



Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/13507

DOI URL: <http://dx.doi.org/10.21474/IJAR01/13507>



RESEARCH ARTICLE

AN EMPIRICAL STUDY ON THE IMPACT OF ECONOMIC DEVELOPMENT IN FOOD SECURITY IN EMERGING AND DEVELOPED ECONOMIES

Sawssen Nafti

Faculty of Economics and Management of Sousse Laboratory, University of Sousse Street of Khalifa El Karoui Sahloul - BP n° 526 - 4002 Sousse Tunisia.

Manuscript Info

Manuscript History

Received: 31 July 2021

Final Accepted: 31 August 2021

Published: September 2021

Key words:-

Safety Food, Economic Development, Poverty, Malnutrition

Abstract

In this paper, we empirically investigate if food security is specific to a space, a level of development or an economic mode, using Panel data. Our study initially exploited a total sample of 52 emerging and developed countries, for the period 1980-2006, then, we subdivided the sample in two subsamples according to the classification of the World Bank and according to the income. In this way, food safety can be defined as the capacity of all people to a sufficient, healthy and nutritive food, the physical and the economic access. Our results indicate that the countries in the process of development are the most vulnerable to food safety (in quantity: undernourishment) because of the increases of the percentage of poverty. But the developed countries suffers also by this problem(in quality: obesity).

Copy Right, IJAR, 2021.. All rights reserved.

Introduction:-

Access to food is an absolute right granted to every people by multiple international legal regulations. Although the agriculture can feed all the population of the world, today millions of people can't eat on their hunger, suffers from evil and under nutrition. However, food is the main problem for poor people in a large number of developing countries. Also in developed countries millions of people haven't access to an adequate, safe and healthy food. So both insufficient and excess supplies are two major problems. Based on this idea, our investigation researches a request to the question, if food problem is specific to an area, to a level of development or to economic regime.

This study is organized as follow: Firstly, we show a review of previous literature on the nexus between food safety and economic development. Secondly, we explore the econometric method used in our paper and we present the empirical results. Thirdly, we give interpretation of results and concluding remarks.

Literature Review:-

There are substantial differences in the level of food security across the developing countries. The percentage of people suffering from hunger in Nicaragua fell by 31% from 1990 to 2009, while the decline was 4.9% in Ecuador during the same period (s. Willaartset, 2014).Some authors showed that economic growth is essential to improve nutrition in developing countries (Ravallion, 1990; Pritchett and Summers, 1996; Smith and Haddad, 2002). Other authors argue that economic growth is necessary but not sufficient to fight against malnutrition. Indeed, there must be cost-effective investments in public health, sanitation, and a good educational system (Wolf and Behrman 1983; Timmer, 2000; Alderman et al., 2003; Suri et al., 2011; Ruel and Alderman, 2013).

Corresponding Author:- Sawssen Nafti

Address:- Faculty of Economics and Management of Sousse Laboratory, University of Sousse Street of Khalifa El Karoui Sahloul - BP n° 526 - 4002 Sousse Tunisia.

Food safety is a very broad concept and quite complex, multi-dimension (Availability, Access, Stability and Utilization) and different areas (national, local, households and individual level). Each dimension has different indicators:

1. Availability: (Adequacy of average dietary energy supplies, average value of food production, Share of dietary energy supplies made of cereals, roots and tubers, medium protein supplies, and medium protein supplies of animal origin.
2. Access: (Percentage of paved roads throughout the network, Road density, Gross Domestic Product per capita (purchasing power parity), the national price Index of food, prevalence of undernourishment, Part food expenditure among the poor, the food deficit Extent, Prevalence of food insufficiency.
3. Stability: Dependency rate in respect of cereal imports, Percentage of arable lands equipped for irrigation, Value of food imports to total merchandise exports, Political stability and absence of violence / terrorism, Instability in domestic prices of food, Variability in food production per capita, Variability in food availability per capita.
4. Use: Access to improved water sources, Access to improved sanitation facilities, Percentage of emaciated children under 5, Percentage of children under 5 who suffer growth retardation, Percentage of children under 5 who are underweight, Percentage of adult underweight, Anemia prevalence among pregnant women, Anemia prevalence in children under 5 years, Prevalence of vitamin A deficiency in the population and Iodine deficiency prevalence of pre-school children (6-12 years).

The most commonly used indicator is related to undernourishment (Dijk and Meijerink, 2014).

Econometric Methodology:-

Analysis of the evolution of food security

We consider models that include a linear trend and quadratic¹ trend specific to each country.

The first model is written as follows:

$$PREVAL_t = \alpha_0 + \alpha TREND_t + \varepsilon_t \quad (1.1)$$

With:

PREVAL : The variable relating to the prevalence of undernourishment.

TREND :

Linear trend. The quadratic trend model is written as follows:

$$PREVAL_t = \alpha_0 + \alpha TREND_t + \beta TREND_t^2 + \varepsilon_t \quad (1.2)$$

With:

TREND² : Quadratic linear trend.

The coefficient for the quadratic term (β), gives information about the shape of the curve. The coefficient (α) indicates the direction of the curve. If (α) is positive then we can conclude that malnutrition increases over time.

Table 1.1:- The estimates of linear trend models and exponential trend.

