Когда наука достигает какой-либо вершины, с нее открывается обширная перспектива дальнейшего пути.
С. И. Вавилов

Механізм регулювання економіки

POPULATION GROWTH AND ENVIRONMENTAL DEGRADATION IN PAKISTAN: A CAUSALITY ANALYSIS

UDC [314.114:504.03] (549.1)

Irfan Ullah
Mahmood Shah

This paper has empirically analyzed the casual relationship between population growth and environmental degradation in case of Pakistan using time-series data from 1970 to 2010. Granger causality is employed for empirical assessment and the empirical findings reveal causal relationship between population growth and environmental degradation, indeed all the components of environment degradation like air degradation (AD), land degradation (LD) and water degradation (WD) are also mutually causing each other indicating multivariate causality. All of these findings imply that population growth is a major factor responsible for environmental degradation in Pakistan which imposes a burden on country's limited resources. High fertility rate disrupted nature resources through increase in production and consumption level, improper industrial waste dumping and degradation of land resources etc. There is need of proper attention and government should adopt special policy in order to conserve environmental resources for future generation.

Keywords: population growth, environmental degradation, Granger causality.

ЗРОСТАННЯ НАСЕЛЕННЯ ТА ПОГІРШЕННЯ СТАНУ НАВКОЛИШНЬОГО СЕРЕДОВИЩА В ПАКИСТАНІ: ПРИЧИННО-НАСЛІДКОВИЙ АНАЛІЗ

УДК [314.114:504.03] (549.1)

Ірфан Уллах
Махмуд Шах

Емпірично проаналізовано причинно-наслідкові зв'язки між зростанням населення та погіршенням стану навколишнього середовища на прикладі Пакистану з використанням даних часового ряду за період з 1970 до 2010 рр. Для емпіричного оцінювання застосовано причинність за Гренджером, і завдяки емпіричним результатам розкрито причинно-наслідкові зв'язки між зростанням населення та погіршенням стану навколишнього середовища, крім того, всі складові екологічної деградації, включаючи деградацію повітря (ДП), деградацію ґрунту (ДҐ) і деградацію води (ДВ), здійснюють взаємний вплив одна на одну, що свідчить про багатопараметричність причинно-наслідкових зв'язків. Усі ці результати дають підстави вважати зростання населення головним чинником погіршення стану навколишнього середовища в Пакистані, що обтяжує обмежені ресурси країни. Високий рівень родючості завдає шкоди природним ресурсам внаслідок підвищення продуктивності й рівня споживання, неналежного поводження з промисловими відходами, руйнування земельних ресурсів тощо. Належної уваги потребує і має бути прийнята урядом соціальна політика, спрямована на збереження природних ресурсів для майбутніх поколінь.

Ключові слова: зростання населення, погіршення стану навколишнього середовища, причинність за Гренджером.

6

РОСТ НАСЕЛЕНИЯ И УХУДШЕНИЕ СОСТОЯНИЯ ОКРУЖАЮЩЕЙ СРЕДЫ В ПАКИСТАНЕ: ПРИЧИННО-СЛЕДСТВЕННЫЙ АНАЛИЗ

УДК [314.114:504.03] (549.1)

Ирфан Уллах
Махмуд Шах

Эмпирически проанализированы причинно-следственные связи между ростом населения и ухудшением состояния окружающей среды на примере Пакистана с использованием данных временного ряда за период с 1970 по 2010 гг. Для эмпирического оценивания была применена причинность по Грэнджеру, и благодаря эмпирическим результатам раскрыта причинно-следственная связь между ростом населения и ухудшением состояния окружающей среды, кроме того, все составляющие экологической деградации, включая деградацию воздуха (ДВ), деградацию почвы (ДП) и деградацию воды (ДВ), оказывают взаимное влияние друг на друга, что свидетельствует о многопараметричности причинно-следственных связей. Все эти результаты дают основания полагать, что рост населения является решающим фактором в ухудшении состояния окружающей среды в Пакистане, и это накладывает отпечаток на ограниченные ресурсы страны. Высокий уровень плодородия наносит вред природным ресурсам вследствие повышения продуктивности и уровня потребления, неправильного размещения отходов, разрушения земельных ресурсов и т. д. Надлежащего внимания требует и должна быть принята правительством социальная политика, направленная на сохранение природных ресурсов для будущих поколений.

