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Dynamics of Multidimensional Food Security in Azerbaijan

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Abstract

This study explores the size of the dynamics of multidimensional factors on food security status, which gives deep understanding to decision and policymakers. The multidimensional food security index was constructed by using diverse indicators based on food security pillars (availability, access, utilization, stability). PCA analysis was used to construct multi-dimensional food security approach by using the 16 diverse indicators. Ranking of Azerbaijan's based on multidimensional food security in 2017-18 obtained in the present study does not correspond with ranking given by the Global Food Security Index (GFSI) due to the more diverse and broad spectrum indicators used in this study. However, it provides deeper insight into food utilization and stability dimensions. In Azerbaijan fluctuations in the food security situation was the outcome of various factors, such as food price shocks, low agricultural production, and depreciation of domestic currency, climate change and rise in oil prices. This study suggests that there is urgent need to develop a concrete and comprehensive broad-spectrum food security policy. Based on our findings, further studies should be focused on advocating for a well-targeted policy that could overcome the gap in food security caused by multidimensional factors.

Keywords

Food availability, food access, food utilization, food stability, Azerbaijan

JEL Codes: F5, Q01, Q5, Q18, Q19

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1. Introduction

Important policy objectives which will focus on elimination of poverty and hunger which are major and fundamental aspects of cause and consequence of food insecurity are key to solving Azerbaijan's National food security challenge. Several studies have highlighted the status of food security at national, household and individual's food security level. However, a model for estimation of national food security tends to be dissimilar in different countries across the world. This is because every country has a distinctive characteristics and prevailing social and economic situations and many indicators such as availability, access, utilization and stability have been used along with four key dimensions of food security (FAO, 2003; Grainger, 2010).

These dimensions play a significant role in the food security status of any country. One of the key causes of food insecurity issue is non-availability of food that produces price shocks. A country like Azerbaijan with limited agriculture share to GDP growth has more problems with food security. In Azerbaijan, despite massive investment in macro-economic programs, improvements in gross domestic product growth, and trade between 2010 to 2015, rural households and individual's food insecurity is still a great challenge (FAO, 2015). The agricultural sector plays a pivotal role in the economy of Azerbaijan. The major area of the country is used for agricultural activities. About 58% area of Azerbaijan was used for growing the different crops and farming of different animals. The major crops which are grown in 2010 were wheat and tomatoes. These two crops provide the maximum amount of production which was the highest value of the ever production. The peoples of Azerbaijan also take interest in cattle breeding, fishing, and forestry. They earn a lot of money by adopting such type of profession which directly affects the economy of the country. The country made progress through an investment of money in the field of Agriculture. Poultry farming and buffalo breeding are also done for obtaining the highest monetary return. These two fields play a great role in developing the economy of the country. Meat is used by people and indirectly provides great money to the country and in return boosting the country's economy (GOA, 2016). The main causes of rural food insecurity in Azerbaijan are numerous, including environmental, structural, political, social and economic policy failures (Schmitz and Kennedy, 2016). Thus, the food availability dimension involves economic factors on demand and supply side. On the supply side of the economy, food availability and food stability dimension of food security characterize economic factors, relating foreign trade and macroeconomic production levels. On the other side, food access and food utilization dimension denote the demand side of the economy such as income and price level. Therefore, economic factors have a significant role for the national, household and individual level food security status. To understand the deeper the dynamics of national food security, it is important to examine the impact of multidimensional factors. This study aims to explore the

size of the dynamics of multidimensional factors on food security status, which gives deeper understandings to decision and policymakers. It will give a rational choice for food security policymaking for any country (Vasa, 2011). The basic and foremost step to address with food insecurity issue is to examine its performance and to appraise the available policy choices (Vasa, 2010). To attain sustainable food security is one of the prime objectives of social and economic policy formulation. A well-targeted policy could overcome the food insecurity gap caused by multidimensional factors. This study seeks to study the factors that influence national food security in Azerbaijan and give multidimensional food security that is useful for a comprehensive policymaking in Azerbaijan.