Country	Linear Trend		Exponential Trend		
	Adjustment Quality	Linear Coefficient α	Adjustment Quality	Exponential Coefficient β	Linear Coefficient α
1-Algeria	0.56	-0.149***	0.85	-0.018***	0.017
2-Bangladesh	0.80	-1.06***	0.85	0.044***	-1.46***
3-Bolivia	0.88	-0.689***	0.95	-0.03***	-0.413***
4-Botswana	0.60	0.057	0.89	-0.074***	0.728***
5-Brazil	0.90	-0.57***	0.90	0.007	-0.64***
6-Cameroon	0.94	-1.43***	0.98	-0.043***	-1.04***
7-Chile	0.49	-0.118***	0.86	0.016***	-0.26***
8-China	0.91	-0.554***	0.93	0.016***	-0.70***
9-Colombia	0.60	-0.292***	0.84	0.031***	-0.578***

¹In general, a **quadratic form** is a homogeneous polynomial of degree two with any number of variables.

10-Costa Rica	0.58	0.005	0.04	-0.001	0.016
11-Ecuador	0.21	-0.18**	0.48	-0.03***	0.116
12-El Salvador	0.35	-0.20***	0.70	0.034***	-0.51***
13-Fiji	0.49	-0.042***	0.82	0.006***	-0.09***
14-Ghana	0.88	-1.54***	0.95	0.07***	-2.23***
15-India	0.54	-0.282***	0.54	0.0004	-0.286***
16-Indonesia	0.30	-0.248***	0.95	0.108***	-0.133
17-Iran	0.41	0.06***	0.55	-0.006**	0.123***
18-Jordan	0.46	-0.124***	0.47	-0.003	-0.09*
19-Mexico	0.68	-0.08***	0.88	0.007***	-0.149***
20-Morroco	0.69	-0.104	0.71	-0.003	-0.077***
21-Pakistan	0.12	-0.076	0.10	-0.002	-0.05
22-Paraguay	0.86	-0.45***	0.97	0.027***	-0.703***
23-Perou	0.94	-0.90***	0.95	-0.01*	-0.78***
24-Philippines	0.98	-0.75***	0.98	-0.004	-0.71***
25-Zambia	0.84	0.99***	0.89	-0.039***	1.35***
26-ZIMBABWE	0.83	-0.63***	0.97	-0.044***	-0.234***

***, ** and *refer to the significance at respective thresholds of 1%, 5% and 10%.

Source: own elaboration based on estimates from the Stata software 12.0.3

Table (1.1) shows the results of the model estimates (1.1) and (1.2), and their quality. The adjustment coefficient for the quadratic term is statistically significant for most countries. This result indicates that the evolution of the undernourished population exhibits a quadratic trend.

Our sample will be divided into four groups. :

Group 1: characterized countries which undernourishment is improving at a decreasing rate.

$$\alpha < 0, \beta > 0$$

Group 2: characterized countries which undernourishment is improving at an increasing rate.

$$\alpha > 0, \beta > 0$$

Group3: characterized countries which undernourishment deteriorated at a decreasing rate.

$$\alpha > 0, \beta > 0$$

Group 4: characterized countries which undernourishment deteriorated at an increasing rate.

$$\alpha > 0, \beta > 0$$

According to the results of estimations the following three groups :

Group 1: Algeria, Botswana, Costa Rica, Ecuador, Iran and Zambia

Group 2: Bolivia, Cameroon, Jordan, Morocco, Pakistan, Peru, Philippines and Zimbabwe

Group3: Bangladesh, Brazil, Chile, China, Colombia, El Salvador, Fiji, Ghana, India, Indonesia, Mexico and Paraguay

Food security and economic growth

Along these lines, we proceed in a dynamic panel data model. Indeed, this model is more powerful than static since

it allows to eliminate the term specific individual heterogeneity (η_i) and offers, therefore, a better efficiency of the estimators. The method used is that of GMM system of Arellano and Bond (1991). The command used is **Xtabond2**, under the STATA software 12.0. We will, first, estimate a model for the whole sample (26 countries).

Indeed, the basic equation can be described as follows:

$$PREVAL_{i,t} = \alpha PREVAL_{i,t-1} + \beta_1 PIBtete_{i,t} + \beta_2 Sante_{i,t} + \beta_3 (alphab)_{i,t} + \beta_4 improvedwater_{i,t} + \beta_5 dummyregion + \eta_i + \varepsilon_{i,t} \quad (1.1)$$

$$DEFICIT_{i,t} = \alpha DEFICIT_{i,t-1} + \beta_1 PIBtete_{i,t} + \beta_2 Sante_{i,t} + \beta_3 (alphab)_{i,t} + \beta_4 improvedwater_{i,t} + \beta_5 dummyregion + \eta_i + \varepsilon_{i,t} \quad (1.2)$$

i: index of individuals (countries)

T: the time dimension

The dependent variables:

PREVAL_{i,t} : The population below minimum level of dietary energy consumption (also referred to the prevalence of undernourishment) shows the percentage of the population whose food intake is insufficient to meet dietary energy requirements continuously.

DEFICIT_{i,t} : The extent of the food gap is the amount of calories that lack an undernourished population to no longer be considered as such, all things being otherwise equal. The average intensity of food deprivation of undernourished people, which corresponds to the difference between the average dietary energy requirements and the average dietary energy intake of undernourished population is multiplied by the number of undernourished people to get estimate of the total existing food deficit in the country, a figure which is then adjusted to the total population. (Source :<http://www.fao.org/docrep/019/as212f/as212f.pdf>)

The explanatory variables:

PIBtete_{i,t} : It is the GDP per capita, it is a proxy for economic growth.

