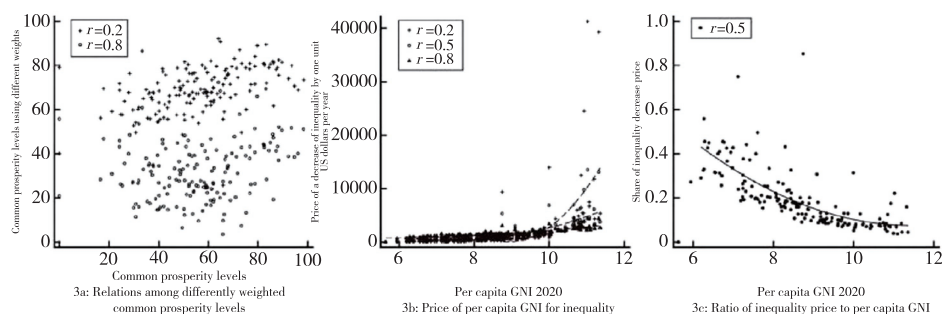


Figure 3. Functional Outcomes of Common Prosperity

Which is more important, development or sharing? It is an issue of value judgment. Like the global Multidimensional Poverty Index, the assessment of the outcomes of common prosperity needs a comprehensive and systematic approach. An economy with high development and low sharing and another economy with high sharing and low development may score the same in terms of the level of common prosperity. This means that less developed economies should give priority to economic development to avoid the poverty trap of egalitarianism, while developed economies should lay more emphasis on income distribution to avoid polarized wealth. Therefore, this paper starts with the three assumptions presented above and proposes a quantitative method for the measurement of common prosperity. The economic assumptions of development and sharing are consistent with our previous understanding of the connotation of common prosperity and logically consistent with each other.¹ In conclusion, there is a significant gap between the exponential function proposed by Chakravarty (2011) and the reality itself, despite some of its mathematical properties. As quantification is designed as the multiplication of indicators, the relational formula of common prosperity constructed in this paper is not decomposable but standardized and homogenous.

6. Test and Comparison of the Quantitative Measurement Method of Common Prosperity

6.1. Quantitative Results and Composition of Common Prosperity

Figure 4 shows shared development across 162 countries and regions. As shown

¹ Another reason for using the logarithm of per capita GNI lies in the consideration that the contribution of per capita GNI to overall prosperity (development) needs to observe the law of diminishing marginal rate of substitution. This means that as income increases, the marginal contribution of per capita GNI to development will gradually decrease. This has in fact been proven by the Human Development Index (UNDP, 1990).

in Figure 4a, an overall positive correlation exists between shared development and national per capita income, with the curve flattening out at the top. As shown in Figure 4b, the Gini coefficient is significantly negatively correlated with shared development. Countries or regions with large income gaps are more likely to have low shared development. A comparative review shows that for some countries or regions, high income is accompanied by a large income gap, leading to a relatively low level of shared development (e.g., Singapore and the United States). For other countries or regions, although the income is not very high, the income gap is small and the level of shared development is relatively high (e.g., as France and the United Kingdom). For Nordic countries, high income is accompanied by a small income gap, and the level of shared development is even higher. For China, the value of shared development is close to the average of the 162 economies. China's Gini coefficient is significantly higher than the global average, which means that a big income gap has hindered China from attaining a higher level of shared development.

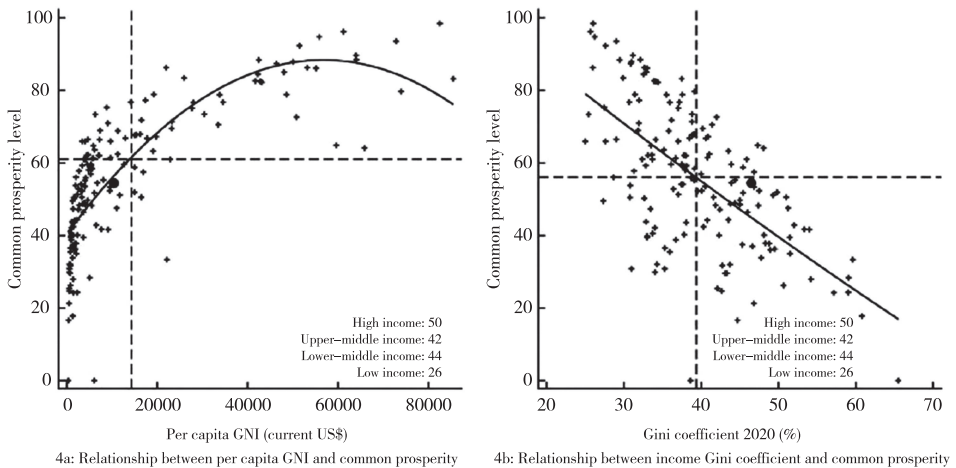


Figure 4. Common Prosperity Level and Its Relationship with Per Capita GNI and Gini Coefficient

