

## Determinants of Animal Protein Consumption in the Cities of East Kalimantan Province, 2020–2025

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### Article History

Received: 22-09-2026

Revised: 28-09-2026

Published: 30-09-2026

**Keywords:** *Animal protein consumption, Income Structure, Population structure, PLS-SEM, Food security, East Kalimantan*

### ABSTRACT

This study aims to analyse the effect of income structure and population structure on animal protein consumption in Samarinda, Balikpapan, and Bontang, East Kalimantan, during 2020–2025. Secondary panel data (18 observations) were obtained from BPS and the East Kalimantan Office of Industry, Trade, Cooperatives, and SMEs. Income structure was measured by per capita income and the city minimum wage (UMK), population structure by the population aged 0–14, 15–59, and 60+ years, and animal protein consumption by beef and chicken meat consumption. Data were analysed using PLS-SEM (SmartPLS 4) with 5,000 bootstrap subsamples. The results show that income structure ( $\beta = 0.808$ ;  $t = 6.440$ ;  $p < 0.001$ ) and population structure ( $\beta = 0.570$ ;  $t = 4.252$ ;  $p < 0.001$ ) have positive and significant effects on animal protein consumption, with an  $R^2$  of 0.828 and a  $Q^2$ predict of 0.781. Food security policies should maintain purchasing power and anticipate population-driven demand.

## INTRODUCTION

Animal-source food is an important component in fulfilling the nutritional needs of the population. Among the various animal-source commodities, local beef and chicken meat play a strategic role in the consumption patterns of Indonesian society, including in the urban areas of East Kalimantan Province. These two commodities are not only the main sources of animal protein but also influence the dynamics of inflation, food security, and community welfare at the regional level.

Nationally, beef and chicken meat consumption in Indonesia remains far below the world average. According to the Organisation for Economic Co-operation and Development, average beef consumption in Indonesia is only about 2.2–2.5 kg per capita per year, whereas the world average reaches 6.3–6.4 kg per capita per year; chicken meat consumption in Indonesia, at 8.1 kg per capita per year, also lags behind the world average of 14.9 kg per capita per year (OECD/FAO, 2021). This condition reflects the low adequacy of meat-based animal protein, which is partly attributable to limited purchasing power and considerable price fluctuations.

Data from Statistics Indonesia show that per capita consumption of fresh beef in 2023 reached 0.50 kg per year, a decrease of 9.1 percent from the previous year, while chicken meat consumption stood at around 0.538 kg per capita per week or approximately 27.98 kg per capita per year (BPS, 2025). The large gap between the two commodities reflects differences in price accessibility, as chicken meat is far more affordable than beef.

East Kalimantan Province has distinctive characteristics in animal-source food consumption. Based on data from the National Strategic Food Price Information Centre (PIHPS), East Kalimantan belongs to the group of provinces with beef consumption above the national average. At the beginning of 2026, the price of first-grade beef in traditional markets in East Kalimantan was recorded at IDR 190,250 per kg, placing the province fifth nationally among regions with the highest beef prices, while chicken meat prices ranged from IDR 35,000 to IDR 40,000 per kg. The high prices, particularly of beef, are driven by a heavy dependence on supply from outside the region, with around 72 percent of the province's total beef requirement being brought in from outside East Kalimantan (ANTARA, 2023). Price data further indicate that chicken meat prices in Balikpapan rose from IDR 22,400/kg in 2015 to IDR 42,400/kg in 2024, in Samarinda from IDR 29,000/kg to IDR 45,800/kg, and in Bontang from IDR 37,500/kg to IDR 45,833/kg, while beef prices in the three cities generally increased from IDR 110,000–125,000/kg to around IDR 150,000–160,000/kg over the same period. At the same time, the real Gross Regional Domestic Product (GRDP) of Balikpapan grew from IDR 69,785.74 billion (2015) to IDR 100,191.74 billion (2024), that of Samarinda from IDR 39,523.55 billion to IDR 58,247.55 billion, whereas that of Bontang, which is based on the petrochemical industry, fluctuated from IDR 43,437.18 billion to IDR 41,563.91 billion.

This phenomenon has become increasingly relevant in the context of the relocation of the national capital (Ibu Kota Nusantara, IKN) to East Kalimantan, which has direct consequences for consumption dynamics in the surrounding areas, including the main buffer cities of Samarinda, Balikpapan, and Bontang. Presidential Regulation Number 63 of 2022 on the Master Plan of the Nusantara Capital City projects that around 488,409 people will move to the IKN area in 2022–2024, and that the area will be inhabited by approximately 1.9 million people by 2045. Since the 2020 Population Census, the population of East Kalimantan has reached 3.77 million with a growth rate of 2.13 percent per year in 2010–2020, largely driven by immigration. On the supply side, local food production, including livestock, is only able to meet about 66.57 percent of the provincial population's needs, and the IKN Authority projects that the demand for ruminant meat by IKN residents in 2045 will reach 8,343 tonnes per year and that for poultry meat 35,113 tonnes per year, far exceeding current local production capacity.

