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Status and Extent of Crop Diversification Index in Uzbekistan and its Empirical Analysis

Status and Extent of Crop Diversification Index in Uzbekistan and its Empirical Analysis

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Abstract

The main objective of this study is to examine the status and level of crop diversification among farms in the country through an empirical analysis using panel data collected in 2009-2017. In doing so, we performed the Stata-16 software utilizing the Simpson Diversification Index model in determining the diversification index. According to the results, the highest diversification indicators were found for Samarkand, Fergana and Tashkent regions, respectively, and accounted for 0.74, 0.74 and 0.76, respectively. It can be seen that the existing farms in Tashkent region used more diversified crops than other regions of the country. The average diversification rate of these regions was 0.66. This means that farms in the study areas are not highly diversified. Increasing crop diversification will allow farms to manage different price and production risks, as well as to ensure food security for farmers and further increase their overall incomes.

Keywords: Crop diversification, Simpson index, Cropping patterns, Empirical analysis, Panel data.
JEL: Q1, D31, O18

1. Introduction and Background of the Study

Agriculture plays an important role in the country's overall economy. The agricultural sector is one of the leading sectors of the national economy and contributes over 28.8% of the annual gross domestic product (GDP) and engages 27% of the country's total workforce [1, 2]. Importantly, about 50% of the country's population resides in rural areas and depend on agriculture as well as other related activities [3]. Since independence in 1991, the government of Uzbekistan has been doing several important reforms to find out the best options to increase income of the agricultural sector. The main important reform was to replace state and collective farms with private farms and shirkats. However, the productivity and occupied land area of the shirkats were decreasing throughout the years which led them to abolish agriculture. Instead, the role of private farms and dekhan farms has increased in the agricultural output [4]. Private farms predominantly produce state-order crops which are winter wheat and cotton, whereas smallholders are occupied in the livestock and partly produce other agricultural crops such as fruits and vegetables [5].

At the beginning of independence, agriculture prevailed by cotton and wheat production, accounting for 70% of the total cultivated area and 34% of gross agricultural output. The production of higher value crops, such as fruit and vegetables, was constrained by limited access to land, inputs, modern crop-specific technologies, and finance. Additionally, Uzbekistan's agricultural policies were more highlighted at the strategically significant crops cotton and winter wheat. Additionally, the state planning system has only retained for these crops whilst fruits and vegetables obtained less policy attention in terms of the lack of state procurement system [5, 6]. Following independence, the country has managed to gradually move away from cotton monoculture towards a more diversified pattern of agricultural produce, including cereals, potatoes, vegetables and melons [2, 5, 7].

Recently, agricultural policy in Uzbekistan has launched paying more attention to intensify high-value diversification of agricultural production while focusing on the development of fruits and vegetables. Therefore, the national administration has recently issued several crucial legislative acts in order to enhance crop diversification through the country [8, 9]. Following this, in the beginning of 2017, the Government's reform and development agenda places increasing emphasis on diversification which is reflected in national strategies and investment priorities. The National Development Strategy for 2017-2021 recognizes the need for diversification of cotton and cereal crops into high value-added and labor-intensive production and processing, including, horticulture, fruits, and vegetables, which are expected to significantly contribute to significant growth of rural jobs, food security and exports revenues [10].

Likewise, the national administration planned to undertake new structural reforms and diversification in agriculture, more productive use of land and water, improved mechanization and infrastructure development, agribusiness development and more market-oriented agricultural policies. Furthermore, the government of Uzbekistan initiated specific activities towards crop diversification. The area of cotton plantations has been significantly reduced towards an increase of wheat to reach higher food security. Farmers were encouraged to use larger parts of their farms for cultivating vegetables. Especially in the pre-urban zones, their share has been increased. However, vegetable and fruit production are still not sufficient to supply the Uzbek population and there is also room to further extend the area of these cash crops and to improve the marketing structures for export [11]. Therefore, crop diversity plays an essential role in sustainable agriculture and diversification of the crops can be an effective tool to help farmers deal with several types of risks [12].

Furthermore, crop diversification is a strategy to maximize the use of land, water, and other resources and for the overall agricultural development in the country. It provides farmers with viable choices to grow diverse crops on their land [13]. In line with the existing views, Saraswati (2011) also suggested that the diversification in agriculture is practiced with a view to avoiding risk and uncertainty due to climatic and biological vagaries. It can also help to minimize the adverse effects of the current system of crop specialization and monoculture for better resource use, nutrient recycling, reduction of risks and uncertainty and better soil conditions. In addition, it also ensures better economic viability with value-added products and the improvement of ecology as well [13].