Sante : Share of health expenditure in GDP. Total health expenditure is the sum of public and private health expenditures. It covers the provision of health services (preventive and curative), family planning activities, activities related to nutrition and using emergency reserved to health but excludes the provision of water and hygiene services.

alpha_{i,t} :Adult literacy rate (15 years +) (%). It is the percentage of the population aged 15 and over who can understand, read and write short statements about her daily life. Generally, literacy also includes numeracy, that is to say the ability to perform simple arithmetic operations. This indicator is calculated by dividing the number of literates aged 15 and over by the population of the relevant age group and multiplying the result by 100.

improvedwater_{i,t} :Access to improved water source is the percentage of the population with reasonable access to an adequate amount of water coming from an improved source such as a household outlet of water, public standpipe, a well, a spring or a protected well or collected rainwater. Unimproved sources include vendors, tanker trucks and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 liters per person from a source located within one kilometer of the dwelling.

dummyregion : These are binary variables relating to the regions (Asia, sub-Saharan Africa and Latin America)

η_i : Fixed individual heterogeneity; with $\eta_i \rightarrow i.i.d.(0, \sigma_\eta^2)$

$\varepsilon_{i,t}$:An error term; with $\varepsilon_{i,t} \rightarrow i.i.d.(0, \sigma_\varepsilon^2)$;

Descriptive statistics

Table 2.1:- Descriptive statistics of the variables (total sample).

	DEFICIT	SANTE	IMPROWATER	ALPHA	PIBTGROWTH	PREVAL
Moyenne	117.5526	5.294416	84.00000	80.62884	3.997464	17.07258
Médiane	95.00000	4.982231	86.50000	87.66985	4.335136	15.00000
Maximum	457.0000	10.16272	99.00000	98.64901	19.44997	53.20000
Minimum	10.00000	1.932486	49.20000	25.72519	-17.66895	5.000000
Ecart-type	92.39774	1.810993	11.07693	16.46805	4.334891	11.63759
Skewness	1.298614	0.591790	-1.051353	-1.353930	-0.782319	0.967016
Kurtosis	4.412998	2.730591	3.706406	4.041671	6.065530	3.204845
Jarque-Bera	235.3098	29.16191	138.5908	54.36354	449.1443	94.24592
P-Value	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Source: own elaboration based on the outputs of Eviews 9.0 software.

Table 2.2:- Descriptive statistics of the variables (Group 1).

	DEFICIT	SANTE	IMPROWATER	ALPHA	PIBTGROWTH	PREVAL
Moyenne	133.7517	5.479621	85.00321	3.894653	79.30296	18.30870
Médiane	62.00000	5.116393	92.00000	3.980890	82.99695	10.20000

Maximum	457.0000	10.16272	97.80000	19.44997	97.40659	53.20000
Minimum	20.00000	3.235168	49.20000	-13.22964	49.63089	5.000000
Ecart-type	123.8015	1.615601	14.30101	4.254780	12.70598	14.92303
Skewness	1.147430	0.958165	-1.359987	-0.394793	-0.648534	0.856941
Kurtosis	3.185223	3.577492	3.508947	5.184945	2.572020	2.417873
Jarque-Bera	32.90844	19.02765	49.77237	47.22754	2.331937	18.83850
P-Value	0.000000	0.000074	0.000000	0.000000	0.311621	0.000081

Source: own elaboration based on the outputs of Eviews 9.0 software

Table 2.3:- Descriptive statistics of the variables (Group 2).

	DEFICIT	SANTE	IMPROWATER	ALPHA	PIBTGROWTH	PREVAL
Moyenne	149.9550	5.109926	82.15865	75.37718	3.531311	21.75543
Médiane	155.0000	4.723007	82.95000	83.54765	4.164301	22.05000
Maximum	367.0000	9.901884	96.90000	97.89032	19.01175	46.60000
Minimum	12.00000	2.754422	51.30000	25.72519	-17.66895	5.000000
Ecart-type	95.43791	1.801220	9.876015	19.71387	4.854679	12.25625
Skewness	0.413884	1.162776	-0.750528	-0.814883	-0.940782	0.185599
Kurtosis	2.356168	3.668446	3.733571	2.482889	6.460899	1.969075
Jarque-Bera	9.164319	32.44654	24.19123	5.603450	181.0446	9.204556
P-Value	0.010233	0.000000	0.000006	0.060705	0.000000	0.010029

Source: own elaboration based on the outputs of Eviews 9.0 software

Table 2.4:- Descriptive statistics of the variables (Group 3).

	DEFICIT	SANTE	IMPROWATER	ALPHA	PIBTGROWTH	PREVAL
Moyenne	87.60606	5.309432	84.72596	84.19026	4.359638	13.33261
Médiane	81.00000	5.202434	87.30000	90.53562	4.667663	13.45000
Maximum	352.0000	9.725062	99.00000	98.64901	15.20706	47.30000
Minimum	10.00000	1.932486	53.00000	29.22723	-13.12672	5.000000
Ecart-type	55.45314	1.903948	9.805914	14.88002	3.970089	7.323319
Skewness	1.260884	0.225402	-0.846839	-1.956464	-0.701924	1.108158
Kurtosis	5.602053	2.106439	3.166274	6.321543	5.274738	5.150986
Jarque-Bera	162.4837	9.515906	37.65046	86.71451	125.0414	109.6961
P-Value	0.000000	0.008583	0.000000	0.000000	0.000000	0.000000

Source: own elaboration based on the outputs of Eviews 9.0 software

The tables of descriptive statistics show that:

- The average growth rate for the total sample is 3.99%. The rate of prevalence of undernourishment is about 17.07%.
- The variable related to food deficit is the most volatile because it shows the most volatility gap. The HEALTH variable is the less volatile.
- All Variables do not follow a normal distribution. Indeed, the P-Value related to Jarque-Beratest is less than 5%.
- The group number 3 has the highest growth rate and the lowest prevalence. In contrast, Group 1 has the lowest growth, and group 2 exhibits the highest prevalence rate.
- The Group 1 has the highest share of health spending in GDP compared to group 3 and group 2. The last group has the lowest share.

