Trends and Pattern in fish production since 1991 in India

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Abstract:

Fish has been regarded as a food source since ancient times, both globally and in India. Furthermore, it serves as an important source of high-quality protein essential for human nutrition and has historically been utilized as a trade commodity. Therefore, this paper aims to analyze the trends and patterns of per capita fish production in India since 1991. The trend shows a significant positive correlation over time. Conversely, the pattern has been positively validated with the first lag and is stationary.

Keywords: Fish Production, OLS Assumptions, Augmented Dickey Fuller test, Trend and Patterns.

Introduction

Fishing is now considered as an important production option to meet the growing needs of global proteins. Due to its significance, fish farming is increasingly recognized as a vital production method for meeting the escalating protein demands of the global population. In a similar vein, Prem et al. (2015) argued that fisheries support the livelihoods of over 30 million fishers, aquaculturists, and their families around the globe. Fish serve as a crucial source of minerals and essential fatty acids, constituting more than 16% of the animal protein consumed by humans worldwide. Furthermore, fish represent a key source of high-quality protein essential for human nutrition. When compared to other sources of animal protein such as beef and poultry, fish boosts the highest levels of easily digestible high-quality protein, lipids, vitamins, calcium, iron, and essential amino acids (Ayoola, 2010). Consequently, fish has been a fundamental source of sustenance for human survival since the dawn of human evolution. Humans have traditionally engaged in fishing across various aquatic environments using diverse methods. These environments include both sea-level and inland water bodies. In addition to being a food source, fish has historically served as a trade commodity. Over the last five decades, global fish production has shown a consistent upward trend, with the supply of food fish increasing at an average annual rate of 3.2%, outpacing the 1.6% growth rate of the global population. In 2012, capture fisheries and aquaculture collectively provided approximately 158.0 million tonnes of fish to the world, with 91.3 million tonnes sourced from capture fisheries and 66.6 million tonnes from aquaculture. In that year, India contributed a total of 8.66 million tonnes, of which 3.372 million tonnes were derived from capture fishing and 5.294 million tonnes from other sources (Prem et al., 2015).

So, this paper has an objective to see the trend and pattern of the fish production in India since 1991.

Methodology

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In order to identify the trend, this study utilized the distributed lag model to analyze the pattern of fish production.

$Y_t = a + b\ Y_{t-1} + e_t$

Y_t represents the per capita fish production, while Y_{t-1} denotes the per capita fish production from 1993 to 2022. Additionally, e_t signifies the residual term, which follows a normal distribution. The data utilized in this analysis is sourced from the World Bank Data, 2024.

If the residuals of this model exhibit stationary as determined by the Augmented Dickey Fuller (ADF) test, and if the model satisfies the Ordinary Least Squares (OLS) assumptions, including tests for normality, heteroskedasticity, and serial correlation, it can be concluded that the trend and pattern of per capita fish production is a well-fitted model (Gujarati and Sangeetha, 2004).

Results and Discussion

The consumption of fish has been recognized as a hygienic food source since the dawn of humanity. Consequently, it is regarded as one of the oldest food items in the world. In India, the development of fish production as a profession has been facilitated by river systems and inland ponds since ancient times. This profession gained further prominence following the introduction of liberalization, privatization, and globalization (LPG) in 1991. The trend is illustrated in Fig. 1.

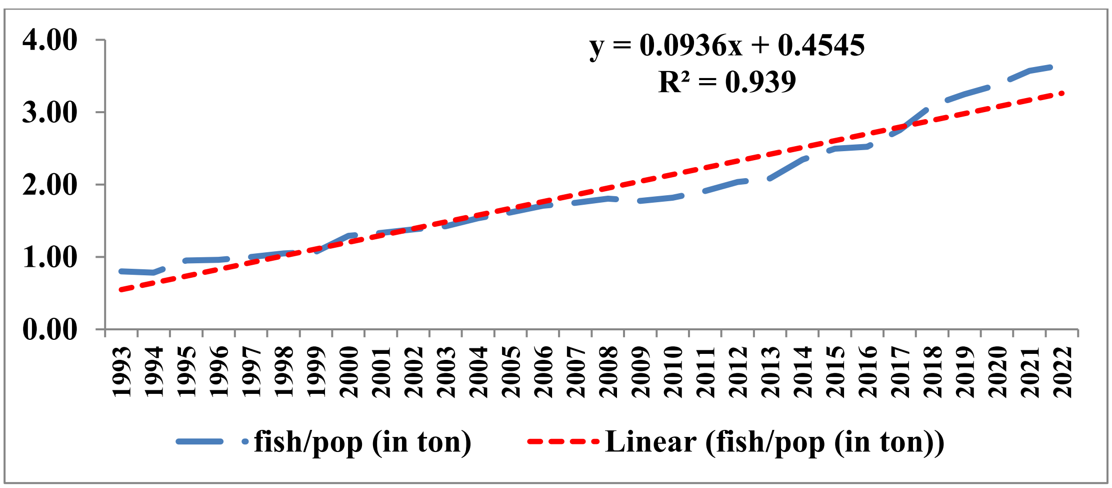

Fig.1 Trend of the per capita fish production in India since 1991

A notable upward and positive linear trend has been identified in India (Fig. 1). This trend is increasing at a rate of 9.3 percent per annum. Utilizing the distributed lag model, the equation for per capita fish production is as follows:

$$Y_t = 0.011 + 1.05\ Y_{t-1}$$

P = (0.765) (0.000)

R2 = 0.99, F = 2903.7 (0.000)

It is evident that per capita fish production significantly depends on its lagged value. In the current year, fish production increases by 1.05 units for every unit increase in fish production from the previous year. The residual term of this distributed lag model is stationary, as confirmed by the Augmented Dickey Fuller (ADF) test. The tau value is -5.484, which is statistically significant at the 1 percent level of significance.