6.2. Test and Comparison of the Quantitative Measurement Method of Common Prosperity

We have so far discussed the average level of development and sharing of economies, but with more attention to the common prosperity of the low-income group than that of the average population. A quantitative method that fails to address this heterogeneity must be revised and further tested. This paper tests the quantitative method for the measurement of common prosperity from multiple angles. For the dimension of overall prosperity, we use the income or consumption of the bottom 40 percent of the income

distribution. For the dimension of shared prosperity, we use the highest-lowest income ratio and the income share held by highest 10 percent. We also use gross national income (GNI), instead of gross national income per capita (PGNI), to measure the dimension of overall prosperity.

As shown in Figure 5, no matter we use the income or consumption of the low-income group, the level of adjusted common prosperity has a significantly positive correlation with the original result. Similarly, there is a significantly positive correlation between the level of common prosperity as substituted by gross national income (GNI) and the original result. This proves that regions performing better in overall development and sharing score significantly higher in terms of common prosperity per capita. A look at the dimension of sharing identifies a significantly positive correlation between the level of sharing and the original result of the previously discussed quantitative method of common prosperity, no matter we substitute the highest-lowest income ratio or the income share held by highest 10 percent. In summary, the quantification results before and after adjustment are strongly correlated, with no significant change to the relative size of common prosperity. It is worth noting that the substitution of different indicators for the dimensions is only meant to reflect the varied

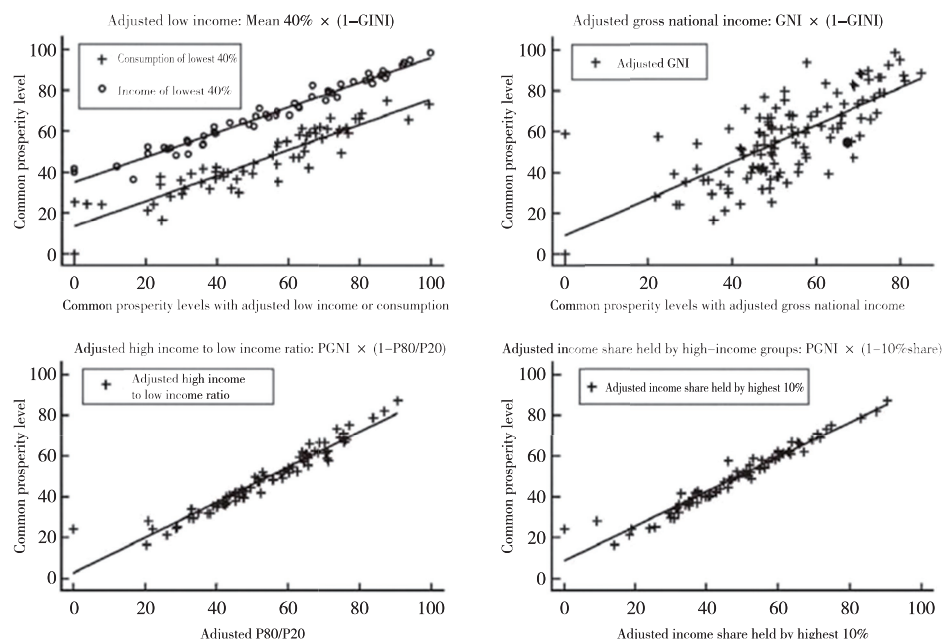


Figure 5. Comparison of Adjusted Common Prosperity Levels

Note: Income or consumption data of low-income economies are collected from the Global Database of Shared Prosperity; data of the high income to low income ratio and the income share held by highest 10% are collected from the UNU-WIDER database; and to ensure comparability, only sample of the same definition as previously used for calculating income Gini coefficient are selected.

understanding of common prosperity and represents no preference of the approaches. In fact, the data availability of some indicators may not be as good as per capita GNI and Gini coefficient.