The Correlation Analysis**Table 2.5:-** The Correlation Analysis (Total Sample).

	DEFICIT	SANTE	IMPROWATER	ALPHA	PIBTGROWTH	PREVAL
DEFICIT	1,000					
SANTE	-0,490	1,000				
IMPROWATER	-0,704	0,424	1,000			
ALPHA	-0,429	0,514	0,417	1,000		
PIBTGROWTH	0,169	-0,183	-0,146	-0,058	1,000	
PREVAL	0,978	-0,476	-0,691	-0,372	0,177	1,000

Source: own elaboration based on the outputs of Eviews 9.0 software

Table 2.6:- The Correlation Analysis of the (Group 1).

	DEFICIT	SANTE	IMPROWATER	ALPHA	PIBTGROWTH	PREVAL
DEFICIT	1,00	-0,82	-0,13	0,28	0,99	-0,58
SANTE	-0,82	1,00	0,06	-0,15	-0,81	0,57
IMPROWATER	-0,13	0,06	1,00	-0,21	-0,14	0,57
ALPHA	0,28	-0,15	-0,21	1,00	0,29	-0,19
PIBTGROWTH	0,99	-0,81	-0,14	0,29	1,00	-0,53
PREVAL	-0,58	0,57	0,57	-0,19	-0,53	1,00

Source: own elaboration based on the outputs of Eviews 9.0 software.

Table 2.7:- The Correlation Analysis (Group 2).

	DEFICIT	SANTE	IMPROWATER	ALPHA	PIBTGROWTH	PREVAL
DEFICIT	1,000	-0,746	-0,353	-0,273	-0,183	0,978
SANTE	-0,746	1,000	0,352	0,528	0,089	-0,642
IMPROWATER	-0,353	0,352	1,000	0,198	0,013	-0,395
ALPHA	-0,273	0,528	0,198	1,000	0,227	-0,115
PIBTGROWTH	-0,183	0,089	0,013	0,227	1,000	-0,153
PREVAL	0,978	-0,642	-0,395	-0,115	-0,153	1,000

Source: own elaboration based on the outputs of Eviews 9.0 software.

Table 2.8:- The Correlation Analysis of the (Group 3).

	DEFICIT	SANTE	IMPROWATER	ALPHA	PIBTGROWTH	PREVAL
DEFICIT	1,00	-0,68	-0,78	-0,52	0,28	0,94
SANTE	-0,68	1,00	0,76	0,42	-0,26	-0,61
IMPROWATER	-0,78	0,76	1,00	0,60	-0,21	-0,73
ALPHA	-0,52	0,42	0,60	1,00	-0,14	-0,50
PIBTGROWTH	0,28	-0,26	-0,21	-0,14	1,00	0,28
PREVAL	0,94	-0,61	-0,73	-0,50	0,28	1,00

Source: own elaboration based on the outputs of Eviews 9.0 software

-The Correlation matrix shows that the prevalence of undernourishment is negatively correlated with health spending and access to an improved water source, that's for the total sample.

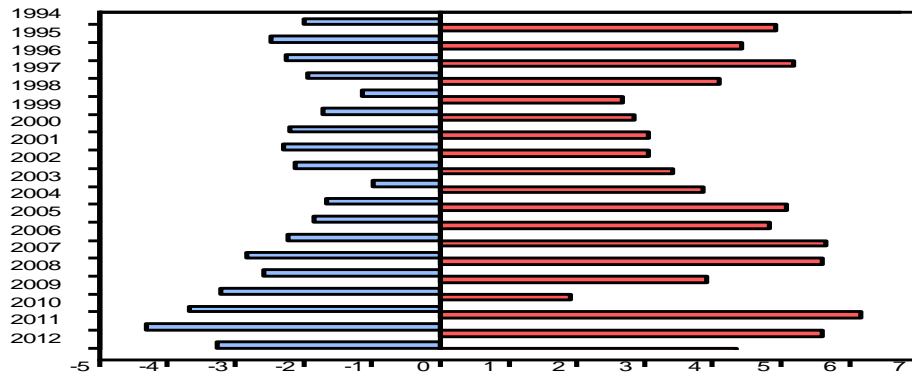
- For the group 1, it is characterized by a strong negative correlation between the rate of prevalence and IMPROVEWATER and the literacy rate.

-For Group 2, it is characterized by a strong negative correlation between health spending and the variable to undernourishment.

- With respect to group 3, it is characterized by a negative correlation with the prevalence of access to water, spending on health and literacy rates.