Ключевые слова: рост населения, ухудшение состояния окружающей среды, причинность по Грэнджеру.

Malthus estimated that food production is growing in arithmetic way against human population, which grows exponentially and causes serious food shortage and human misery at some points. However, later evidences prove this wrong as food production were examined more than its prediction and conversely population growth witnessed more slowly. However, the idea survived that the human population cannot continue to grow indefinitely without reaching and exceeding at some point the carrying capacity of the earth [1]. In 1970s, the neo-Malthusian literature emerged with the theory that repaid population of the world would exceed the resource base and lead to serious environmental destruction, wide-spread hunger, and violent conflicts [2 – 6]. Thomas Homer-Dixon [7] moderated neo-Malthusian theory as population growth is an important source to demand induced scarcity. For example, if demand of the resource is constant the availability of the resource will tend to diminish the number of people who share it and consequently lead to an increase in per capita demand.

Population growth has severe implication for environmental resources and leads to environmental degradation, which includes pressure on land, soil degradation, deforestation, habitat destruction and loss of biodiversity, change in the consumption pattern, solid and hazardous waste, water scarcity and water pollution, global warming, climate change and air pollution etc. Although there are many factors responsible for environmental degradation but population is the most prominent. Repaid population growth exerts pressure on scarce environmental resources via rising demand for production and consumption, uncontrolled urbanization, industrialization, expansion and intensification of agriculture, high energy consumption and consequently leads to destruct natural habitats [8]. It has witnessed that relative environmental degradation is higher in urban area rather than rural area. Environmental degradation can also detract from the pace of economic development by imposing high costs on developing countries through health related expenses and reduced productivity resources [9]. High population growth, which mainly emerged from high birth rates, declination in death rates and migration to urban areas followed by increase in affluence has resulted in rapid growth of energy industrial production and high consumption in Pakistan and expected to be widening in the future. Environmental pollution not only deteriorates environmental conditions but also has adverse implication for sustainable development and health of people. A considerable amount of both surface water and ground water are contaminated due to chemical fertilizers and insecticides in the country and causes various water borne diseases [8]. To this context, population growth is a fundamental factor affecting the natural resources, environmental and technological progress.

R. Dudal [10] estimated that 7 million hectares of total world arable land are 0.3 to 0.5 % lost annually due to land degradation and if the present trend continues this figure will double till 2000. Environmental degradation has serious implication for soil salinization and desertification badly affected both commercial farmers and small-holders. Government gave incentives to use the water-dependent green revolution techniques, which considered the main cause of salinization [11; 12] et al. Soil degradation reduces productivity range from 5 to 1.5 percent of GNP (commonly in tropical region), offsite siltation of reservoirs, rivers channels and many other hydrologic investments, causes further loss biodiversity also affects the productivity via reduction in ecosystem adaptability and arises in loss of genetic resources. Water pollution and water scarcity are two main channels for environmental degradation. In 1991 World Development estimated that at the global level, 22 countries are facing severe water shortages and further 18 are in the danger of facing shortages if rainfall continues in the same pattern [13; 14]. Water pollution resulted in declination of fisheries; time and public cost of provision of safe water and high health expenditures etc. The World Bank estimates 1.3 billion people, most of them in developing countries, live in towns or cities which do not meet minimum WHO standards for Suspended Particulate Matter (SPM) [15]. Air pollution threats domestic vehicles industries through the restriction on industrial activities during critical situation; it also harms forests and water and leaves acidic effect.

Most of the pressing environmental challenges in developing countries commonly and in Pakistan particularly in recent decades are followed by persisting of poverty. It is generally accepted that environmental degradation, rapid population growth and stagnant production are closely linked with the fast spread of acute poverty in many countries of Asia [15; 16] because of poor health condition created by lack of access to clean water and sanitation, indoor air pollution, deforestation and severe soil degradation. In Pakistan land degradation emerged from deforestation and desertification, sodicity and salinity, water logging, negative nutrient balances, soil erosion, and depletion of solid fertility. Pakistan currently holds a population of 177 million with an average population density of 222 persons per sq km, which is obviously higher than many other developing countries, and 37 percent people live in urban areas and 63 % in rural. Repaid migration to urban areas made the cities dysfunctional overcrowded and very congested. Air Quality data obtained for five capital cities confirmed the presence of high concentration of suspended particulate matter mainly due to energy consumption and combustion source, the estimated value particulate matter size below 2.5 micron, which reached an alarming point (2 – 4.7 times higher than the safe limit) National Environmental Quality Standards (NEQS) for particulate matter 2.5 is 25 microns/m^3 annual average [17]. The water resources in Pakistan are also under threat due to untreated discharge of municipal and industrial wastes to rivers and most of the people are drinking unsafe polluted water. 0.884 billion people face lack of access to the safe water, while 2.5 billion don't have access to basic sanitation.

