

Analyzing Participation Trends in Indonesian Pension Funds: A Quantitative Time Series Study

Dewi Susanawati ^{1*}, Yusrina Nur Dianati²

¹ Universitas Darunnajah, ² UIN Salatiga

*Email Corresponding Author: dewisusanawati@darunnajah.ac.id

ABSTRACT

Indonesia ranks 7th globally in terms of *Purchasing Power Parity* (PPP) and 17th in nominal GDP, recording 5.02% year-on-year growth in the fourth quarter of 2024. Despite this positive performance, pension fund participation has remained stagnant since the enactment of Law No. 11/1992. Data from the Financial Services Authority (OJK) show that pension benefit liabilities increased by 4.6% (YoY) to IDR 393.52 trillion, while participant contribution growth slowed to 1.92% (YoY). This study applies trend analysis using several trend models within a *time series* framework to forecast the growth of pension fund participants. The exponential trend model was found to be the most accurate, with the lowest *Standard Error of the Estimate*. Projections indicate a modest increase in participants for the Financial Institution Pension Fund (DPLK) and a decline for the Employer Pension Fund (DPPK). These results provide insights for stakeholders to formulate strategies that enhance pension fund participation and ensure long-term benefit sustainability.

Keywords: Pension Fund, Trend Analysis, Time Series, Retirement Sustainability, Indonesia Economy

1. INTRODUCTION

Indonesia is one of the largest economies in the world, ranking 7th globally in terms of Purchasing Power Parity (PPP) [1] and 17th in nominal GDP. In the fourth quarter of 2024, the national economy grew by 5.02% year-on-year (YoY) [2]. This growth was primarily driven by the “Other Services” sector (6.47%), which includes various businesses providing services to consumers outside the main service categories, with the labor force participation rate reaching 69.30% as of December 2024. However, such favorable economic growth has not been accompanied by an increase in pension fund participation, as a significant proportion of the workforce remains outside the coverage of pension fund programs. Pension Fund is a legal entity that manages and runs a program that promises pension benefits[3], the implementation of which is regulated by applicable regulations.

Pension fund has operated in Indonesia since the enactment of Law No. 11/1992 in 1992. Over a relatively long period, the number of new participants particularly in Employer Pension Funds (Dana Pensiun Pemberi Kerja, DPPK) has remained stagnant, while the growth of Financial Institution Pension Fund (Dana Pensiun Lembaga Keuangan, DPLK) has been minimum increase. This reflects persistent challenges in expanding pension fund participation in the labor market. Pension fund management plays a critical role in Indonesia’s long-term national development roadmap, especially in strengthening the financial sector [4]. In developed countries, there has been a notable trend of allocating investments into alternative capital instruments, one of which is linked to sustainable finance. Pension fund function as institutions that directly support the sustainability of national economic growth, especially in the investment and assets.

According to statistics published by the Financial Services Authority (OJK), during the first five months of 2025, total pension fund liabilities increased by 4,6% YoY to IDR 393,52 trillion, whereas voluntary pension fund contributions grew at a slower rate of 1,92% YoY to IDR 15,16 trillion, down from 6,65% YoY in April 2025. This indicates that contributions remain lower than the benefits to be disbursed.

The industry faces several challenges, including the requirement for investment guidelines to remain flexible yet prudent, competition from the Employment Social Security Agency (BPJS Ketenagakerjaan), and the generally declining voluntary participation rate [5].

Therefore, a comprehensive analysis is necessary to estimate the growth of pension fund participants within the national economic system. This relates directly to the sustainability of benefit payments, with the aim of achieving a minimum replacement ratio of 40%. Trend analysis offers a method for forecasting pension fund participation in future periods, providing stakeholders with valuable insights for strategic decision-making to accelerate participation growth and ensure long-term pension fund resilience in the economy.

Trend analysis models are widely used in economic and financial research. For example, the Consumer Price Index (CPI) and money supply have shown a positive contribution to economic growth based on trend analyses conducted during the 2015–2020 period [6], while macroeconomic indicators have been found to influence GDP fluctuations in various countries [7]. As a subset of time series models, trend analysis requires identifying the underlying data pattern, where a sustained upward or downward movement over time is referred to as a trend [8]. This method requires sufficient historical data to detect fluctuations and assess influencing factors. Since pension fund data are time-dependent, trend analysis models are well-suited for modeling the observed phenomena [9].