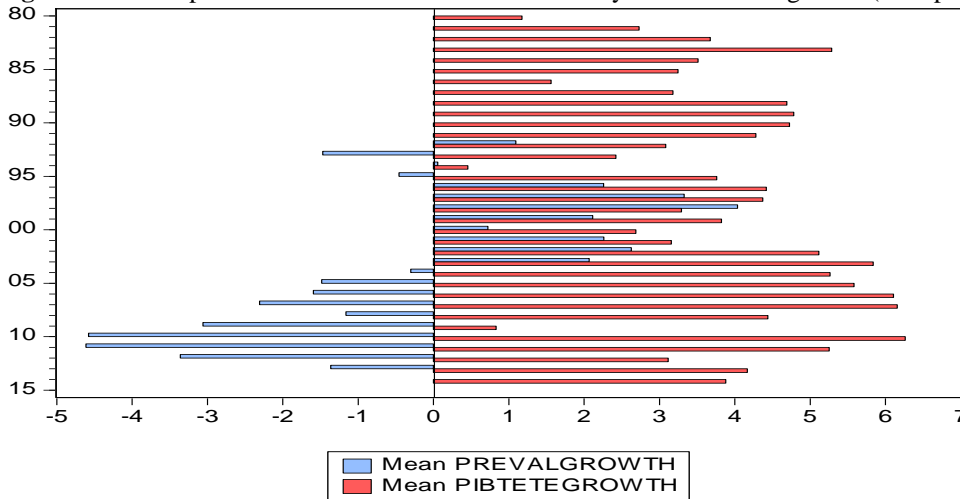
Graphical Analysis

Figure 1.1:- Comparative evolution between food security and economic growth (Total sample).



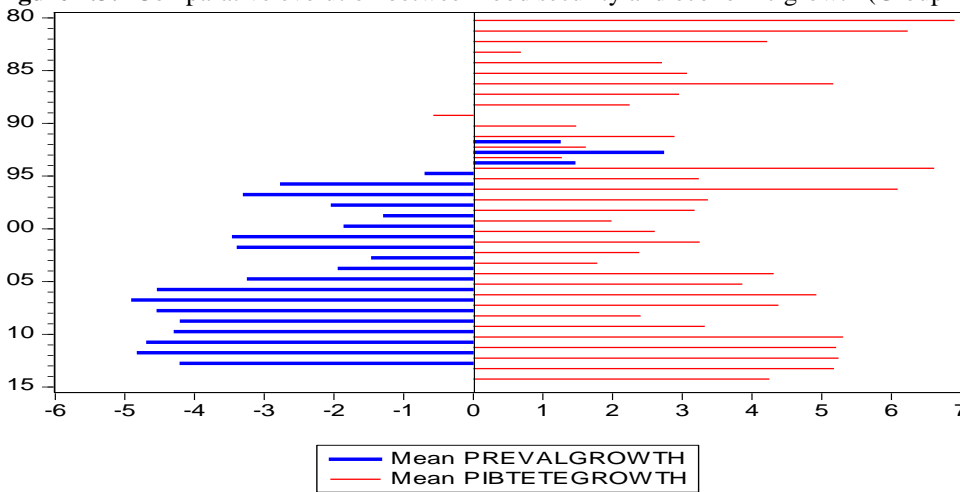
Source: own elaboration based on the outputs of Eviews 9.0 software.

Figure 1.2:- Comparative evolution between food security and economic growth (Group1).

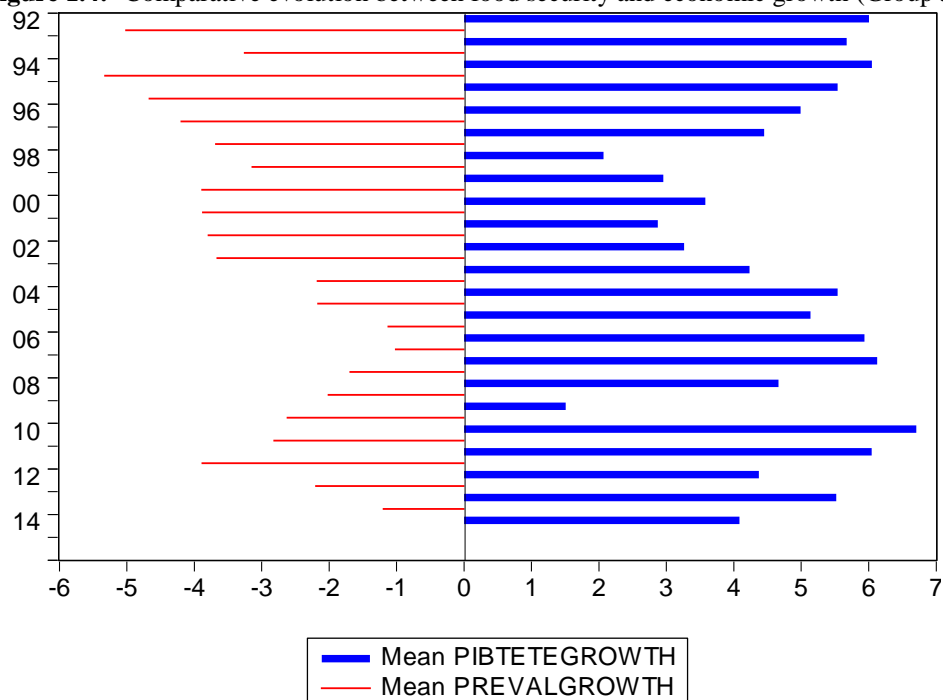


Source: own elaboration based on the outputs of Eviews 9.0 software.

Figure 1.3:- Comparative evolution between food security and economic growth (Group 2).



Source: own elaboration based on the outputs of Eviews 9.0 software.

Figure 1.4:- Comparative evolution between food security and economic growth (Group 3).

Source: own elaboration based on the outputs of Eviews 9.0 software.

The comparative analysis of the evolution of the economic growth rate and the prevalence of undernourishment highlights the following remarks:

- The undernourishment prevalence rate seems to go in the opposite direction with the economic growth rate of the total sample, and that's for the entire period.
- For Group 1, it appears that the rate of economic growth has failed to compromise undernourishment during the period 2006-2003. For group 2, during the period from 1992 to 1994, the rate of economic growth seems to be going in the same direction with the non-fed population rates.
- In regards with the group number 3, throughout the study period, the malnutrition prevalence rate seems counter-cyclical.