2. Literature review

2.1. Present challenges in ensuring Azerbaijan's national food security

The agriculture sector in Azerbaijan is facing many challenges. Agriculture is very sensitive to climate because when climate changes there is a great effect on the production of crops because specific crops grow with specific temperature, specific day length, specific photoperiod, and specific water requirements. When any one of these factors changes then the crops are automatically affected and finally the production of such crops is decreased. If crops are grown under favourable conditions, there tends to be a spontaneous increment in their growth with an increase in the overall production. With the incidence of climate change, the climate in Azerbaijan is also changing and the sector of agriculture is being affected. The agriculture facing drought, water scarcity, salinity and soil degradation in Azerbaijan (Chaaban *et al.*, 2018). About 47% of the population of Azerbaijan is currently living in rural areas and they depend on agriculture, so their lifestyle is affected due to changes in climate. Around 39% of employers are working in the agriculture sector so their living habits and living styles are also affected. Currently, the peoples of Azerbaijan are working to address climate change. Many other environmental issues in Azerbaijan are pollution of water resources with wastewater including transboundary pollution, insufficient quality of water and the soil of Azerbaijan are degraded due to soil erosion and salinity etc. It is stated that 39 km water is present in Azerbaijan and out of it, 29.3 km is surface water and 8.8 km of water is underground. The agriculture sector in the country is facing the problems of water shortage due to the uneven distribution of water in the country and wastage of water regularly without considering its importance. The main reason for the shortage of water is due to reliance on irrigated lands. Azerbaijan produces a huge amount of waste which is polluting the water and lands are irrigated with this polluted water, so the crops grown are not healthy and beneficial (Clapp, 2017).

The other major problem in Azerbaijan is the problem of soil erosion. Erosion is caused in soil due to poor management, dropped irrigation and drainage infrastructure. The chemicals are applied in the soil to increase productivity in the form of fertilizers and pesticides; this also causes the erosion of soil (FAO, 2015). The pastures are being degraded due to overgrazing and which also leads to soil erosion. 96% of soil erosion is due to agricultural activities in Azerbaijan. About 3.7 million ha of land in Azerbaijan is eroded and 0.7 million ha of that area is intended for agriculture. The soil in Azerbaijan is eroded due to heavy winds, gullies, due to improper land management, water, and irrigation. Some factors which also because soil erosion includes poor cultivation practices, overgrazing, and soil salinization. The reduction of forests grown in Azerbaijan and reduction in vegetation is also caused by soil erosion. Flooding also causes major damage to Azerbaijan. About 1 million ha of soil is damaged due to floods. This was a huge loss to the economy of the country in the year. Similarly, in different years the loss occurred due to flooding. Due to these challenges, the production of different crops was affected, and the production of cereal was reduced from 3% to 14% in 2005 and 2009, all due to flooding and other environmental issues (Djuric *et al.*, 2017).

3. Methodology of research

3.1. Building and scope of multidimensional food security definition

The multidimensional food security (MFS) is based on World Food Summit definition: "When all the people, all the time have availability and access (physical, economic, social) of Sufficient, safe and healthy food, to fulfil their food demands for living an active and healthy life". The data for building the index is taken from FAO, WHO and the world data bank.

The data of diverse indicators are classified into four dimensions to get food security status ranking at the national level based on FAO definition. Dimension 1, 2 and 3 contain food availability, access and utilization indicators. Dimension 4 provides information about food stability and resilience. The food availability dimension examines each factor that controls the food supply and eases the food availability access within Azerbaijan. It studies how supply-side structural framework determines the ability of a country to supply the food and finds significant factors that might influence the supply chain. The food accessibility and affordability dimension explore the ability of common people within a country to buy food items and the relative cost they may face in the short run and long run. It is a crucial dimensional of national food security. The food utilization dimension examines the nutritional value and verity of average food within the country. In this approach, we will

use the indicators that explore the quality of aggregate food supplied. The food stability dimension forecasts the future outlook of the first three dimensions at a national level in Azerbaijan. This multidimensional food security index (MFSI) will serve as a warning parameter for examining the food price shocks that may worsen or threaten the national food security status of Azerbaijan.

3.2. Selection of Azerbaijan's national food security indicators

The relevance of selecting the national food security indicators is that policymakers and researchers could easily compare the progress and performance of Azerbaijan's government programs on national food security over time. This section presents a selection process of macro and micro scale indicators that have been employed to construct a multidimensional index. The distribution of indicators within food security dimensions are below:

3.2.1. National food availability dimension

The four indicators used to estimate the food availability dimension include (1) average food energy supply, data is taken from FAO from the period of 1992 to 2018. It is determined by the ratio of food energy supply in Azerbaijan to the average food requirement of energy. It involves both food waste and food consumed at a national level (2) average value of food production. It is also called an annual value of food production per capita at the national level. Data is also taken from the FAO over the period 1992 to 2018. This indicator explains the significance of the agriculture sector in Azerbaijan and the share of this sector to attain food security (3) average supply of protein. It is expressing the national supply of protein taken from various resources. Data is also taken from the FAO over the period 1992 to 2018, (4) average protein supply from animal origin. It is explained as an average per capita national supply of protein from the animal resources. This indicator reflects the significance of meat products such as animal meat, fats, eggs, milk, seafood, and fish products. Data is also taken from FAO for 1992 to 2018.