2. METHODS

The data used in this study is monthly records of pension fund participants in Indonesia from January 2022 to May 2025, obtained from the Pension Fund Statistics published by the Financial Services Authority (OJK). The pension fund participant data reflect the overall growth of pension fund and include participants from both the Employer Pension Fund (Dana Pensiun Pemberi Kerja, DPPK) and the Financial Institution Pension Fund (Dana Pensiun Lembaga Keuangan, DPLK). The primary difference between the two lies in the institutional establishment: DPPK can only be established by an employer with the approval of OJK, whereas DPLK can only be established by a legal entity licensed by OJK as a financial institution or other entities regulated under the relevant OJK regulations [3].

The analysis combines descriptive and inferential statistics. Descriptive statistics are used to identify data patterns in pension fund participation. Time series data patterns may follow horizontal, seasonal, cyclical, or trend patterns. In time series analysis, a normality test is required as an initial step to determine whether the data are normally distributed, as normally distributed data tend to yield more stable and representative results for the population, while minimizing bias in the analysis [10]. Normality testing was conducted using the Kolmogorov–Smirnov test. The inferential statistical approach in this study involves three trend analysis models: linear trend, quadratic trend, and exponential trend.

2.1. Linear Trend

The linear trend represents an upward or downward movement in a straight line, expressed as [11]:

$$Y_t = \beta_0 + \beta_1 t \quad (1)$$

where β_0 and β_1 are unknown parameters. Using the Ordinary Least Squares (OLS) method, parameter estimates can be obtained as [8]:

$$\hat{\beta}_1 = \frac{\sum_{t=1}^n (Y_t - \bar{Y})(t - \bar{t})}{\sum_{t=1}^n (t - \bar{t})^2} \quad (2)$$

$$\beta_0 = \bar{Y} - \hat{\beta}_1 \bar{t} \quad (3)$$

where $\bar{t} = (n + 1)/2$ is the average of $1, 2, \dots, n$.

2.2. Quadratic Trend

The quadratic trend describes a parabolic pattern, which is nonlinear in a straight line. The quadratic trend equation is [11]:

$$Y_t = \beta_0 + \beta_1 t + \beta_2 t^2 \quad (4)$$

The parameter estimates are obtained as:

$$\hat{\beta}_2 = \frac{n(\sum_{t=1}^n t^2 Y_t) - \sum_{t=1}^n t^2 \sum_{t=1}^n Y_t}{n(\sum_{t=1}^n t^4) - (\sum_{t=1}^n t^2)^2} \quad (5)$$

$$\hat{\beta}_1 = \frac{\sum_{t=1}^n t Y_t}{\sum_{t=1}^n t^2} \quad (6)$$

$$\beta_0 = \frac{(\sum_{t=1}^n Y_t) - \hat{\beta}_2(\sum_{t=1}^n t^2)}{n} \quad (7)$$

with $\sum_{t=1}^n t^3 = 0$

2.3. Exponential Trend

The exponential trend represents a data distribution pattern that tends to increase exponentially. The model is expressed as [11]:

For discrete variables:

$$Y_t = \beta_0(1 + \beta_1)^t \quad (8)$$

For continuous variables:

$$Y_t = \beta_0 \exp(\beta_1 t) \quad (9)$$

To estimate parameters using OLS, Y_t value is first transformed into its natural logarithm (\ln), yielding:

$$\beta_1 = \text{anti ln} \frac{\sum_{t=1}^n X \ln \hat{Y}_t}{\sum_{t=1}^n t^2} \quad (10)$$

$$\beta_0 = \text{anti ln} \frac{\sum_{t=1}^n \ln \hat{Y}_t}{n} \quad (11)$$

2.4. Model Selection

After estimating the parameters using different trend analysis models, the best-fitting model is selected. The most appropriate model is the one with the predicted values closest to the actual data, where the difference between the predicted and actual values is referred to as the error. Two criteria are used for model selection are the Standard Error of the Estimate (SSE) and the Adjusted R-square. The formulas are:

$$SSE = \sqrt{\frac{\sum_{t=1}^n (Y_t - \hat{Y}_t)^2}{n - k}} \quad (12)$$

$$R_{Adj}^2 = 1 - \frac{\frac{SS \text{ residual}}{df \text{ residual}}}{\frac{SS \text{ total}}{df \text{ total}}} \quad (13)$$

where Y_t is the actual data, \hat{Y}_t is the estimated value from the model, and k is number of parameters. This study use software *SPSS* for calculating the forecasting and best model selection [12].

3. RESULTS AND DISCUSSION

Data plotting was conducted to identify the characteristics of the data to be analyzed. Figure 1 illustrates the plot of pension fund participants from January 2022 to May 2025. Based on Figure 1, it can be observed that the number of participants in the DPPK pension fund program exhibited a gradual decline, whereas the DPLK pension fund program showed fluctuating patterns. A significant decrease occurred in the first quarter of 2022, followed by a slow upward trend beginning in early 2024.

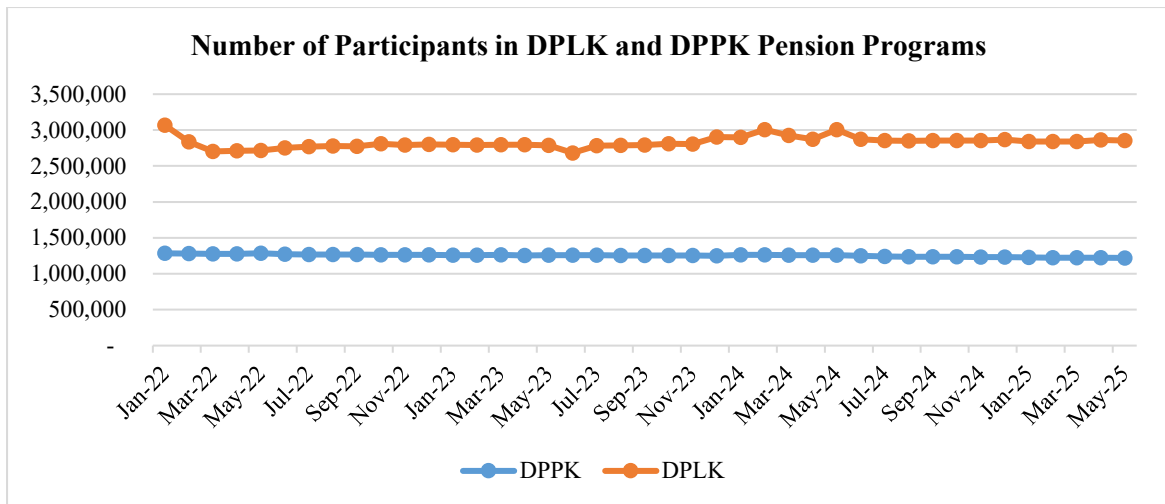


Figure 1. Indonesia Pension Fund Program Participants, January 2022 to May 2025

The normality of the data was tested using the Kolmogorov–Smirnov test at a significance level of $\alpha = 0,05$. The decision rule for the Kolmogorov–Smirnov test is as follows:

- If the p-value is greater than $\alpha = 0,05$, the data are normally distributed.
- If the p-value is less than $\alpha = 0,05$, the data are not normally distributed.

Based on the results, both datasets were found to follow a normal distribution, as presented in Table 1. The p-values for both pension fund programs indicate that the data are normally distributed; thus, trend analysis can be applied for forecasting the subsequent periods.

Table 1. Result of Normality Test

One-Sample Kolmogorov-Smirnov Test	DPPK Participant	DPLK Participant
p-value ($\alpha = 0,05$)	0,015	0,044

Trend analysis was conducted separately for each program (DPPK and DPLK) using linear, quadratic, and exponential trend models. The research data are presented in Table 2.

