



**The Different Effects of the Dynamic
Population on Agricultural Productivity
as a Comparison among Less and More
Developed Countries**

مقارنة التأثيرات المختلفة لديناميكا السكان علي الإنتاجية الزراعية بين
البلدان المنخفضة التنمية والمرتفعة التنمية

By

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The Different Effects of the Dynamic Population on Agricultural Productivity as a Comparison among Less and More Developed Countries

Abstract:

The objectives of this study are to identify and explain the different between population dynamic and agricultural productivity in LDC's and MDC's; as well as to investigate the relationships between population dynamic and agricultural productivity in LDC's and MDC's. The sample was involved 109 countries. According to the Human Development Report (2019), 58 of these countries are considering as LDC's, while others 51 are considering as MDC's. Means, standard deviation, T test, and Spearman correlation coefficients used as statistical techniques. Results of T test indicate a different statistically significant between LDC's and MDC's for the all dependent and independent variables, except the total population variable.

The results of Spearman's correlation coefficients showed that the highest index of crop production is likely to occur among LDC's that have a high population growth rate and more dependency ratio, while it occurs among MDC's with the highest percentage of the population age composition (0-14). Furthermore, the results suggest that the highest food production index are more likely to occur among MDC's that have the more growth rate of population, more growth rates of urban population, highest rate of net migration, lowest dependency ratio, highest percent of population age composition (0-14 and 15-64), and lowest percent of population age composition (65+), while it occurs among LDC's with the high population growth rate. Moreover, the results suggest that the highest livestock production index are more likely to occur among MDC's that have the highest growth rate of population, highest growth rate of urban population, highest rate of net migration, less

dependency ratio, highest percent of population age composition (15-64), and lowest percent of population age composition (65+).

Key words: Dynamic Population, Agricultural Productivity, Agricultural Development, Development, Comparative Studies.

المستخلص:

هدفت هذه الدراسة لمقارنة التأثيرات المختلفة لديناميكا السكان على الإنتاجية الزراعية في البلدان المنخفضة التنمية والبلدان المرتفعة التنمية، والتعرف على العلاقات الارتباطية بين ديناميكا السكان والإنتاجية الزراعية في البلدان المنخفضة التنمية والمرتفعة التنمية، وتضمنت العينة ١٠٩ دولة منها ٥٨ دولة منخفضة التنمية و٥١ دولة مرتفعة التنمية وفقا لتقرير التنمية البشرية (٢٠١٩)، واستخدم المتوسط الحسابي والانحراف المعياري واختبار T ومعاملات ارتباط سبيرمان كأساليب إحصائية، وأشارت نتائج اختبار T إلى وجود فروق ذات دلالة إحصائية بين جميع المتغيرات التابعة والمستقلة بين كلا المجموعتين من الدول باستثناء متغير إجمالي السكان، كما أظهرت نتائج العلاقات الارتباطية أن زيادة مؤشر إنتاج المحاصيل يحدث بين البلدان المنخفضة التنمية التي لديها معدل نمو سكاني مرتفع ونسبة إعالة مرتفعة، بينما يزيد مؤشر إنتاج المحاصيل في البلدان المرتفعة التنمية التي تزيد فيها نسبة التركيبة العمرية للسكان (٠-١٤ عام)، كما أشارت النتائج إلى زيادة مؤشر إنتاج الغذاء بين البلدان المرتفعة التنمية التي لديها معدل نمو سكاني مرتفع، ومعدل نمو أكبر لسكان الحضر، ومعدل عالي لصادفي الهجرة، وأدنى نسبة للإعالة، وأعلى نسبة للتركيبة العمرية للسكان (٠-١٤ و ١٥-٦٤ عام)، وأدنى نسبة للتركيبة العمرية للسكان (٦٥+)، بينما يزيد مؤشر إنتاج الغذاء في البلدان المنخفضة التنمية التي يزيد فيها معدل نمو السكان، إضافة لذلك أوضحت النتائج أن أعلى مؤشر للإنتاج الحيواني يحدث بين البلدان المرتفعة التنمية التي لديها معدلات عالية من النمو السكاني والنمو السكاني الحضري، ومعدل عالي لصادفي الهجرة، وأدنى نسبة للإعالة، ونسبة عالية للتركيبة العمرية للسكان (١٥-٦٤)، ونسبة منخفضة للتركيبة العمرية للسكان (٦٥+).

الكلمات الافتتاحية: ديناميكا السكان، الإنتاجية الزراعية، التنمية الزراعية، التنمية، دراسات مقارنة.