3.2.2. National food access and affordability dimension

Road density (FAO, 1990–2015: 2013) is expressed as kilometres of road per 100 square km of land area across countries. The road in general, paved or non-paved is important for trade and makes physical access to food easier. Four indicators were used to estimate the food access and affordability dimension: (1) Density of road. It is expressed in terms of kilometres of each 100 square kilometres of land. The provision and standard of the road are played an important role in physical food access and trade. (2) Consumer price index. It is used for examining the relative price change at the national level. The food price shock during 2007-08 leads to an increase in the food insecurity level by about 11 percent in 70 developing countries (Shapouri, 2010). (3) GDP per capita. It is used to measure the average purchasing power of common consumers at the national level. (4) POU (prevalence of undernourishment). It is using to reflect the level and sufficiency of caloric intake. POU is a traditional indicator to study the dynamics of food utilization dimensions. The dataset of all four indicators was taken from FAO from the period 1992 to 2018.

3.2.3. National food safety and utilization dimension

In this dimension, there are also four indicators used to estimate the food utilization status of Azerbaijan at the national level. (1) Access to clean/improved water sources. It represents the percentage share from the total population drinking clean and improved water. This indicator gives data that is important to examine the food security outcome of utilization dimension. The dataset was taken from World Data Bank (WB) from the period 1993 to 2018. (2) Prevalence of anaemia among pregnant women. It will explain the percentage share of pregnant women who have anaemia at the national level in Azerbaijan. (3) The percentage share of kids under 5 years of age who are underweight. This indicator will give you data about kids 5 years or below whose weight for age is less than the standard level. The dataset was taken from World Data Bank (WB) from the period 1993 to 2018. (4) Prevalence of iodine deficiency. This indicator is selected to get the information about parentage share of the population who have iodine levels less than standard. The dataset was taken from World Data Bank (WB) from the period 1993 to 2018.

3.2.4. National food stability and resilience dimension

The food stability and resilience dimension explain the future outlook of the national food security of Azerbaijan. There were also four indicators used to estimate it. (1) Food import dependency ratio. It examines Azerbaijan's dependence on the import of food items to fill the demand gap of the domestic market. According to Napoli (2011), any increase in the food dependency ratio is indicating the domestic shortfall of food production. (2) Percentage of food imports over total merchandise exports. It examines the share of food items imports over other products imports over time. Increases in the gap between shows that there is more emphasis on other sectors over the agricultural sector. (3) Variability in CPI (consumer price index). (4) Variability in the exchange rate. Both variables will explain the domestic Vis a Vis international

market volatility that could directly influence the national food security of any country. All selected indicators dataset was taken from World Data Bank (WB) from the period 1993 to 2018.

3.3. Empirical Model (Principle Component Analysis)

The study used secondary data that is taken from the Food and Agricultural Organization (FAO) and the World Bank. In the case of Azerbaijan, data limitation is the major problem that is faced by the researchers. Therefore, this study used only those indicators in which data was available for the period 1992 to 2018. There were still a few food utilization and access indicators that had some years missing data. We imputed the missing data and omitted those variables which have less than 5 percent missing data of total data. This study used the Principle Components Analysis method to construct the multidimensional food security status for Azerbaijan. Before applying the PCA method, the selected data need to be transformed or normalized for creating the index on a standard scale. Several methods are useful for the normalization of variables that are estimated on various scales (Freudenberg, 2003). The Z-Score method was applied for each indicator over the period 1992 to 2018. The PAC analysis was done with the help of STATA software. The PAC analysis gives separate estimation results for each food security dimension.

4. Results and discussions

The multidimensional food security index was constructed on diverse indicators based on food security pillars (availability, access, utilization, stability). The PCA analysis suggests that 4 indicators characterize food availability dimensions, 4 indicators embody food accessibility dimension, 4 indicators represent food utilization and safety dimension and also 4 indicators choose for food stability and resilience dimension.