The primary objective of this research paper is to investigate casual relationship between population growth and environmental degradation with relevance to Pakistan, since environmental degradation along with population has remained a crucial issue both in developed and transition economies. Therefore, this paper will

provide empirical background to this phenomenon, the subcomponents of environmental degradation notably land degradation, air degradation and water degradation will provide separate effect for each component.

The authors adopted causality analysis suggested by Granger [18] due to several statistical features, a common regression analysis to estimate dependency of one variable on the other variable, which doesn't necessarily imply causation. Granger causality is often tested for the question, wheather variable "X" causes variable "Y" or variable "Y" causes variable "X" and can be tested in Granger causality framework as follows:

$$Y = \sum_{i=1}^{n} \alpha X_{t-1} + \sum_{i=1}^{n} \beta Y_{t-1} + u1t. \quad (1)$$

$$X = \sum_{i=1}^{n} \lambda Y_{t-1} + \sum_{i=1}^{n} \delta X_{t-1} + u2t. \quad (2)$$

The above equations 1 and 2 can be estimated for bilateral causality, there is the possibility of unidirectional, bidirectional and no causality. If estimated coefficient ($\sum\alpha = 0$) of X t-1 is statistically different from zero, while coefficient of ($\sum\delta$) is not statistically different form zero it will indicate unidirectional causality from X to Y and vice versa. Conversely in bidirectional causality both coefficients $\sum\alpha$ and $\sum\delta$ in equations 1 and 2 respectively hold significant signs. No causality will occur in case where both coefficients $\sum\alpha$ and $\sum\delta$ are not statistically significant. To summarize Granger causality test predicts future value on the basis of past value change in one variable.

The coefficients $\sum\alpha$ and $\sum\delta$ are normally tested through F-statistics as follows:

$$F = \frac{(RSSr - RSSur)/m}{RSSur/(n-k)},$$

where RSSr is restricted residual of sum of square;

RSSur indicates unrestricted residual sum of square;

m and (n-k) are the degrees of freedom.

If the computed value exceeds it one may reject null hypothesis otherwise we accept the null hypothesis. However, computer packages estimate F-statistics value along with its critical probability value, in probability criterion we may reject hypothesis if p-value is less than 0.05 alternatively if p-value exceeds 0.05 we may reject the H0.

The authors have incorporated three major components of environmental degradation, that is air degradation (AD), water degradation (WD) and land degradation (LD), a specific variable for each component is not available, therefore we take average values of different interrelated variable and later we implement statistical tools. Air degradation (AD) comprises CO2 emission and GHG net emissions, land degradation (LD) is the average value of cultivable waste and deforestation, for water degradation (WD) we incorporated fresh water withdrawal as a single variable. The empirical findings are shown in the Table.

Table

Pairwise Granger Causality Tests

Null Hypothesis (H0)	Obs	F-Statistics	Prob	Conclusion
LD does not Granger Cause AD	38	1.28901	0.2891	Reject H0
AD does not Granger Cause LD		1.88974	0.1671	Reject H0
POP does not Granger Cause AD	38	3.23162	0.0523	Reject H0
AD does not Granger Cause POP		0.48404	0.6206	Accept H0
WD does not Granger Cause AD	38	1.21978	0.3083	Reject H0
AD does not Granger Cause WD		4.19079	0.0239	Reject H0
POP does not Granger Cause LD	38	2.01926	0.1488	Reject H0
LD does not Granger Cause POP		0.16455	0.8490	Accept H0
WD does not Granger Cause LD	38	1.11405	0.3403	Reject H0
LD does not Granger Cause WD		1.23545	0.3038	Reject H0
WD does not Granger Cause POP	38	1.30914	0.2837	Reject H0
POP does not Granger Cause WD		7.80565	0.0017	Reject H0

Note. Sample: 1970 – 2010
Lags: 2

The above Table shows causality estimations, the findings suggest that land degradation (LD), air degradation (AD) and water degradation (WD) have mutually bidirectional causality, which, implies that all the three components are causing each other. Indeed unidirectional causality has been found between population growth and AD, WD and LD, which suggests that population growth is causing AD, WD and LD. All of these findings suggest that population growth has significantly and positively associated with environmental degradation, both population and environmental degradation are moving in the same direction.