Diagnostic Analysis

In the context of OLS assumption evaluations, this paper validates the normality test, heteroskedasticity test, and serial correlation test through the application of the Jarque-Bera test, Breusch-Pagan-Godfrey test, and Breusch-Godfrey test, respectively (Table 1).

Table.1 OLS Assumptions Tests

OLS Test	Null Hypothesis	Tabulated Value	P-value
Jarque Bera	**Normal**	**4.107**	**0.1288**
Bruesch Godgrey	**No Serial Correlation**	**F = 0.5144**	**0.6040**
Bruesch Pagan Godgrey	**Homoskedasticity**	**F = 0.5046**	**0.4835**

This table elucidates that all OLS assumptions are met, as none of the null hypotheses are rejected at the 5 percent significance level (Appendix A).

Discussion

Aquaculture is regarded as a profession that provides a source of income. It is essential to uphold a healthy aquatic environment and ensure the production of adequate fish food organisms within ponds. The aquatic system must be sustained by two key factors: physical and chemical elements (Banerjea, 1967).\

Conclusion

Fish is an essential source of high-quality protein and it is crucial for human nutrition and has been used as a trade commodity as well as a food source since ancient times. Consequently, this paper seeks to examine the trends and patterns of per capita fish production in India from 1991 onwards. The trend shows a positive significance over time. In contrast, the pattern has been positively validated with the first lag and is stationary as per the ADF test. Additionally, the OLS assumptions have been verified. This suggests that pursuing fish production as a profession is significantly warranted.

References

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Appendix-A

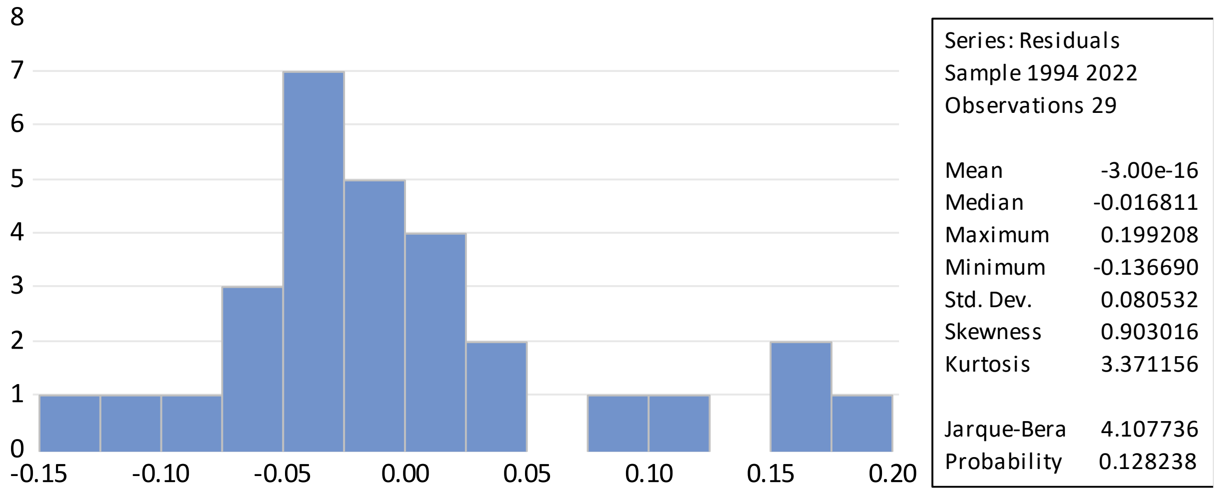
Dependent Variable: F
Method: Least Squares
Date: 07/02/25 Time: 05:40
Sample (adjusted): 1994 2022
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.011771	0.038924	0.302399	0.7647
F(-1)	1.046917	0.019428	53.88669	0.0000

R-squared	0.990787	Mean dependent var	1.942069
Adjusted R-squared	0.990446	S.D. dependent var	0.839032
S.E. of regression	0.082010	Akaike info criterion	-2.097482
Sum squared resid	0.181592	Schwarz criterion	-2.003186
Log likelihood	32.41349	Hannan-Quinn criter.	-2.067950
F-statistic	2903.776	Durbin-Watson stat	2.082231
Prob(F-statistic)	0.000000		

Null Hypothesis: RESID01 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.484270	0.0001
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	



Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.504698	Prob. F(1,27)	0.4835
Obs*R-squared	0.532136	Prob. Chi-Square(1)	0.4657
Scaled explained SS	0.546871	Prob. Chi-Square(1)	0.4596

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.514491	Prob. F(2,25)	0.6040
Obs*R-squared	1.146433	Prob. Chi-Square(2)	0.5637

Stability test

Chow Breakpoint Test: 2008
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1994 2022

F-statistic	0.167904	Prob. F(2,25)	0.8464
Log likelihood ratio	0.386944	Prob. Chi-Square(2)	0.8241
Wald Statistic	0.335808	Prob. Chi-Square(2)	0.8454