Karimov (2013) indicated that enhancing crop productivity on the farm level plays an essential role in developing economic growth, improving food security and easing poverty in the country. Whilst the government ought to carry on crop diversification among farmers, as it supports obtaining extra income, improves food security as well as lessens famine [14]. Dagar (2018) defined that crop diversification is planned to give a wider choice in the production of a variety of crops in a specified area to increase production related activities and minimize risk [15].

The results of the previous studies emphasized that most of the achievements in cotton and wheat production are based on high input use technologies such as water, seed, fertilizers, and pesticides which are not sustainable on a long-term basis. Therefore, high input use technologies will not be appropriate for all privet farms [7]. Furthermore, the area available for high-value alternative crops, however, cultivation of these types of crops is very limited in spite of high economic and ecological potential [17, 18].

Hence, it is the right time to look for a suitable and realistic strategy by which cropping intensity could be enhanced and diversification achieved. Moreover, comprehensive studies of crop diversification in Uzbekistan are still sparse and mostly studies based on hypothetical scenarios and multi-sensor remote sensing data results, only limited research on this subject has been conducted in Uzbekistan to date [16, 19]. To the best of our knowledge, there are currently no study to date has attempted to the empirical analyzes comprehensive understanding of the status and extent of crop diversification at the farm level in Uzbekistan.

2. Materials and methods

In this study, all regions of Uzbekistan were chosen for the analysis because these provinces are located in different part of the country, as shown in Figure 1. The northwestern provinces have enough arable land where farmers mainly cultivate wheat and cotton crops and these two crops are controlled by the government in terms of state procurement policy [20, 21, 6]. In the eastern part of the Fergana Valley where Tashkent region is situated in the northeastern part of Uzbekistan. These areas have greater independence to choose their own crop and subsequently often focus on fruits and vegetables. In these ‘non cotton’ areas, it is common to see vegetables being produced as second crops after winter wheat, with farmers cultivating vegetables, beans and potato or melon crops (Tashkent - 15.5%, Andijan - 12.9%, respectively) [22, 2].