Table 2. Indonesia Pension Fund Program Participants Data

Period	DPPK	DPLK
Jan-22	1.284.119	3.067.420
Feb-22	1.280.712	2.837.321
Mar-22	1.276.989	2.700.830
Apr-22	1.275.147	2.710.239
May-22	1.283.509	2.715.236
Jun-22	1.270.999	2.751.197
Jul-22	1.269.513	2.767.740
Aug-22	1.268.068	2.778.111
Sep-22	1.266.634	2.772.948
.	.	.
.	.	.
.	.	.

(excerpt – source: OJK publication, processed)

The results of the trend analysis model are summarized in Table 3.

Table 3. Model Summary

Coefficients	DPPK			DPLK		
	Linear	Quadratic	Exponential	Linear	Quadratic	Exponential
Case Sequence	- 1.327,3141	- 521,7200	- 0,0011	2.600,0373	1.558,9451	0,0009
Case Sequence ** 2		- 19,1808			24,7879	
(Constant)	1.282.398,5232	1.276.625,0987	1.282.658,2072	2.774.436,0463	2.781.897,2068	2.772.929,4923

Based on Table 3, it can be explained as the follow:

DPPK Program

a. Linear Trend Model

$$Y = 1.282.398,5232 - 1.327,3141t \quad (14)$$

Equation (14) shows a decrease of approximately 1.327 participants per period. At $t = 0$, the baseline number of participants is 1.282.398 participants.

b. Quadratic Trend Model

$$Y_t = 1.276.625,0987 - 521,72t - 19,1808t^2 \quad (15)$$

Equation (15) indicates a decrease of about 521 participants per period, with a concave-downward (“U”-shaped) relationship between time and the number of participants. At $t = 0$, the baseline number of participants is 1.276.625 participants.

c. Exponential Trend Model

$$Y_t = 1.282.658,2072exp^{(-0,0011t)} \quad (16)$$

Equation (16) shows an exponential decrease of approximately 0,11% per period from a baseline of 1.282.658 participants.

DPLK Program

a. Linear Trend Model

$$Y = 2.774.436,0463 + 2.600,0373t \quad (17)$$

Equation (17) shows an increase of approximately 2,600 participants per period from a baseline of 2,774,436 participants.

b. Quadratic Trend Model

$$Y_t = 2.781.897,2068 + 1.558,9451t + 24,7879t^2 \quad (18)$$

Equation (18) indicates an upward concave (“inverted U”-shaped) relationship, with an increase of about 1.558 participants per period.

c. Exponential Trend Model

$$Y_t = 2.772.929,4923exp^{(0,0009t)} \quad (19)$$

Equation (19) indicates an exponential increase of approximately 0.09% per period from a baseline of 2.772.929 participants.

Model Significance and Selection

The analysis of variance (ANOVA) results (Table 4) show that all models have p-values smaller than $\alpha = 0.05$, indicating that all parameters are statistically significant. However, ANOVA alone is insufficient to determine the best-fitting model.

Table 4. Analysis of Variance

ANOVA	DPPK			DPLK		
	Linear	Quadratic	Exponential	Linear	Quadratic	Exponential
Significance	0,000000	0,000000	0,000000	0,010130	0,036943	0,007918

To select the optimal model, both the Standard Error of the Estimate (SEE) and the Adjusted R-squared (Adj R²) values were considered (Table 5). The exponential trend model exhibited the smallest SEE for both programs, making it the preferred model despite the quadratic model having slightly higher Adjusted R-square values for DPPK.

Table 5. Best Model Selection

Criteria	DPPK			DPLK		
	Linear	Quadratic	Exponential	Linear	Quadratic	Exponential
Adj R-Square	0,855	0,873	0,854	0,136	0,115	0,146
SEE	6.521,002	6.117,963	0,005	72.881,730	73.764,171	0,025

Table 5 indicates that the smallest Standard Error of the Estimate (SEE) is observed in the exponential trend model, whereas the highest Adjusted R-square value for the program type is found in the quadratic trend model. Nevertheless, given that the SEE for the exponential trend is substantially smaller compared to the linear and quadratic trend models, the exponential trend is considered more appropriate. This is because the SEE represents the deviation between the actual data and the estimated data, where a smaller value indicates a lower model error. Consequently, the exponential trend model is selected as the most suitable approach for forecasting the number of pension fund participants in Indonesia for the subsequent period, as presented in Equations (16) and (19). The forecasting results of exponential trend model are provided in Table 6.