7. Application of the Quantitative Measurement Method of Common Prosperity

7.1. Horizontal Comparison of Shared Development Levels

A horizontal comparison of shared development levels across regions helps us draw experience and lessons useful for promoting common prosperity in China. Table 1 reports the statistical results of applying the quantitative method to common prosperity. In 2020, the average common prosperity score of the 162 economies was 56.0, the average per capita GNI was USD 14286, and the average Gini coefficient was 0.394. In terms of income groups, economies with higher income register a higher level of shared development. The difference in GNP per capita is the main reason for the difference in shared development level. For example, the high-income group enjoys a per capita GNI 47 times higher than that of the low-income group and a Gini coefficient only 7% smaller than that of the latter. Even after standardization, high-income economies still have a development level 4.9 times that of low-income economies, while the level of sharing is only 1.1 times that of the latter. It can be seen that the difference in the level of shared development mainly derives from the difference in the dimension of development.

In terms of regional groups, Southern Africa scores the lowest in terms of shared development, South America, Asia, Northern Africa, and Oceania are in the middle, North America and Europe perform better, and Northern Europe the best. In terms of index composition, Southern Africa has a low per capita GNI and a high Gini coefficient. South America, Asia, and Oceania enjoy a per capita GNI of approximately USD 10000, but their income gap is relatively high. South America, especially, has an average Gini coefficient as high as 0.457. In Northern Africa, low income is accompanied by low income gap, resulting in a medium level of shared development. North American and European countries enjoy high income and low income gap. Especially in Northern Europe, a very high income coupled with a very low Gini coefficient leads to a very high level of shared development. China's score of common prosperity was close to the average of the 162 economies in 2020, mainly due to the quite big income gap in the country.

Table 1. Changes in Shared Development Levels across Regions: 1990–2020

		2020 (162 economies)			1990–2020 (67 economies)						
	Mean	Common prosperity level	Per capita GNI (USD)	Gini coefficient (%)	2020	2015	2010	2005	2000	1995	1990
By income	Low	31.1	791	39.9	49.0	48.1	44.0	35.4	29.0	24.5	23.7
	Lower-middle	47.5	2651	40.6	60.0	58.7	55.5	48.9	44.4	42.5	44.1
	Upper-middle	56.8	7211	40.8	62.8	63.1	60.6	56.5	52.7	52.6	48.7
	High	75.8	37486	37.0	82.4	81.8	81.3	79.6	77.3	76.8	75.9
By region	Southern Africa	35.4	2446	43.6	38.0	37.8	33.6	25.8	22.9	17.1	14.2
	South America	51.7	9081	45.7	56.0	54.7	51.2	44.5	41.3	39.2	37.4
	Asia	58.1	12433	37.5	62.2	60.8	56.7	51.0	45.7	44.1	42.4
	Northern Africa	58.8	3315	32.8	58.2	60.3	56.5	49.6	48.6	38.5	42.0
	Oceania	60.0	13337	38.8	82.6	81.6	80.5	78.5	74.8	74.5	75.6
	Europe	72.7	24617	35.0	74.6	74.0	74.0	70.0	65.4	64.9	66.6
	North America	75.7	56110	39.5	77.0	76.8	75.6	75.5	72.6	74.4	74.0
	Northern Europe	83.9	49139	33.1	87.8	87.0	86.7	84.7	81.4	80.2	80.9
	China	54.2	10390	46.8	58.5	56.6	50.0	41.3	37.1	29.8	21.1
	Whole sample	56.0	14286	39.4	66.0	65.2	62.9	57.9	53.9	52.0	51.7

Note: For cross-sectional data, the 2020 standard is followed to classify economies. For panel data, as many low-income economies have become middle-income economies, the 1990 standard is followed through to classify economies and ensure the consistency of samples across years.