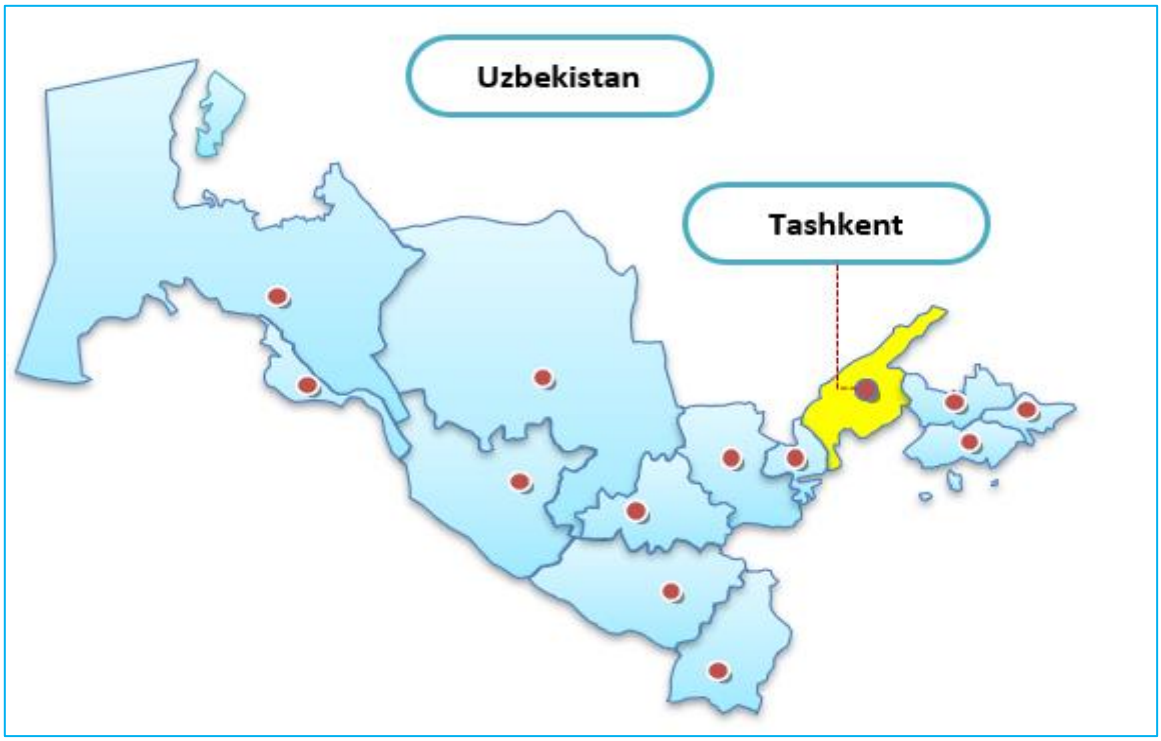

Figure 1. Map of study areas of Uzbekistan.

Source: http://yourfreetemplates.com (Own illustration)

The study has used a panel data for the years 2009-2017 collected by the Official Statistical Agency of Uzbekistan. All regions were included in gathering this data for the analysis. All regions have different agro-ecological, crop production and marketing access facilities. For instance, Samarkand, Tashkent and Fergana provinces have great potential in both cases, however, Khorezm, Bukhara and Kashkadarya districts are in low potential zones, respectively.

The extent of crop diversification can be measured by using several indices Simpson's Index (SI), Composite Entropy Index (CEI), and Shannon Index (ShI). These indices have been widely used by many other researchers to estimate the nature and extent of crop diversification practices of farmers [23, 25, 26]. However, in terms of data availability and crop patterns, this study is employed Simpson Diversity Index (SDI) because it is the most used index in numerous studies related to crop diversification [24, 27] including in Uzbekistan [16, 19]. The Simpson Diversification Index (SID) is calculated using the following equation:

$$\mathrm{SID} = 1 - \sum_{i=1}^{n} P_i^2 \quad (1)$$

$$P_i = \frac{A_i}{\sum_{i=1}^{n} A_i} \quad (2)$$

where A_i is the value or area of the ith commodities and P_I is the proportionate value or area of the ith commodities in the total value or area. The index ranges between 0 and 1 value. If the values close to 1 point at more diversify cropping pattern or complete diversification, value of 0 indicates in contrast a situation of monoculture or complete specialization. In this study, we used a panel data for the years 2009-2017 considering with several agricultural

crops in order to calculate the index common in smallholder farming in all provinces of Uzbekistan. Crops included cereals (barley, rice, wheat), pulses (bean and leguminous), potatoes, vegetables and others.

3. Results

Based on utilizing Stata-16 statistical software tool we obtain the result that in terms of diversification, the result indicated that the average crop diversification index within the nine years for the sample of regions was 0.58 with a standard deviation of 0.04. The result implies that during the nine years farmers had an average level of crop diversification index in different regions of the Uzbekistan (Table 1).

Table 1. Level of crop diversification of farmers in study areas

Regions	Observations, years	SD	Min	Mean	Max
Andijan	2009-2017	0.02	0.64	0.69	0.70
Bukhara	2009-2017	0.01	0.63	0.64	0.66
Jizzakh	2009-2017	0.02	0.68	0.71	0.73
Fergana	2009-2017	0.03	0.69	0.74	0.77
Karakalpakstan	2009-2017	0.04	0.62	0.69	0.73
Kashkadarya	2009-2017	0.03	0.64	0.69	0.72
Khorezm	2009-2017	0.01	0.67	0.70	0.71
Namangan	2009-2017	0.02	0.69	0.73	0.75
Navoiy	2009-2017	0.05	0.64	0.68	0.73
Samarkand	2009-2017	0.03	0.70	0.74	0.76
Sirdarya	2009-2017	0.05	0.58	0.64	0.69
Surkhandarya	2009-2017	0.03	0.65	0.69	0.73
Tashkent	2009-2017	0.01	0.74	0.76	0.77

Source: Own estimation

According to the results, the highest diversification indicators were found for Samarkand, Fergana and Tashkent regions, and accounted for 0.74, 0.74 and 0.76, respectively. It can be seen that the existing farms in Tashkent region used more diversified crops than in other regions of the country. These figures are higher than in other provinces, and in these provinces not only grain and cotton crops grown on the basis of the state order, but also other agricultural crops are grown by farms. In Bukhara and Syrdarya regions the diversification index is lower than in other regions (0.64 and 0.64, respectively). The average diversification rate of these regions were 0.58. This means that farms in the study areas are not highly diversified. The findings were almost comparable with the findings of [4] and [18] who found 0.65 and 0.68 in Khorezm (in 2008) and Fergana Valley (during 2010-2012), respectively.