Table 1. List of selected food security indicators

S/N	Food security Indicators (Data Sources)	Dimension	Weights	PCA loading
1	Average food energy supply (FAO)	Availability	0.25	.413
2	Average value of food production (FAO)			.342
3	Average supply of protein (FAO)			.457
4	Average protein supply from animal origin			.830
5	Density of road (WB)	Access	0.25	.40
6	Consumer Price Index (WB)			-.53
7	GDP per capita (WB)			.33
8	Prevalence of undernourishment (FAO)			.74
9	Access to clean/improved water sources	Utilization	0.25	.39
10	Prevalence of anemia among pregnant women			-.45
11	Percentage share of kids under 5 years of age who are underweight			-.23
12	Prevalence of iodine deficiency			-.13
13	Food import dependency ratio	Stability	0.25	-.67
14	Percentage of food imports over total merchandise exports			-.42
15	Variability in CPI			-.34
16	Variability in Exchange rate			-.64

Source: Author's calculations

Generally, the multidimensional food security index is comprised of 16 indicators represents the national food security of Azerbaijan. Overall weights are got with the help of multiplying PCA loading indices with component assigned weights and each food security dimension with equal weights specifies the uniform importance of each food security dimension for multidimensional index and these established the robustness of index results. Each indicator indices from the estimation have the expected sign of weighting relative to their impact on national food security. According to Harman (1976), the sign of loading PAC factor is arbitrary whereas indicator variance will unchanged as signs of selected indicators are reversed. Hence, this criterion is equally applied to all dimensions of food security. The signs of for selected indicators of PCA loading are negative in food utilization and food stability dimensions because any variation in these indicators leads to changes in national food security status in the opposite way. In the next step, we will estimate the score of multidimensional food security for Azerbaijan for the period 1993 to 2018. Table 2 represents the multidimensional food security index score for Azerbaijan. The negative values of the index in the results Table 2, because PCA analysis uses a normalization process for all the indicators.

Table 2. Results of Multidimensional Food Security in Azerbaijan

AZERBAIJAN	Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	MFSI Ranking 2018	GFSI Ranking 2018
	MFSI Ranking	-0.74	-0.73	-0.77	-0.77	-0.81	-0.85	-0.91	-0.9	-0.92	59 th	54 th
	Year	2002	2003	2004	2005	2006	2007	2008	2009	2010		
	MFSI Ranking	-0.94	-0.96	-0.95	-0.94	-0.96	-0.96	-0.93	-0.96	-0.99		
	Year		2011	2012	2013	2014	2015	2016	2017	2018		
	MFSI Ranking		-1.03	-1.02	-1.04	-1.06	-1.06	-1.06	-1.05	-1.07		

Source: Author's calculations

Data from the Global Food Security Index (GFSI) indicated that Azerbaijan food security has received significant improvement over time as shown in 2017-18. But the ranking of Azerbaijan as per multidimensional food security in 2017-18 obtained in present study does not correspond with ranking given by Global Food Security Index (GFSI). The differences in the ranking of Azerbaijan in both indexes were because we used more diverse and broad spectrum indicators. It gave us deeper insights about food utilization and stability dimensions.

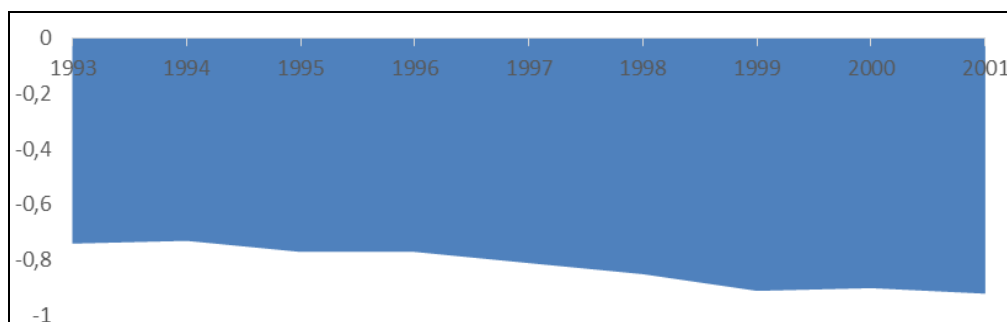


Figure 1. Trend of Multidimensional Food Insecurity in Azerbaijan (1993-2001)