7.2. Vertical Changes of Shared Development Levels

Table 1 tracks the performance of 67 economies from 1990 to 2020. During this period, the average value of shared development rose from 51.7 to 66.0. A look at different income groups finds that low-income economies registered the fastest progress, with an increase in the average value of shared development from 23.7 to 49.0 that mainly occurred after 2000. High-income economies registered the slowest progress, with the average value of shared development rising from 75.9 to only 82.4 and the growth almost stagnated after 2010. This was mainly because of the rapid increase in per capita GNI of low-income economies, which contributed significantly to the progress in shared development. However, high-income economies had to tackle a slow growth in per capita GNI and a rising Gini coefficient, which led to the stagnation of shared development in the region and eventually a significant slow-down globally. In terms of regional groups, the most significant progress was observed in Southern Africa, South America, Asia, and Northern Africa. Within 30 years, the average value of shared development in Southern Africa increased from 14.2 to 38.0, a rise of 23.8 in the absolute value. South America, Asia, and Northern Africa registered

an average increase of about 20. In Oceania, Europe, and North America, the growth was quite slow.

In 2020, China's score of common prosperity was close to the average of the upper-middle-income group in the sample of 67 economies. Within the sample range, China's score had tripled, an increase significantly higher than the average in other regions. China thus became the only big country in the world to have achieved such a progress. This was mainly due to progress made in the dimension of development. During this period, China's per capita GNI increased by 31 times, driving the surge in the progress of common prosperity. However, China's income Gini coefficient increased by 33.4% from 1990 to 2020, reflecting a widening income gap that inhibited the improvement of common prosperity. If the income gap is significantly narrowed in the future, China can expect further leaps towards common prosperity.

8. Main Conclusions

In the discourse system with Chinese characteristics, previous research on common prosperity tended to focus on the qualitative expression of its theoretical connotations and might have missed a probe into its quantitative measurement methods, especially an empirical study that applied the theory of common prosperity to mathematical analysis. The Fifth Plenary Session of the 19th Central Committee of the Communist Party of China clearly stated the goal of achieving more substantial progress in promoting common prosperity. The Outline of the 14th Five-Year Plan (2021–2025) specifically called for an action plan for promoting common prosperity. The *Opinions of the Central Committee of the Communist Party of China and the State Council on Supporting Zhejiang in Building a Demonstration Zone for Achieving Common Prosperity through High-Quality Development* released in 2021 echoed the requirement of achieving more notable and substantial progress towards the goal of common prosperity by 2035. Common prosperity has indeed shifted from a conceptual goal to an actual policy. At the new stage in the new journey of promoting common prosperity, we must fully understand the theoretical connotation of common prosperity, construct quantitative methods for its measurement, and monitor and analyze how common prosperity evolves in China in order to truly put policy measures into practice and promptly respond to policy research needs of major real-world issues.

This paper starts with the technical framework of constructing the method and cites the consensus baselines developed over the past four decades of reform and opening up in China as the prerequisite assumptions for quantifying common prosperity with Chinese characteristics, including “egalitarian poverty is not common prosperity”, “polarized prosperity is not common prosperity”, and “common prosperity is not about everyone getting rich at the same time to the same degree”. This paper then proceeds to define the connotation of common prosperity in the two dimensions of

development and sharing. Assuming that resources are relatively scarce, we identify a functional relation of incomplete sustainability between development and sharing and apply the geometric mean to measure it. From a result-oriented perspective, we use per capita GNI, which promises high availability of data, to measure the dimension of development and the Gini coefficient of per capita disposable income, which promises high comparability, to measure the dimension of sharing. This paper then explores other related issues such as the dimensions of common prosperity and indicator selection, standardization and threshold selection, scale-free assumptions, weights and functional forms, and index processing and goal setting, etc. It further tests the axiomatic criteria for the functional relation such as monotonicity, consistency, and homogeneity and finds the quantitative method constructed in this paper to be highly stable and in line with actual policies. Moreover, it promises easy monitoring in practice, easy horizontal and vertical comparison, and easy application.

Calculations based on the functional relation of common prosperity find that China's score of shared development is close to the average cross-sectional value of upper-middle-income economies among the 162 countries and regions. Moreover, China registers the fastest progress in shared prosperity in the sample of 67 traceable economies, mainly due to achievements in the dimension of development. The past 30 years has witnessed a significant improvement in shared development in low-income economies and a stagnation in shared development in developed countries, due to a slow economic growth and a widening income gap. That leads to a certain degree of convergence in terms of shared development globally in recent years.

This paper takes the lead to construct a quantitative method for measuring common prosperity from a result-oriented perspective, proposes the technical framework for discussion, and analyzes shared development around the world using global databases. However, it is worth noting that the quantitative method proposed in this paper only serves as the starting point of a quantitative study on common prosperity and more remains to be done to continuously improve the rationality and stability of the functional relation of common prosperity.

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