Table 6. Forecasting Results

Time	Period	DPPK Forecast	DPLK Forecast
42	Jun-25	1.226.784	2.884.148
43	Jul-25	1.225.484	2.886.850
44	Aug-25	1.224.185	2.889.554
45	Sep-25	1.222.887	2.892.261
46	Oct-25	1.221.591	2.894.970
47	Nov-25	1.220.297	2.897.682
48	Dec-25	1.219.003	2.900.397
.	.	.	.
.	.	.	.
.	.	.	.

Based on Table 6, the forecasts indicate a gradual decline in DPPK participants and a modest increase in DPLK participants. These contrasting trends suggest that stakeholders should implement strategies to maintain and expand pension fund participation across different generations.

4. CONCLUSION

The normality test results indicate that Indonesia's pension fund participant data follow a normal distribution, enabling time series trend analysis. The exponential trend model yielded the lowest Standard Error of the Estimate (SEE) values (0,005 for DPPK and 0,025 for DPLK), making it the most

suitable for forecasting. The findings reveal a downward trend in DPPK participation and a slight upward trend in DPLK participation. These trends highlight the need for pension fund managers and policymakers to develop targeted strategies to encourage greater workforce participation in pension programs. Future research could incorporate additional factors influencing participation rates, such as pension fund financial ratios, investment performance, public literacy levels regarding pension schemes, and external macroeconomic conditions.

REFERENCE

- [1] International Monetary Fund, “World Economic Outlook,” Washington DC, Apr. 2025.
- [2] Badan Pusat Statistik, “Berita Resmi Statistik,” Feb. 2025.
- [3] Otoritas Jasa Keuangan, “POJK 35 Tahun 2024 Perizinan dan Kelembagaan Dana Pensiun,” 2024.
- [4] Otoritas Jasa Keuangan, “Peta Jalan pengembangan dan Penguatan Dana Pensiun Indonesia 2024-2028,” 2023.
- [5] A. Ahmad Saefuloh *et al.*, “KEBIJAKAN PENGELOLAAN DANA PENSIUN SEKTOR KORPORASI (Pension Fund Management Policy in Corporate Sector).”
- [6] H. P. Upadhyay and B. L. Pradhan, “Trend Analysis of Inflation and its Relationship with Economic Growth of Nepal,” *International Journal of Silkroad Institute of Research and Training*, vol. 1, no. 2, pp. 53–58, Dec. 2023, doi: 10.3126/ijst.v1i2.61664.
- [7] L. Žalgirytė and V. Gižienė, “The Analysis of Trends in GDP and Cyclical Nature of GDP Changes in Baltic States,” *Procedia Soc Behav Sci*, vol. 156, pp. 371–375, Nov. 2014, doi: 10.1016/j.sbspro.2014.11.205.
- [8] J. D. Cryer and K.-S. Chan, “Springer Texts in Statistics Time Series Analysis With Applications in R Second Edition,” 2008.
- [9] R. Rahmawati, “Model Trend untuk Peramalan Jumlah Penduduk.” [Online]. Available: <https://www.researchgate.net/publication/332093792>
- [10] F. B. Salam and D. Kartikasari, “Perbandingan Metode Peramalan Double Exponential Smoothing dan Triple Exponential Smoothing with Damped Parameter terhadap Kunjungan Wisatawan Mancanegara di Provinsi Jawa Barat,” 2023. [Online]. Available: www.dpr.go.id
- [11] F. Pertanian and U. Singaperbangsa Karawang, “Analisis Komparatif Metode Trend dalam Peramalan Produksi Kopi Indonesia,” *Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, vol. 8, no. 2, pp. 1465–1475, 2022.
- [12] B. J. Junaidi, *Ekonometrika Deret Waktu, teori dan Aplikasi*. Bogor: PT Penerbit IPB Press, 2011.