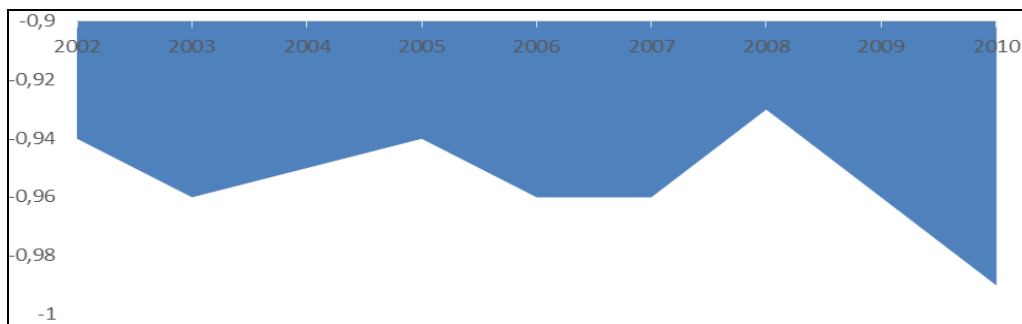


Figure 2. Trend of Multidimensional Food Insecurity in Azerbaijan (2002-2010)

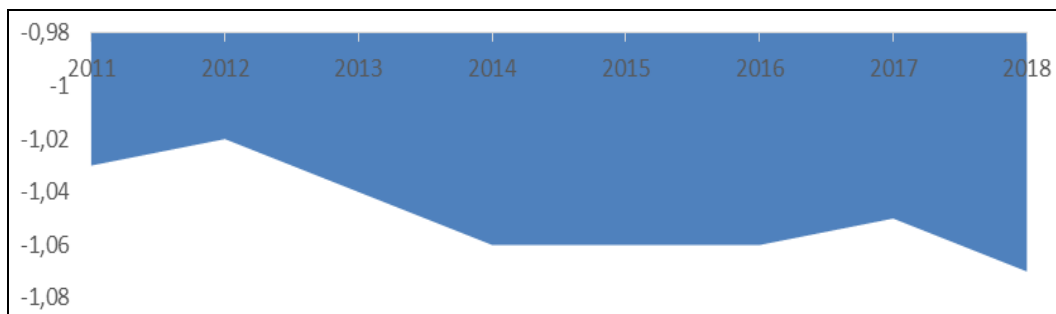


Figure 3. Trend of Multidimensional Food Insecurity in Azerbaijan (2011-2018)

Figure 1 reports the trend of multidimensional food insecurity in Azerbaijan from 1993 to 2001. The graph is showing a downward trend. However, Figure 2 is portraying a reverse situation. It shows high volatility in national food security dynamics in Azerbaijan. It might be due to the economic crisis and food price shocks in the global market which happened in 2007-08. In Azerbaijan, such up and down movement of food insecurity situation is the outcome of various factors, such as food price shocks, low agricultural production, deprecation of domestic currency, climate change and rising in oil prices

(FAO, 2014). On the other hand, from 2013 to 2018 again food insecurity levels decreased in Azerbaijan (see Figure 3). Our results conclude the 16 indicators share the dynamics of diverse food security dimensions. They come up with results that a simple food security index shows improvement over time as shown Global Food Security Index (GFSI) in 2017-18. But the ranking of Azerbaijan as per multidimensional food security in 2017-18 obtained in the present study does not correspond with ranking given by the Global Food Security Index (GFSI). The difference in the ranking of Azerbaijan in both indexes was because we used more diverse and broad spectrum indicators. It offered us deeper insights into food utilization and stability dimensions. In Azerbaijan, such up and down in the food insecurity situation was the outcome of various factors, such as food price shocks, low agricultural production, and depreciation of domestic currency, climate change and rise in oil prices.

4. Conclusions

This study explores the size of the dynamics of multidimensional factors on food security status, which gives deep understandings to decision and policymakers. This study provides a rational choice for food security policymaking for any country. The basic and foremost step to address with food insecurity issue is to examine its performance and to appraise the available policy choices. The multidimensional food security index was constructed by using diverse indicators based on food security pillars (availability, access, utilization, stability). The PCA analysis was used to construct multi-dimensional food security by using the 16 diverse indicators. They come up with results that a simple food security index shows improvement over time as shown Global Food Security Index (GFSI) in 2017-18. But the ranking of Azerbaijan based on multidimensional food security in 2017-18 obtained in the present study does not correspond with ranking given by the Global Food Security Index (GFSI). The difference in the ranking of Azerbaijan in both indexes was because we used more diverse and broad spectrum indicators. It offered us deeper insights into food utilization and stability dimensions. In Azerbaijan, such up and down in the food insecurity situation was the outcome of various factors, such as food price shocks, low agricultural production, and depreciation of domestic currency, climate change and rise in oil prices. Hence this study suggests that the Azerbaijan government should develop a comprehensive and broad-spectrum food security policy. This study advocates a well-targeted policy could overcome the food insecurity gap caused by multidimensional factors.

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