INTRODUCTION:

The problem how to feed the world's rapidly increasing population and to bring about some stability and balance between this and resources available for the purpose is not a problem confined to one or even to all of these developing countries alone, but a global problem which must be realistically faced. While, in general, world population growth is slowing down, in some regions population will continue to expand well beyond 2050 and even into the next century. More people now live in cities than in rural areas, and this discrepancy is projected to increase as population grows. Urbanization has been accompanied by a transition in dietary patterns and has had great impacts on food systems.

Global population growth is slowing, but Africa and Asia will still see a large population expansion. In its projections, FAO has always considered, as a key driver of changes in demand for food and agricultural products, not only population in absolute numbers but population dynamics, which includes diversity in regional trends, structure by age groups, and location (rural and urban), net migration rate, and dependency ratio (Alexandratos & Bruinsma, 2012).

The differences within regions of LDC's and MDC's are even more pronounced. LDC's are currently projected to grow so rapidly that their populations would reach multiples of their current levels by 2050. At the top of the list of fast growing populations is Niger. Niger's population would expand from 20 million people today to 72 million by 2050. Annual growth rates of more than 2.5 percent to 2050 are also projected for Angola, Burundi, Chad, the Democratic Republic of the Congo, Gambia, Malawi, Mali, Senegal, Somalia, the United Republic of Tanzania, Uganda and Zambia. In addition to these 13 African countries, a few Asian ones also currently have annual population growth rates above 2.5%. They are Afghanistan, Iraq,

and Lebanon and other several small states in the Arabic Gulf. All these countries are located in sub-Saharan Africa and Asia. The combined population of these countries reached 320 million people in 2015, and it will nearly double by 2050 and more than redouble by 2100 to reach a projected total of 1.8 billion (Anriquez & Stloukal, 2008).

Rapid population growth changes the population structure, with younger generations making up an increasing share of the overall population. Between 2015 and 2050, in LDC's, the number of people between 15 and 24 years of age is expected to rise from about 1 billion to 1.2 billion. Most of these young people are expected to live in Africa and South Asia, particularly in rural areas, where jobs will likely to be difficult to find. Without sufficient employment opportunities, this population trend may lead to a more rapid rate of outmigration. The impacts of outmigration are already being felt in some emigration destinations, not only at the national level, but also abroad, notably in MDC's. (Anriquez & Stloukal, 2008).

This study deals with what happened in global regarding the population dynamics. It investigates countries' level of human development index according to changes of population structure. Moreover, The current study will answer the following questions. What are the different between LDC's and MDC's according to population dynamic? What are the different concerning to agricultural productivity between LDC's and MDC's? What are the effects of population dynamic on the agricultural productivity in LDC's and MDC's?

The study is significant because it is a global one. It included one hundred and nine countries from the all regions of the world, fifty eight (58) are LDC's and fifty one (51) are MDC's, compared to other studies that covered one continent, one regions, or some countries. It is unique because it dealt with

productivity that consists of crop, food, livestock productions, while other studies included only one of these groups. It is exceptional because it dealt with all aspects of population dynamic variables, as dependent variables, while other studies included some of these variables.

The objectives of this study are (1) to identify and explain the different between population dynamic and agricultural productivity in LDC's and MDC's. (2) to investigate the different effects of the dynamic population on agricultural productivity in LDC's and MDC's.

THEORETICAL FRAMEWORKS AND LITERATURE REVIEW:

The relationship of population dynamics and agricultural productivity has long been debated by social scientists throughout the eras. Then, the interpretation of the data will be based on the demographic analysis of Malthus, Boserup' vision of agriculture and development in rural communities, and her treatment for his pessimistic view.

Since the middle of the twentieth century, food demand has increased at an unprecedented pace. Most of the growth has been demographic, with human numbers rising from 2.47 billion in 1950 to 6.06 billion in 2000 and 7.53 billion in 2017 (World Bank, 2018). But living standards have also improved in recent decades in several world countries, where less than half the human population resides. As a result, what we eat has changed substantially. In addition, consumption of livestock products has increased, which has driven up the demand for corn and other feed grains eaten by cattle, chickens, and other livestock.