Results of estimates and interpretations

Table 2.9:- Estimation Results of dynamic models by GMM system method (total sample).

	Variable dépendante $PREVAL_{it}$		Variable dépendante $DEFICITALIM_{i,t}$	
	Statique	Dynamique	Statique	Dynamique
Spécifications	(1)	(2)	(3)	(4)
$PREVAL_{it-1}$	-	0.368*** (4.55)	-	-
$DEFICITALIM_{i,t-1}$	-	-	-	1.04 (131.07)
$PIBtete_{i,t}$	-0.064 (-0.85)	-0.267** (-2.14)	-0.436 (-0.67)	-0.037 (-0.33)
$alpha_{i,t}$	-0.12 (-1.21)	-0.079* (-1.77)	-0.78 (-0.86)	-0.009 (-0.18)
sante	-0.892* (-1.84)	-0.663** (-2.29)	-8.75** (-1.99)	-2.04*** (-7.24)
$improvedwater_{i,t}$	-0.427* (-1.94)	0.056 (0.62)	-2.93* (-1.72)	-0.346*** (-4.91)
$dummyregion$				

Asie	11.84*** (6.50)	10.93*** (2.88)	80.06*** (13.40)	6.89 (1.59)
Amerique latine	13.11*** (4.18)	10.78*** (2.97)	86.62 (3.26)	6.668 (1.44)
Afrique Sub saharienne	18.03* (1.96)	16.99*** (3.37)	137.47* (1.69)	11.33** (2.49)
Contante	54.47*** (3.82)	-13.29 (-1.53)	383.12*** (3.69)	19.93*** (3.25)
m2	-	-1.09(0.27)	-	-1.10(0.236)
Sargan test	-	3.87(0.203)	-	2.06(0.321)

(***), (**) and (*) respectively correspond to the statistical significance of 1%, 5% and 10%. m2 indicate the test of serial correlation of order 2 between residues. The Sargan test of validity means the instrument test (p-value).

Source: own elaboration based on the outputs of the Stata 12.0.

Table 2.10:- Estimation results of dynamic models by GMM system (Group 1).

	Variable dépendante $PREVAL_{it}$		Variable dépendante $DEFICITALIM_{i,t}$	
	Statique	Dynamique	Statique	Dynamique
Spécifications	(1)	(2)	(3)	(4)
$PREVAL_{it-1}$	-	0.98*** (6.13)	-	-
$DEFICITALIM_{i,t-1}$	-	-	-	0.981***(151.36)
SANTE	0.061 (0.13)	0.44 (0.64)	6.922991 (1.41)	0.1589645 (1.16)
$PIBtete_{i,t}$	-0.48*** (-4.22)	-0.347** (-2.01)	-3.9351 (-1.43)	-0.44178***(-5.53)
$alpha_{i,t}$	0.093 (0.70)	-0.002 (-0.03)	4.789769 (0.35)	-1.244959**(-2.41)
$improvedwater_{i,t}$	-1.15*** (-5.78)	0.039 (0.66)	-5.35*** (-3.15)	-0.3779*** (-6.35)
Constante	84.10*** (4.24)	-7.17 (-1.02)	857.21***(5.90)	63.305*** (8.84)
Sargan test	-	13.89(0.178)	-	0.89(0.96)

(***), (**) and (*) respectively correspond to the statistical significance of 1%, 5% and 10%. m2 indicate the test of serial correlation of order 2 between residues. The Sargan test means the (p-value) instrument validity test.

Source: own elaboration based on the outputs of the Stata 12.0

	Variable dépendante $PREVAL_{it}$		Variable dépendante $DEFICITALIM_{i,t}$	
	Statique	Dynamique	Statique	Dynamique
Spécifications	(1)	(2)	(3)	(4)
$PREVAL_{it-1}$	-	0.48*** (6.85)	-	-
$DEFICITALIM_{i,t-1}$	-	-	-	0.9749***(57.93)
$PIBtete_{i,t}$	-0.513* (-1.85)	-0.575*** (-3.89)	0.6052(0.44)	-0.74142 **(-2.27)
$alpha_{i,t}$	-0.185 (-1.09)	-0.065*** (-3.47)	0.94808(1.26)	-0.191***(-3.31)
$improvedwater_{i,t}$	-0.357 (-1.30)	-0.225*** (-5.25)	-10.14*** (-7.99)	0.2943533 *** (3.77)
SANTE	-2.09* (-1.65)	-0.948** (-4.27)	-10.99928*(-1.89)	0.4977687 (0.58)

constante	55.42** (2.54)	-18.40*** (-5.14)	950.039***(9.27)	-12.24304 (-1.43)
m2	-	0.68(0.49)	-	0.12(0.906)
Sargan test	-	0.62(0.88)	-	6.97(0.112)

Table 2.11:- Estimation Results of dynamic models by GMM system method (Group 2).

(***), (**) and (*) respectively correspond to the statistical significance of 1%, 5% and 10%. m2 indicate the test of serial correlation of order 2 between residues. The Sargan test of validity means the instrument test (p-value).

Source: own elaboration based on the outputs of the Stata 12.0.

Table 2.12:- Estimation results of dynamic models by GMM system method (Group 3).