This paper has empirically analyzed causal relationship between environmental degradation and population growth in case of Pakistan our the period of 1970 to 2010. Time-series data have been used follow by Granger Causality test for empirical investigation. The empirical findings reveal all the three components of environmental degradation, namely land degradation (LD), air degradation (AD) and water degradation (WD), mutually cause each other. While unidirectional causality is found between population LD, WD and AD. All of the findings show that population growth has significant impact on environmental degradation and both population and environmental degradation are moving in the same direction. This implies that population growth is a major factor responsible for consistent environmental degradation mainly due to high energy consumption, land resource depletion, and clean water withdrawal etc. Further environmental deterioration not only increases the per capita health expenditures of individuals but also hinders overall economic growth. To this context there is need of proper population and environment mix policy in order to conserve and protect natural resources from degradation, since population growth is the primary factor responsible for environmental degradation. First of all, government should take serious measures for controlling the birth rates and adopt environmental protection plan in order to ensure clean air, clean water, solid waste management. Various steps can be made to this reference, government should give incentives to use friendly environment fuel (compressed natural gas, CNG) and introduce industrial waste taxes in order to minimize the industrial wastes into surface water and take steps for the betterment of sewerage system both in urban and rural areas. Various incentives should be used at public and private level in order to minimize the land degradation components, namely deforestation and desertification, loss of fertility, salinity and soil erosion. Environmental degradation lower the labor productivity and poses higher production cost and hence affects economic growth, however this task is left for the future research.

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КОМПЛЕМЕНТАРНОСТЬ ИНСТИТУЦИОНАЛЬНЫХ БЛОКОВ КАК ИНСТРУМЕНТ АНАЛИЗА СОЦИАЛЬНО-ЭКОНОМИЧЕСКИХ СИСТЕМ

УДК 330.342

Липов В. В.

Приведена иерархия элементарных оснований институциональной архитектоники социально-экономических систем, выделены её нано- (ценности, стили мышления, коллективные конвенции, институциональные формы и функции и т. д.), микро- (институты, формы координации и управления трансакционными издержками и др.), мезо- (институциональные блоки, социальные системы производства и т. п.), макро- (базовые институты, социально-экономические системы и т. п.) и мегауровни (модели капитализма, интеграционные союзы и др.). Даны определения институциональной комплементарности, её структурного и функционального компонентов, институционального блока. Представлены подходы к определению их состава, обоснована ключевая роль социальных ориентаций ценностей в формировании целостных институциональных блоков финансирования, корпоративного управления, производственных отношений, подготовки и повышения квалификации, моделей производства, инноваций, социальной поддержки.

Ключевые слова: институциональная архитектоника, институты, институциональная комплементарность, институциональные блоки, социально-экономические системы.

КОМПЛЕМЕНТАРНІСТЬ ІНСТИТУЦІОНАЛЬНИХ БЛОКІВ ЯК ІНСТРУМЕНТ АНАЛІЗУ СОЦІАЛЬНО-ЕКОНОМІЧНИХ СИСТЕМ

УДК 330.342

Липов В. В.

Наведено ієрархію елементарних підстав інституціональної архітектоніки соціально-економічних систем, виділено її нано- (цінності, стилі мислення, колективні конвенції, інституціональні форми і функції та ін.), мікро- (інститути, форми координації та управління трансакційними витратами і т. д.), мезо- (інституціональні блоки тощо), макро- (базові інститути, соціально-економічні системи та ін.) та мегарівні (моделі капіталізму, інтеграційні союзи і т. д.). Подано визначення інституціональної комплементарності, її структурного та функціонального компонентів, інституціонального блоку. Наведено підходи до визначення їх складу, обґрунтовано ключову роль соціальних орієнтацій цінностей у формуванні цілісних інституціональних блоків фінансування, корпоративного управління, виробничих відносин, підготовки та підвищення кваліфікації, моделей виробництва, інновацій, соціальної підтримки.

Ключові слова: інституціональна архітектоніка, інститути, інституціональна комплементарність, інституціональні блоки, соціально-економічні системи.