However, contrary to predictions of the pessimists, rising numbers have not led to an unmeasured expansion of farmland and pasture. Instead, agricultural yields have increased, by the Green Revolution and other technological advances. For the world as a whole, per-hectare output of cereals, which account

for more than half the food people eat, had risen by the late 1990s to 3.0 metric tons, which was double the average yield in the early 1960s (Southgate & Graham, 2007). Also, productivity of cereals increase from 3.089 kilograms per hectare in 2000 to 3.967 kilograms per hectare in 2016 (FAO, 2018). Primarily because of yield growth, food supplies increased faster than food demand throughout this period. However, the population dynamics pressure on the land and maintaining food self-sufficiency will require combating poverty in general, through a series of actions aimed at both LDC's and MDC's.

The changes over time in agricultural productivity demand derives entirely from a simplistic understanding of the demographic analysis of Malthus (1963). According to this view, total consumption of edible goods is directly proportional to human numbers, which rise exponentially whenever food supplies exceed what people require for bare subsistence. This view neglects the increases in consumption that coincide with a sustained improvement in living standards. Also unappreciated is the deceleration in population growth that has happened in recent decades. Understanding this deceleration requires a little knowledge of demographic transition. Then, As population dynamics changes, the resulting from economical growth are having a correspondingly greater impact on trends in land use and agricultural productivity, especially in MDC's.

The causes and consequences of population dynamics on agricultural productivity have long been a subject of interest to social scientists in general and sociologists and demographers in particular. During the last five decades, Demographic trends have determined the paths of structural changes in age composition and dependency ratio in LDC's and MDC's. The processes of structural changes brought about significant welfare improvements in some countries. However, concerns have arisen

over their social sustainability, as well as the persistent inequalities within and between countries (Binswanger–Mkhize, 2012).

With population growth, supply growth was largely a consequence of increases in cultivated area. For example, plantings of soybeans and other oil crops grew by 98% between 1961 and 2010. Likewise, land used to produce fruits and vegetables at the turn of the 21st century was nearly double the area used for this purpose four decades earlier. These increases in land use coincided with yield growth (Southgate, 2009). Increases in agricultural land use, generally, were greatly exceeded by growth in human numbers and food demand. Yet output went up even faster, almost entirely because of productivity improvement, specifically in MDC's.

For more than fifteen years beginning in the middle 1980s, improvements in cereal yields were concentrated in countries of south and southeast Asia. This advance, which was made possible by agricultural research and testing carried out over many years, thanks to support provided by donor agencies such as the World Bank and USAID, resulted in new varieties of maize, rice, and wheat. These new varieties produced more grain than traditional strains when fertilizer and irrigation water were applied to farm fields (World Bank, 2008)

To meet demand, agriculture in 2050 will need to produce almost 50% more productivity from food and feed than it did in 2012. The FAO estimate takes into account recent United Nations projections indicating that the world's population would reach 9.73 billion in 2050 (Alexandratos & Bruinsma, 2012). In sub-Saharan Africa and South Asia, agricultural output would need to more than double by 2050 to meet increased demand, while in the rest of the world the projected increase would be about one-third above current levels (FAO, 2012 & 2016a).

Historically, much bigger increases in agricultural production have been recorded in comparable time frames. Between 1961 and 2011, global agricultural output more than tripled. In LDC's, livestock production has been one of the fastest growing agricultural subsectors. Since the early 1970s, per capita consumption of milk, dairy products and vegetable oils has almost doubled, while meat consumption has almost tripled (Alston, 2010). Over the past five decades, per capita consumption of fish has more than doubled (FAO, 2016c). On the other hand, there are very large differences in crop yields between high and low-income countries (FAO, 2014 & World Bank, 2012). Yields of wheat and rice in low-income countries are currently about half those in high-income countries. Yields of major crops (cereals, roots and tubers, pulses, sugar crops, oil crops and vegetables) also vary substantially across LDC's and MDC's. Estimated yield gaps, expressed as a percentage of potential yields, exceed 50 percent in most LDC's (FAO, 2011b).

Though, owing to a range of factors, including climate change, pressure on natural resources, underinvestment in agriculture and gaps in technology, maintaining the pace of production increases may be more difficult than in the past. For example, per capita fish consumption in Africa may shrink from 7.5 kg a year in 2006 to 5.6 kg a year by 2030, as the population is expected to grow more rapidly than supply (Fairfield-Sonn, 2016). Urbanization impacts food consumption patterns. Higher urban income tends to increase demand for processed foods, as well as animal-source food, fruits and vegetables, as part of a broad dietary transition. With these changes, the nutrient content of diets is changing. Typically, fewer people work in agricultural productivity and more work in transport, wholesaling, retailing, food processing and vending (Cohen and Garrett, 2009).