Figure 2 also deployed that the crop diversification index was normally distributed and moderately skewed to the right implying that most of the farmers were not too diversifier in their cropping portfolio because of the majority of farmers were more likely to cultivate only cereal crops such as cotton, wheat and rice due to the strong regulation of the national government on the agricultural practices in the country [30].

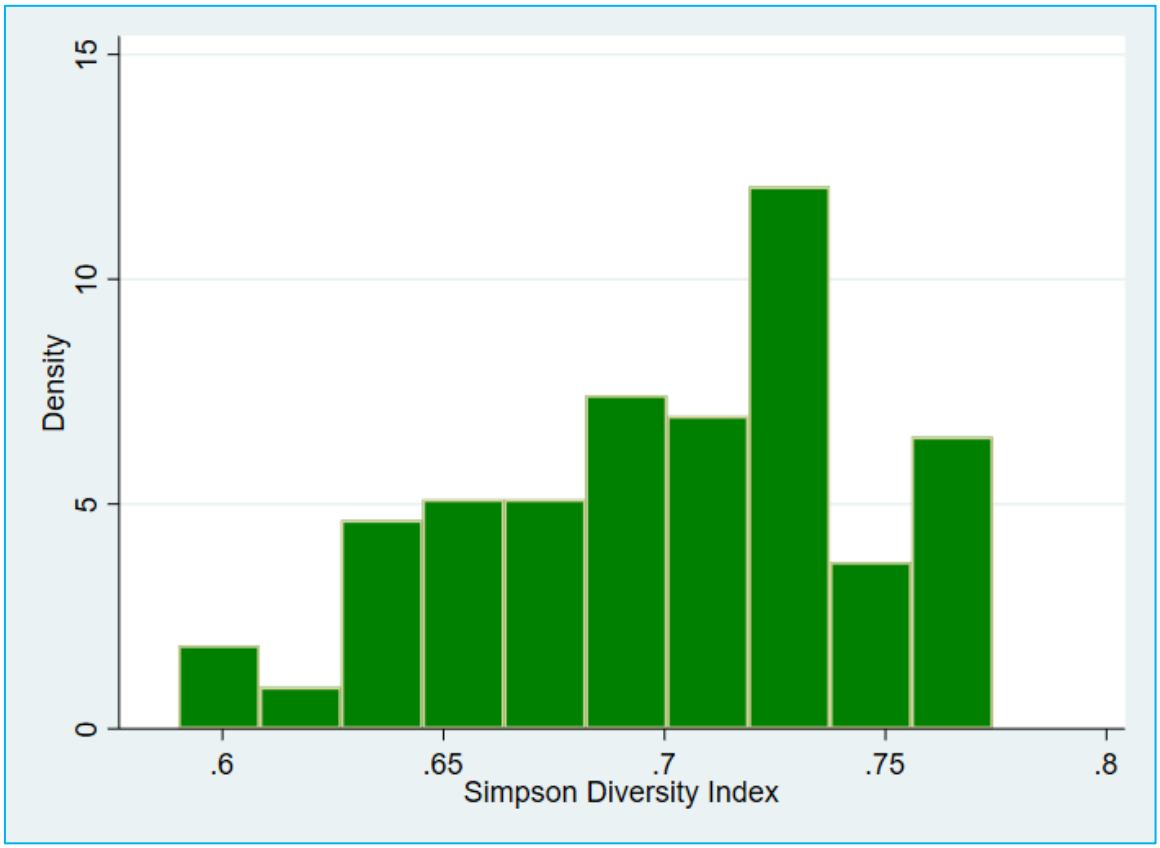

Figure 2. The mean crop diversification index in study areas

Source: Own estimation

We performed the Stata-16 statistical software tool using the Simpson Diversification Index model in determining the diversification index. According to the figure 3 Tashkent regions farmers shifted towards more diversification cropping patterns than other counterparts of the country during the 2009-2017 years.