	Variable dépendante $PREVAL_{it}$		Variable dépendante $DEFICITALIM_{i,t}$	
	Statique	Dynamique	Statique	Dynamique
Spécifications	(1)	(2)	(3)	(4)
$PREVAL_{it-1}$	-	0.58*** (6.83)	-	-
$DEFICITALIM_{i,t-1}$	-	-	-	1.03512*** (52.70)
$PIBtete_{i,t}$	-0.16 (-0.72)	-0.77*** (-2.58)	-0.2834 (-0.41)	-0.4470*** (-3.54)
$alpha_{i,t}$	-1.12* (-1.77)	-0.272*** (-5.16)	-0.54532 (-0.84)	0.0991 (1.41)
$improvedwater_{i,t}$	-1.24*** (-2.31)	-0.07*** (-3.51)	-1.9623***(-2.05)	-.0456326 (-0.29)
SANTE	0.87 (0.88)	-0.93* (-1.96)	-5.8866 ** (-2.05)	2.053*** (6.12)
constante	6.70 (0.26)	13.14 (0.73)	329.72*** (5.56)	19.09852 (-1.42)
m2	-	-0.38(0.70)	-	-0.24(0.12)
Sargan test	-	0.93(0.91)	-	1.26(0.89)

(***), (**) and (*) respectively correspond to the statistical significance of 1%, 5% and 10%. m2 indicate the test of serial correlation of order 2 between residues. The Sargan test of validity means the instrument test (p-value).

Source: own elaboration based on the outputs of the Stata 12.0.

Through the software STATA 12.0, we got the table presented above translating the results of our panel data estimation in a Dynamic approach.

The first observation concerns the general model specification. Indeed, the specification is not rejected by the test of over-identification of Sargan. We accept, thereby the validity of the instruments used. Similarly, there is the absence of serial correlation of orders 2 of the residues.

As expected, the rate of economic growth, access to water, health care spending and the literacy rate exhibit negative and statistically significant impact on the prevalence rates of undernourishment and food shortages. Improved growth, access to water and literacy rates lead to reductions in the rate of non-fed population. This result is consistent with results obtained by Smith and Haddad, 2000; Smith and Haddad, 2002; Alderman et al., 2003; Arcand and Béatrice, 2004; Suri et al., 2011).

Health care spending is a factor that improves food security in the entire sample. Good quality nutrition reduces the likelihood of the emergence of serious diseases caused by poor diet. Food security requires a combination of adequate dietary intake and a healthy environment. This is true for all three groups, since this variable and negatively impacts significantly under-nutrition and / or food shortages.

The literacy rate has a negative and statistically significant impact on undernourishment. A better education system is suitable for food security. Better education facilitates better knowledge in food production and resource management. In the same vein, the authors showed that equity between men and women has a positive impact on the use and food security.

(Quisumbing et al., 1995; Smith and Haddad, 2000. Hyder et al, 2005) .The Group 3 appears to have a better education system which has led to greater food security. However, this variable turns out not statistically significant in group 1.

The IMPROVE WATER variable, exhibited a statistically significant and negative impact on a threshold of 1%, and that the food deficit. Poor sanitation device is associated with the emergence of diarrheal diseases and several other diseases (Cairncross et al, 2010;. Wolf et al, 2014). These types of diseases lead to poor absorption of nutrients (Humphrey, 2009) and contribute to global infant mortality (Liu et al., 2012). Group 2 seems to have the highest impact of this variable on food security.

The results show that a better growth rate contributes to the increase in the proportion of the population nourished. Indeed, the coefficient assigned to the variable related to the growth rate is negative and statistically significant, and this for the total sample and for all groups. Certainly the impact of the growth rate was higher in group 3. This indicates that the impact of growth is faster on food security of the remaining groups. This result is consistent with the earlier analysis that showed that this group is characterized by undernourishment deteriorating at a decreasing rate.

Concerning the variables related to regional dummies, it positively affects undernourishment and in a statistically significant. Sub-saharian Africa seems to have the worst food security, known that it displays the highest coefficient.

Conclusion:-

This paper was dedicated to the study of economic growth-food security relationship for a panel of 52 emerging and developing countries. The technique used is the GMM of Arellano and Bond (1991). The estimation results show clearly a negative relationship between economic growth rates and the prevalence of undernourishment. Economic growth in emerging and developing countries seems to be a key factor to reducing poverty and the proportion of the malnourished population but it isn't the only factor, others factors must be present also. The rate of economic growth, access to water, health care spending and the literacy rate exhibit an important impact on the prevalence rates of undernourishment and food shortages. Health care spending is a factor that improves food security in the entire sample. Good quality nutrition reduces the likelihood of the emergence of serious diseases caused by poor diet. Food security requires a combination of adequate dietary intake and a healthy environment.

References:-

1. Holtz-Eakin, D., W. Newey and H. S. Rosen (1988). Estimating vector autoregressions with panel data. *Econometrica* 56. pp. 1371 - 1395. Roodman, D. (December 2006).
2. How to do xtabond2: an introduction to "Difference" and "System" GMM in Stata. Center for Global Development Working Paper Number 103.
3. Blundell, R., Bond, S. and F. Windmeijer (2001). Estimation in dynamic panel data models: Improving on the performance of the standard GMM estimator. In: B. H.
4. Baltagi, T.b. Fomby, R. Carter Hill, nonstationary Panels, Panel Cointegration, and Dynamic Panels (eds.). *Advances in Econometrics*, Volume 15, Emerald Group Publishing Limited, 53- 91.
5. Bond, S., Hoeáler, A. and J. Temple (2001). GMM estimation of empirical growth models. Economics Group Working Paper 2001-W21, University of Oxford. Bond, S. and F. Windmeijer (2005). Reliable inference GMM estimators for? Finite sample properties of alternative test procedures in linear panel data models. *Econometric Reviews* 24, 1-37.
6. Sargan, J.D. (1958). The estimation of economic relationships using instrumental variables. *Econometrica* 26, 393-415.
7. Arellano, M. and S. Bond. 1998. Dynamic Panel data estimation using DPD98 for Gauss: A guide for users.
8. Arellano, M. and O. Bover. 1995. Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics* 68: 29-51.

