

A Study on the Measurement of Purchasing Power Parity in China : Multilateral Index Number Systems Based on Stochastic Approach

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Affected by many factors such as the level of economic development, resource endowment, location advantages and consumption habits, there are objective differences in price levels between different regions in China. It is obviously unreasonable to use equivalence scales to measure the degree of economic development of different regions. From the perspective of welfare measurement, Consumption-level purchasing power parity (PPPs) is a better statistical indicator than GDP-level PPPs (Deaton and Schreyer, 2021). This paper applies the PPPs theory to the measurement of consumption PPPs in China to measure the degree of differences in consumer price levels between different regions.

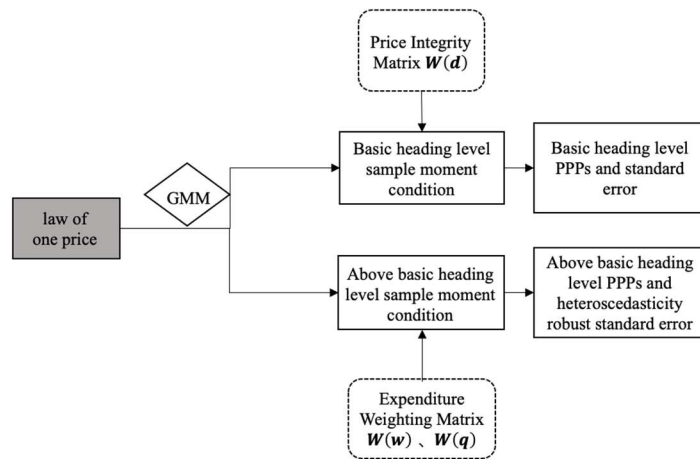
With the expansion of International Comparison Program (ICP) around the world, the measurement method of PPPs has developed from bilateral index to multilateral index, and excellent index methods such as Gini-Eltetö-Köves-Szulc (GEKS) and Geary-Khamis (GK) have emerged. The measurement results of different index methods are often inconsistent, which prompts experts and scholars to discuss which one of the existing index methods is the best method and can better reflect the economic reality (Balk, 1996; Hill, 1997). However, these studies still lack the objective basis for the selection of the index method. In addition, the index method is sensitive to missing values and cannot effectively fill in missing values. Summers (1973) proposed the CPD method based on stochastic approach, which not only solved the calculation problem of basic heading level PPPs in the absence of price data, but also quantified the reliability of the parameters to be estimated. It makes up for the shortcomings of the index method. With the extensive development of ICP in various countries, the CPD method has become the main method for measuring PPPs at the basic heading level of ICP. How to randomize the index method and explore the corresponding degree of reliability becomes an important issue. Selvanathan and Rao tried to randomize the EKS method and the GK method (Selvanathan and Rao, 1992), and proposed a conditional stochastic approach to measure the standard error of the index method (Selvanathan and Rao, 1994). Further, Diewert (2005) perfected the existing stochastic approach by creating different forms of “law of one price” to deduce stochastic approach of GK method. In order to relax the limitation of strict premise assumptions for data distribution, Rao and Hajargasht (2016) introduced the generalized moment estimation method to estimate unknown parameters, which overcomes the problem that the premise assumptions are difficult to satisfy to a certain extent.

With the continuous development and improvement of PPPs measurement methods after China officially participated in the global ICP in 2005, domestic and foreign experts and scholars explored the applicability of different methods in the measurement of PPPs in China (Yu, 2006; Brandt and Holz, 2006; Chen and Hu, 2019). However, the existing studies on PPPs in China all use the index method to measure and analyze the robustness of the results through comparing the differences between the results of different methods. There is a lack of quantitative research on the reliability of the results.

According to the above problem, this paper further optimizes the existing stochastic method based on a systematic study of the stochastic approach proposed by Rao and Hajargasht (2016), builds a generalized framework of the multilateral index number system under the stochastic approach for measuring purchasing power parity in China and combines multi-source data to calculate the consumption PPPs between different regions in China. Finally, this paper calculates the purchasing power parity of 31 regions in China, analyzes the actual consumption level among different regions in China and depicts the consumption gap between residents in different regions.

Method

This paper conducts extended research on the existing stochastic approach (Rao and Hajargasht, 2016), builds a generalized framework of the multilateral index number system under the stochastic approach and deduces the GK system and the Rao system under the stochastic approach. In this way, the reliability of the measurement results can be quantified while measuring the purchasing power parity of 31 regions in China. The generalized framework of the multilateral index number system under the stochastic approach constructed in this paper is shown in the following picture.



Picture 1 The generalized framework of the multilateral index number system under the stochastic approach

Data

By integrating the data of Price Monitoring Center of National Development and Reform Commission, network data at the micro level and the database of National Bureau of Statistics at the macro level, this paper obtained a set of comparable price data at the regional level in China and calculated the purchasing power parity of 31 regions in China. Table 1 gives the data details.

Data Category		Source
Price data	Price data of 232 representative products in 101 cities in 2019	Price Monitoring Center of National Development and Reform Commission; Network data
Expenditure data	Consumption expenditure weighting data of 8 categories and 32 basic categories in 2019	China's National Bureau of Statistics

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