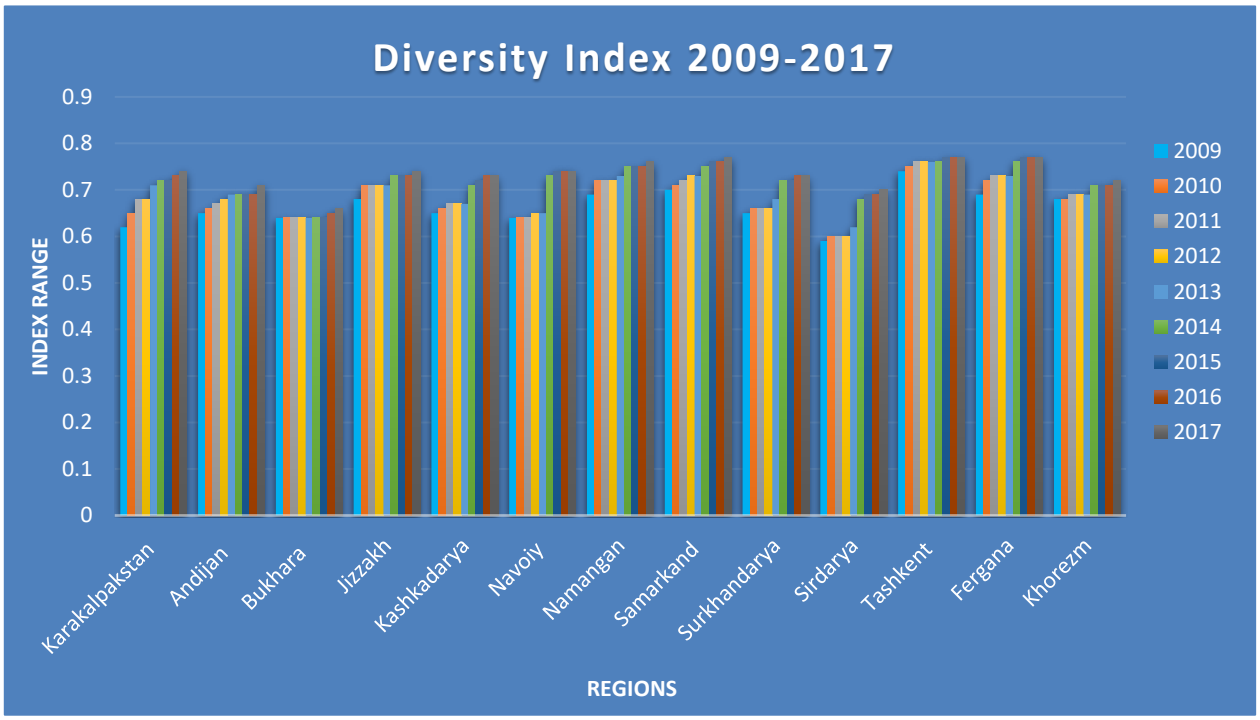

Figure 3. The mean crop diversification index

Source: Own estimation

In addition, the overall result in the country combined in this study reveals a mean Simpson Index within the sample of farmers was 0.58. This implies that the farmers in the study areas were not too diversified in their cropping pattern during the study periods.

4. Conclusion

The study has examined the main status and extent of crop diversification at regional level across different states of Uzbekistan. The Simpson Index values indicate that the highest diversification indicators were accounted 0.74, 0.74 and 0.76 for Samarkand, Fergana and Tashkent regions, respectively. This implies that Tashkent region farmers shifted towards more diversification cropping patterns than other counterparts of the country. However, in Bukhara and Syrdarya regions (0.64 and 0.64, respectively) the diversification index is lower than other regions. The indices are higher than in other provinces, and in these provinces not only grain and cotton crops grown on the basis of the state order, but other agricultural crops are also grown by farms. The overall result in the states combined in this study reveals a mean Simpson Index within the sample of farmers was 0.58. While cultivating several crop species helps the farmers to manage both price and production risks which attains more food options for the household and income through marketing the produce from the surpluses.

Therefore, the government needs to intensify the promotion of crop diversification in order to increase farm income and food security in the country. Alongside, crop diversification might contribute to the efficient use of labor in farming. The analysis also emphasizes that a farmer having own agricultural equipment such as water pump and tractor are more likely to adopt crop diversification. Therefore, the government urgently collaborates with the financial organizations and donors which offer small loans with low interest rates in order to provide such machineries to the farmers. Crop diversification also helps the farmers to improve on the right selection and cultivation of different crop types on their farms.

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