Migration is a growing global phenomenon. In 2015, the number of international migrants total 244 million, an increase of 41% compared to 2000. International migrants among the global population increased from 2.8% in 2000 to 3.3% in 2015 (UN, 2015). The majority of these migrants, estimated at 150 million, are migrant workers, and about one-third are aged from 15 to 34 years (UN, 2011). Internal migration is even larger in scale. The number of internal migrants in 2013 was estimated at 740 million (IOM, 2013). That a large proportion of migrants are rural people (World Bank, 2014).

Based on the theoretical background and literature review mentioned above, the study assumes that using population dynamics considered as dependent variables. It incorporates nine variables: total population, annual growth rate, percent of rural and urban population, annual growth rate for rural and urban population, net migration rate, percent of population age composition, and dependency ratio. Agricultural productivity variable are considered as independent variables. Agricultural productivity consists of three variables: crop production, food production, and livestock production.

The Research hypotheses: based on the theoretical framework and literature review discussed above, the following research hypotheses are tested:

1. There is no different between population dynamics as a dependent variables and agricultural productivity, as an independent variables in LDC's and MDC's.
2. There is no relationships between population dynamics (total population, annual growth rate of population, percent of rural population, annual growth rate of rural population, percent of urban population, annual growth rate of urban population, net migration rate, dependency ratio, and percent of population age composition); and agricultural productivity (crop

production index, food production index, and livestock production index) in LDC's and MDC's.

METHODS:

Sources of Data: The data for this study were collected from various sources. These included: The Human Development Report (2019), United Nations Population Division (2019), United Nations Statistical Division (2019), U.S. Census Bureau: International Database (2018), World Bank (2019), Food and Agriculture Organization (2018), and World Development Indicators Database (2019). The study selected variables from each of these sources were chosen to represent the dependent and independent variables for this study.

The Sample: A developed country is defined as a sovereign state that has a developed economy and technologically advanced infrastructure when compared to other nations. Several factors that determine whether or not a country is developed, such as the Human Development Index, political stability, gross domestic product (GDP), industrialization and freedom. The Human Development Report (2019) classified the countries by level of development to three main groups as following: more (59 countries), moderate (51 countries), and less (78 countries) developed countries. The study chose two groups, the first group of countries is considered as more developed countries and the second group of countries is considered as less developed countries.

The Human Development Index (HDI) was developed by the United Nations to measure human development in a country. HDI is quantified by looking at a country's human development such as education, health and life expectancy. HDI is set on a scale from 0 to 1 as a follow: < 0.1, > 0.1, > 0.2, > 0.3, > 0.4, > 0.5, > 0.6, > 0.7, > 0.8, > 0.9. The United Nations Development Report's 2018 Statistical update ranks each

country in the world based on their HDI ranking. According to the HDI, the study employed the classifieds mentioned above to choose fifty one (51) countries of the first group as more developed countries (MDC's) and fifty eight (58) countries of the third group as less developed countries (LDC's). The whole sample involved one hundred nine (109) countries that have available data (Appendix).

The Definitions and Measurements of Variables: Selected variables from each of these sources mentioned above were chosen to represent the dependent and independent variables for this study. The following a brief statement and definition of variables that used in the study and their measurement.

The Dependent Variables (Population Dynamics): (1) **Total population (2018)** is based on the definition of population, which counts all residents regardless of legal status or citizenship. The values shown are midyear estimates. It measured at midyear in millions on scale of 1 to 10. The highest size of total population is 10 and the lowest is 1. (2) **Annual growth rate of population** refers to the rate at which the number of individuals in a given popular increase over a year, expressed as a fraction of the initial population. The average annual percentage growth rate of population is the percent growth divided by the number of years (2000-2018). It is measured as the positive growth rate indicates that the population is increasing, while a negative growth rate indicates that the population is decreasing, and a growth rate of zero indicates that there were the same number of individuals at the beginning and end of the period. (3) **Percent of rural population (2018)** refers to people living in rural areas. It is measured the same as total population. (4) **Annual growth rate of rural population (2018)** refers to the change in rural population over a unit time period (year). It is measured the same as growth rate of population. (5) **Percent of urban population**