9. Arellano, M. and S. Bond. 1991. Some tests of specification for panel data: Monte Carlo evidence and an Application to emplotment equations. The Review of Economic Studies 58: 277-97.
10. Bai, J., and S. Ng. 2010. Instrumental Variables Estimation in a Data Rich Environment. Econometric Theory 26 (6): 1577-1606.
11. Baum, C.F., M. E. Schaffer, and S. Stillman. 2003 Instrumental Variables and GMM: Estimation and testing. Stata Journal 3: 1-31.
12. Bond, S. 2002. Dynamic panel data models: A guide to micro data methods and practice. Working Paper 09/02. Institute for Fiscal Studies, London.
13. reene, W.H. 2002 Econometric Analysis, 5th ed. Prentice-Hall.

Annex 1:-

Lists of selected countries

1	Algeria		
2	Bostwana		
3	Costarica		
4	Ecuador		
5	Iran		
6	Zambia		
7	Bolivia		
8	Cameron		
9	Jordan		
10	Morroco		
11	Pakistan		
12	Perou		
13	Philippine		
14	Zimbabwe		
15	Bangladesh		
16	Brazil		
17	Chile		
18	China		
19	Salvador		
20	Colombie		
21	Fiji		
22	Ghana		
23	Mexico		
24	Paraguay		
25	India		
26	Indonesia		

Annex 2

List of Groups

Group 1: Algeria, Botswana, Costa Rica, Ecuador, Iran, Zambia

Group 2: Bolivia Cameroon Jordan Morocco Pakistan Peru Philippine Zimbabwe

Group 3: Bangladesh, Brazil, Chile, China, Colombia, El Salvador, Fiji, Ghana, India; Indonesia, Mexico, Paraguay

Group 4: No Country

Annex 3

Preentation of the technical GMM

1-Introduction to the estimation technique (GMM)

The estimate is made by the GMM method of Arellano and Bond (1991)³.

Assuming a linear model to estimate which contains explanatory variables Fitas well as the lagged dependent variable $y_{i,t-1}$:

$$y_{it} = \lambda y_{i,t-1} + F'_{it} \beta + \alpha_i + \mathcal{E}_{it}$$

when $\mathcal{G}_{it} \sim N(0, \sigma^2_v)$ and $|\lambda| < 1$

F: the matrix of explanatory variables

α_i : The individual specific fixed effect.

The estimator proposed by Arellano and Bond (1991) is based on the first difference of variables

$$y_{it} - y_{it-1} = \lambda(y_{it-1} - y_{it-2}) + \beta(F_{it} - F_{it-1}) + \mathcal{G}_{it} - \mathcal{G}_{it-1}$$

Such a transformation deletes the term of heterogeneity (α_i). However, a correlation emerges between the dependent variable ($y_{it-1} - y_{it-2}$), and the error term ($\mathcal{G}_{it} - \mathcal{G}_{it-1}$). To work around this problem, Arellano and Bond (1991)

propose an implementation of the Generalized Moments method. They use instruments for $y_{it-1} - y_{it-2}$

The previous dynamic model (3.2) can be written as follows:

$$\Delta y_i = \Delta W_i \pi + \Delta \mathcal{G}_i$$

¹Arellano, M. and S. Bond. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to emplement equations. The Review of Economic Studies 58: 277-97.

Where π is a parameter vector (λ) and (β), (W) is a matrix that contains the lagged dependent variable and the explanatory variables.

The estimator "GMM" in two stages, which is written as follows:

$$\begin{aligned} \hat{\pi}_{GMM} &= (\hat{\lambda}, \hat{\beta})' \\ &= \left[\left(\sum_i W_i^{*'} Z_i \right) A_N \left(\sum Z_i' W_i^* \right) \right]^{-1} \left[\left(\sum_i W_i^* Z_i \right) A_N \left(\sum Z_i' y_i^* \right) \right] \end{aligned} \tag{6}$$

Where, (W_i^*) and (y_i^*) respectively represent the transformations of W_i and y_i in first difference.

(Z_i) represents the matrix of instrumental variables after processing.

It is essential to go through a first step that consists of making the appropriate transformation (first difference), and use the matrix of suitable instruments (Z_i) and perform a first estimation called "estimation of the first step." The residues of this first estimate will be used, in a second step, to calculate a matrix (H_i) which allows to calculate (A_N):

$$A_N = \left[\frac{1}{N} \left(\sum_i Z_i' H_i Z_i \right)^{-1} \right]$$

with $H_i = \hat{\mathcal{G}}_i^* \hat{\mathcal{G}}_i^{*'}$

2-The specification tests: Sargan test (valid instrument Test)

In order that the estimator GMM remains still valid, perform the test of the validity of instruments a Sargan⁴ test.

The null hypothesis states that all moments of restrictions for the dynamic specification are met.

The test is summarized by the t-statistic that approximately obeys a distribution Chi- two:

$$S = \left(\sum \Delta \mathcal{G}_i^* Z_i \right) A_N \left(\sum Z_i' \mathcal{G}_i^* \right) \rightarrow \chi^2 (N - M - 1)$$

Where (N) is the number of column of (Z_i) and (M) the number of exogenous variables.

¹Sargan (1958) et Hansen (1982).