(2018) refers to people living in urban areas. It is calculated as the difference between total population and rural population. It is measured the same as total population. **(6) Annual growth rate of urban population (2018)** refers to the change in urban population over a unit time period (year). It is measured the same as growth rate of population. **(7) Net migration rate (per 1,000 people)** is the annual difference between the number of immigrants (people entering) and emigrants (people leaving) per thousand members of the population. **(8) Percent of population age composition (2018)** refers to proportionate numbers of persons in successive age categories in a given population. It is measured by percent for categories of, ages 0-14, ages 15-64, and ages 65+. **(9) The dependency ratio (2018)** is an age population ratio of those typically not in the labor force (the dependent part age 0-14 and 65+) and those typically in the labor force (the productive part ages 15-64). It is used to measure the pressure on the productive population. It is measured by proportion of dependents per 100 working-age population in two categories, age dependency ratio of young (is the ratio of younger dependents people less than 15 to the working-age population (15-64) and age dependency ratio of old (is the ratio of older dependents people older than 64 to the working-age population (15-64).

The Independent Variables (agricultural productivity): **(1) Crop production index (2016)** refers to agricultural production for each year relative to the base period 2004-2006. It includes all crops except fodder crops. Regional and income group aggregates for the FAO's production indexes are calculated from the underlying values in international dollars, normalized to the base period 2014-2016. **(2) Food production index (2016)** covers food crops that are considered edible and that contain nutrients. Coffee and tea are excluded because, although edible,

they have no nutritive value. **(3) Livestock production index (2016)** includes meat and milk from all sources, dairy products such as cheese, and eggs, honey, raw silk, wool, and hides and skins.

Statistical Methods: Descriptive analysis used to explain comparative results of population dynamics (dependent variables) and agricultural productivity (independent variables) in MDC's and LDC's by mean and standard deviation. T test used to comparative result of population dynamics and agricultural productivity between MDC's and LDC's. Spearman correlation coefficients used to estimate the relationships between the dependent and independent variables in MDC's and LDC's.

RESULTS AND DISCUSSION:

First: Results of Descriptive Analysis

Comparison between means and standard deviation for LDC's and MDC's are presented in Table 1. The mean and standard deviation were used as a descriptive measure for all dependent and independent variables. For **population dynamics variables** the mean and standard deviation of total population were 62.1 and 182.7 respectively, in LDC's, while the mean and standard deviation of total population were 28.6 and 52.5 respectively, in MDC's. In the LDC's, the mean and standard deviation for annual growth rate of population were 2.2 and 0.9 respectively, while in MDC's were 1.0 and 1.8 respectively. The mean and standard deviation for percent of rural and urban population are the same, in LDC's were 58.8 and 13.2 respectively, while in MDC's were 21.3 and 13.1 respectively. In the LDC's, the mean and standard deviation for annual growth rate of rural population were 1.3 and 1.1 respectively, while in MDC's were -0.5 and 1.3 respectively. Also, the mean and standard deviation of annual growth rate of urban population were 3.3 and 1.3 respectively, in LDC's, while in MDC's, the

mean and standard deviation were 1.0 and 1.3 respectively. Furthermore, the mean and standard deviation for net migration rate were -1.26 and 2.84 respectively, while in MDC's were 4.96 and 11.83 respectively. Related to percent of population age composition, the average for ages 0-14, 15-64, and 65+ in LDC's were 38, 58, and 4 respectively, while the average of same ages were 17, 67, and 16 respectively, in MDC's. According to dependency ratio, the mean and standard deviation were 73.2 and 16.8 respectively, for LDC's, while the mean and standard deviation were 49.3 and 10.3 respectively, for MDC's.

Table 1: Comparison Between Mean, Standard Deviation, and T Test for Independent and Dependent Variables in LDC's and MDC's (N= 109)

Dependent and Independent Variables	LDC's (N=58)		MDC's (N=51)		T test
	Mean	S.D.	Mean	S.D.	
First: Dependent Variables (Population dynamics)					
Total population	62.12	182.67	28.58	52.47	1.34
Annual growth rate of population	2.21	0.88	1.01	1.78	4.349**
Percent of rural population	58.79	16.23	21.29	13.15	13.32**
Annual growth rate of rural pop.	1.32	1.07	- 0.45	1.29	7.76**
Percent of urban population	41.21	16.23	78.71	13.15	13.14**
Annual growth rate of urban pop.	3.30	1.26	1.04	1.26	9.35**
Net migration rate (per 1,000 people)	- 1.26	2.84	4.96	11.83	3.66**
Percent of population age composition					
Ages 0-14	37.79	7.45	17.08	3.54	18.88**
Ages 15-64	58.33	5.94	67.29	5.16	8.43**
Ages 65+	3.95	1.75	15.63	6.29	12.83**
Dependency ratio	73.17	16.83	49.25	10.25	9.08**
Second: Independent Variables (Agricultural Productivity)					
Crop production index	140.40	33.54	114.28	29.97	4.29**
Food production index	137.13	26.97	115.68	25.75	4.25**
Livestock production index	132.08	29.59	114.26	43.74	2.46*

* Significant at 0.05 and ** Significant at 0.01.

Related to **agricultural productivity variables** the mean and standard deviation for crop production index were 140.4 and 33.6 respectively, in LDC's, while in MDC's, the mean and standard deviation were 114.3 and 30 respectively. For food production index, the mean and standard deviation were 137.1 and 27 respectively, for LDC's, while the mean and standard deviation were 115.7 and 25.8 respectively, for MDC's. According to livestock production index, the mean and standard deviation were 132.1 and 29.6 respectively, for LDC's, while the mean and standard deviation were 114.3 and 43.7 respectively, for MDC's.

Second: Results of T Test

The different results for **population dynamics variables** among LDC's and MDC's are showed in T test. The data in Table (1) indicate a different statistically significant for the following dependent variables: annual growth rate of population ($t= 4.4$); percent of rural population ($t= 13.3$); annual growth rate of rural population ($t= 7.8$); percent of urban population ($t= 13.1$); growth rate of urban population ($t= 9.1$); net migration rate ($t= 3.7$); percent of population age composition for less than 14 years ($t= 18.9$), from 15-64 years ($t= 8.4$), and more than 65 years ($t= 12.8$); and dependency ratio ($t= 9.1$). No different statistically significant was found between LDC's and MDC's regarding the total population variable. Moreover, Table (1) explains the results of T test for **agricultural productivity variables** between LDC's and MDC's. It indicates a different statistically significant for crop production index ($t= 4.3$), food production index ($t= 4.3$), and livestock production index ($t= 2.3$).

Third: Results of Spearman Correlation Coefficients

Spearman correlation coefficients among population dynamics as dependent variables and agricultural productivity as independent variables in LDC's and MDC's are presented in

Table 3. According to **crop production index**, the results of LDC's group reveal a statistically significant positive association between growth rate of population, $r = .357$, $p < .01$, the dependency ratio, $r = .274$, $p < .05$, and crop production index. Related to MDC's group, the results of correlation coefficients show a statistically significant positive association between percent of population age composition (0-14 years), $r = .289$, $p < .05$, and crop production index. The crop production index and remaining variables of population dynamics were unrelated in LDC's and MDC's groups.

Table 3: Correlation coefficients among dependent variables (population dynamics) and independent variables (agricultural productivity) in LDC's and MDC's

Dependent Variables	Independent Variables (Agricultural Productivity)					
	Crop production index (first variable)		Food production index (second variable)		Livestock production index (third variable)	
	LDC's	MDC's	LDC's	MDC's	LDC's	MDC's
Total population	-0.018	-0.010	0.026	-0.004	0.102	-0.028
Growth rate of Pop.	0.357**	-0.054	0.335*	0.416**	0.064	0.548**
% of rural Pop.	0.153	0.034	0.114	-0.109	0.042	-0.266
Growth rate of R. Pop.	0.197	-0.111	0.167	0.027	0.076	0.222
% of urban Pop.	-0.153	-0.034	-0.114	0.109	-0.042	0.266
Growth rate of U. Pop.	0.245	-0.008	0.230	0.443**	-0.022	0.408**
Net migration rate	0.075	0.091	0.001	0.409**	-0.010	0.417**
Dependency ratio	0.274*	-0.035	0.230	-0.403**	-0.013	-0.370**
% of Pop. age Comp.						
Ages 0-14	0.252	0.289*	0.234	0.389**	0.011	0.273
Ages 15-64	-0.254	0.029	-0.222	0.407**	0.012	0.587**
Ages 65+	-0.164	-0.184	-0.193	-0.560**	-0.067	-0.549**

* Significant at 0.05 and ** Significant at 0.01(2-tailed).

Regarding to **food production index**, the results of correlation coefficients for LDC's group indicate a statistically significant positive association between growth rate of population, $r = .335$, $p < .05$, and food production index. Also, the results of correlation coefficients for MDC's group imply a statistically significant positive association between growth rate

of population, $r = .416$, $p < .01$, growth rate of urban population, $r = .443$, $p < .01$, net migration rate, $r = .409$, $p < .01$, percent of population age composition (0-14 years), $r = .389$, $p < .01$, percent of population age composition (15-64 years), $r = .407$, $p < .01$, and food production index. Whereas, the results of correlation coefficients reveal a statistically significant negative association between the dependency ratio, $r = -.403$, $p < .01$, percent of population age composition (65+ years), $r = -.560$, $p < .01$, and food production index. No relationship was found between the food production index and remaining dependent variables for both groups of LDC's and MDC's (Table 3).

Related to **livestock production index**, the results of correlation coefficients for LDC's group state that no relationship was found between population dynamics variables and livestock production index. With regard to the MDC's group, the results imply a statistically significant positive association between growth rate of population, $r = .548$, $p < .01$, growth rate of urban population, $r = .408$, $p < .01$, net migration rate, $r = .417$, $p < .01$, percent of population age composition (15-64 years), $r = .587$, $p < .01$, and livestock production index. Whereas, the results indicate a statistically significant negative association between the dependency ratio, $r = -.370$, $p < .01$, percent of population age composition (65+ years), $r = -.549$, $p < .01$, and livestock production index. The livestock production index and remaining population dynamics variables were unrelated for each group of LDC's and MDC's (Table 3).

RESULTS DISCUSSION

The results of T test among LDC's and MDC's do not support most of dependent and independent variables included in general hypothesis. They are: annual growth rate of population, percent of rural population, annual growth rate of rural population, percent of urban population, annual growth rate of urban population, net migration rate, the dependency ratio,

percent of population age composition (0-14, 15-64, 65+), crop production index, food production index, and livestock production index. Thus, the results of T test support only hypothesis which states that is no different between LDC's and MDC's in total population.

The results of correlation coefficients related to the crop production index, first variable of agricultural productivity, in LDC's suggest that no relationship was found between all dependent variables and crop production index, except only two variables (growth rate of population and dependency ratio). Therefore, this results support the general hypothesis which states that is no relationships between all population dynamics variables and crop production index in LDC's. In addition, These results implied that the highest crop production index are more likely to occur among LDC's that have high growth rate of population and more dependency ratio. In MDC's, the results of correlation coefficients support all dependent variables included in general hypothesis, that motioned there is no relationships between population dynamics variables and crop production index, except only one variable (percent of population age composition, 0-14). The results suggest that the highest crop production index are more likely to occur among MDC's that have the highest percent of population age composition (0-14).

In LDC's, the results of correlation coefficients related to food production index support all dependent variables included in general hypothesis; that meaning there is no relationships between population dynamics variables and food production index; except only one variable; growth rate of population. Although positive correlations appeared, but they were not significant. The results explained a statistically significant positive association between growth rate of population and food production index. Hence, the results suggest that the highest food

production index are more likely to occur among LDC's that have more growth rate of population. Furthermore, in MDC's, the results of correlation coefficients related to food production index support four dependent variable included in general hypothesis. They are, total population, percent of rural and urban population, and growth rate of rural population. Consequently, the results suggest that the highest food production index are more likely to occur among MDC's that have the more growth rate of population, more growth rates of urban population, highest rate of net migration, lowest dependency ratio, highest percent of population age composition (0-14 and 15-64), and lowest percent of population age composition (65+).

The results of correlation coefficients related to livestock production index, third variable of agricultural productivity, in LDC's suggest that no relationship was found between all dependent variables and livestock production index. Therefore, this results support the general hypothesis which states that is no relationships between all population dynamics variables and livestock production index in LDC's. In MDC's, the results of correlation coefficients related to livestock production index support five of dependent variables included in general hypothesis. The dependent variables that support hypothesis are: total population, percent of rural and urban population, growth rate of rural population, and percent of population age composition (0-14). In addition, The results suggest that the highest livestock production index are more likely to occur among MDC's that have the highest growth rate of population, highest growth rate of urban population, highest rate of net migration, less dependency ratio, highest percent of population age composition (15-64), and lowest percent of population age composition (65+).

CONCLUSION

The relationship of agricultural development and population growth has long been debated by social scientists in less and more developed countries. Therefore, the main objectives of this study are to identify and explain the different between population dynamic and agricultural productivity in LDC's and MDC's; and to investigate the effects of the dynamic population on agricultural productivity in LDC's and MDC's. This is one of the studies which has undertaken detailed examination of possible interaction effects between a number of variables related to population dynamic and agricultural productivity. The study is a global one, It included one hundred and nine countries from the all regions of the world, fifty eight (58) are LDC's and fifty one (51) are MDC's, compared to other studies that covered one continent, one regions, or some countries. It is unique because it dealt with productivity that consists of crop, food, livestock productions, while other studies included only one of these groups. Data were collected from various sources, basically from the Human Development Report, World Bank, and FAO.

The results of T test indicate a different statistically significant between LDC's and MDC's for the all dependent and independent variables, except the total population variable. The results of Spearman's correlation coefficients indicated that the highest index of crop production is likely to occur among LDC's that have a high population growth rate and more dependency ratio, while it occurs among MDC's with the highest percentage of the population age composition (0-14).

In addition, the results designate that the highest food production index is likely to occur among the LDC's that have the largest population growth rate, whereas it occurs among the MDC's that have the highest both of population growth rate,

urban population growth rate, net immigration rate, and percentage of population age composition (0-14 and 15-64). Additionally, It occurs in the MDC's with lowest dependency ratio and lowest of percentage of population age composition (65+). Moreover, the results show that the highest index of livestock production is likely to occur among MDC's with the highest both of population growth, urban population growth, net migration rate, and percentage of population age composition (15-64). Also, It occurs in the MDC's with lowest of dependency ratio and lowest of percentage of the population's age composition (65+).

Through the previous results, some suggestions can be put forward. For example, to meet demand, agriculture in 2050 will need to produce nearly 50 percent more food, feed, and biofuels compared to what it was in 2012. United Nations projections indicate that the world population will reach 9.73 billion in 2050. In sub-Saharan Africa and South Asia, agricultural production will double by 2050 to meet growing demand, while agricultural production in the rest of the world will more than double by 2050.

Meeting growing demand shouldn't be a big challenge, if past accomplishments serve as evidence. Historically, much larger increases in agricultural productivity have been recorded at similar time frames. Between 1961 and 2011, global agricultural production more than tripled. In LDC's, livestock production has been one of the fastest growing agricultural sub-sectors. Since the early 1970s in MDC's and some of LDC's, per capita consumption of milk, dairy products, and vegetable oils has nearly doubled, while meat consumption has nearly tripled. Over the past five decades, fish consumption per capita has doubled.

Rapid technological development and innovation offers the prospect of meeting future food needs sustainably. However, this

can only be achieved through discerning public policies, increased investments and public-private partnerships, which exploit the opportunities for maintaining current levels of agricultural productivity, sustainably raising yields, and reducing poverty and food insecurity. There are also very large differences in crop yields between MDC's and LDC's. Yields of wheat and rice in LDC's are currently about half those in MDC's. Therefore, the LDC's should be concerned with modern technologies in agriculture, doubling production to meet the population's needs, and develop strategies that lead to accommodating demographic changes. The MDC's should transfer their expertise and technologies to the LDC's.

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APPENDIX

Less Developed Countries- LDC's (58):

Moldova, South Africa, Philippines, Egypt, Vietnam, Indonesia, Bolivia, Iraq, El Salvador, Morocco, Nicaragua, Tajikistan, Guatemala, Namibia, India, Honduras, Bangladesh, Congo Republic, Ghana, Kenya, Zambia, Cambodia, Angola, Myanmar, Nepal, Pakistan, Cameroon, Papua New Guinea, Tanzania, Zimbabwe, Nigeria, Rwanda, Lesotho, Mauritania, Madagascar, Uganda, Benin, Senegal, Togo, Haiti, Afghanistan, Malawi, Djibouti, Ethiopia, Gambia, Guinea, Democratic Congo, Guinea Bissau, Yemen, Mozambique, Liberia, Mali, Burkina Faso, Sierra Leone, Burundi, Chad, Central African Republic, and Niger

More developed countries- MDC's (51):

Norway, Switzerland, Australia, Ireland, Germany, Iceland, Hong Kong, Sweden, Singapore, Netherlands, Denmark, Canada, United States, United Kingdom, Finland, New Zealand, Belgium, Japan, Austria, Luxembourg, South Korea, France, Slovenia, Spain, Czech Republic, Italy, Estonia, Greece, Cyprus, Poland, United Arab Emirates, Lithuania, Qatar, Slovakia, Saudi Arabia, Latvia, Portugal, Bahrain, Chile, Hungary, Croatia, Argentina, Oman, Russia, Bulgaria, Romania, Belarus, Uruguay, Kuwait, Malaysia, and Kazakhstan.