Samarinda, Balikpapan, and Bontang have different socio-economic characteristics. Samarinda, as the provincial capital, is the centre of government and trade with the largest population in East Kalimantan. Balikpapan is an industrial and service city with relatively high per capita income and serves as the main logistics gateway to IKN, while Bontang is a petrochemical industrial city with a unique demographic structure dominated by industrial

workers and their families. These differences make it highly likely that the patterns and determinants of beef and chicken meat consumption vary among the three cities.

Theoretically, Keynes (1936) placed the consumption function at the centre of his theory of economic fluctuations and argued that income is the main determinant of consumption. Keynes posited that the marginal propensity to consume lies between zero and one, meaning that when income rises, people increase their consumption but by less than the increase in income, and that the average propensity to consume declines as income rises. The Keynesian consumption function can be written as  $C = \bar{C} + cY$ , with  $\bar{C} > 0$  and  $0 < c < 1$ , where  $C$  is consumption,  $Y$  is disposable income,  $\bar{C}$  is autonomous consumption, and  $c$  is the marginal propensity to consume (Reksoprayitno, 2000). Early empirical studies based on household surveys and aggregate data confirmed that higher-income households consume more, supporting the view that income is the primary determinant of consumption. In terms of food security, the concept most widely referred to is that of the FAO and the World Food Summit (1996), which comprises four pillars, namely availability, access, utilisation, and stability. The entitlement approach of Sen (1981) further emphasises that food insecurity stems not only from insufficient supply but also from a lack of economic capability to acquire food. In this framework, income reflects the access pillar, while population size and composition determine the total demand that must be met by the availability pillar.

Previous studies support the relationship between income, population, and food consumption. Rochaida and Haliza (2022) found, using simple linear regression on time series data, that income level and population size affect beef demand in Samarinda. Ningsih et al. (2012) showed that household size and income determine protein and energy consumption among fishing households in Tungkai Ilir, Tanjung Jabung Barat. Lestari (2016) found that respondents' income, number of family members, and spouses' income have a positive and significant effect on the household consumption of civil-servant primary school teachers in Kotaanyar, Probolinggo. Ikhlas et al. (2021) analysed the determinants of broiler chicken demand in Samarinda using multiple linear regression, while Umaroh and Vinantia (2018) analysed the consumption of meat, chicken, fish, and milk in Indonesian households using the Almost Ideal Demand System (AIDS) on Indonesian Family Life Survey (IFLS) 5 data. Hidayat et al. (2024) likewise emphasise the importance of demand elasticity analysis in understanding consumer responses in the beef market.

Nevertheless, studies that specifically analyse the factors affecting local beef and chicken meat consumption in the cities of East Kalimantan remain very limited. Most existing studies focus on the national scale or on Java and therefore do not reflect the specific conditions of East Kalimantan, which has unique dynamics owing to its natural-resource-based economy and the IKN mega-project. Several research gaps can be identified. First, no study has comparatively analysed animal protein consumption in the three main cities of East Kalimantan simultaneously within a single panel data framework. Second, previous studies have not covered the period that includes the COVID-19 pandemic and the early stage of IKN development. Third, Bontang, with its distinctive industry-based economy, has hardly ever been

the specific object of food demand analysis. Accordingly, this study aims to analyse the effect of income structure, measured by per capita income and the city minimum wage, and population structure, measured by the number of residents by age group, on animal protein consumption in Samarinda, Balikpapan, and Bontang during 2020–2025.

Based on the theory and previous findings, two hypotheses are proposed. Income structure is expected to increase animal protein consumption because, in line with Keynesian consumption theory, higher per capita income and minimum wages increase the community's ability to purchase beef and chicken meat; this expectation is also consistent with Rochaida and Haliza (2022). Population structure is also expected to increase animal protein consumption because every additional resident requires animal protein to meet nutritional needs, and IKN-related migration has increased the productive-age population, particularly in Samarinda and Balikpapan. Thus, **H1**: Income structure has a positive and significant effect on animal protein consumption in Samarinda, Balikpapan, and Bontang; and **H2**: Population structure has a positive and significant effect on animal protein consumption in Samarinda, Balikpapan, and Bontang.

## RESEARCH METHOD

This study employs a quantitative approach with secondary panel data covering three cities in East Kalimantan Province, namely Samarinda, Balikpapan, and Bontang, over six years (2020–2025), yielding a total of 18 observations. Data on per capita income, the city minimum wage (UMK), and population by age group were obtained from the BPS office of each city (*Kota Samarinda, Kota Balikpapan, and Kota Bontang Dalam Angka*), while data on beef and chicken meat consumption were obtained from the East Kalimantan Provincial Office of Industry, Trade, Cooperatives, and Small and Medium Enterprises. Data were collected through documentation of periodic records (time series) from the relevant institutions, supported by a literature study of journals, books, and other relevant sources. The operational definitions of the variables are presented in Table 1.

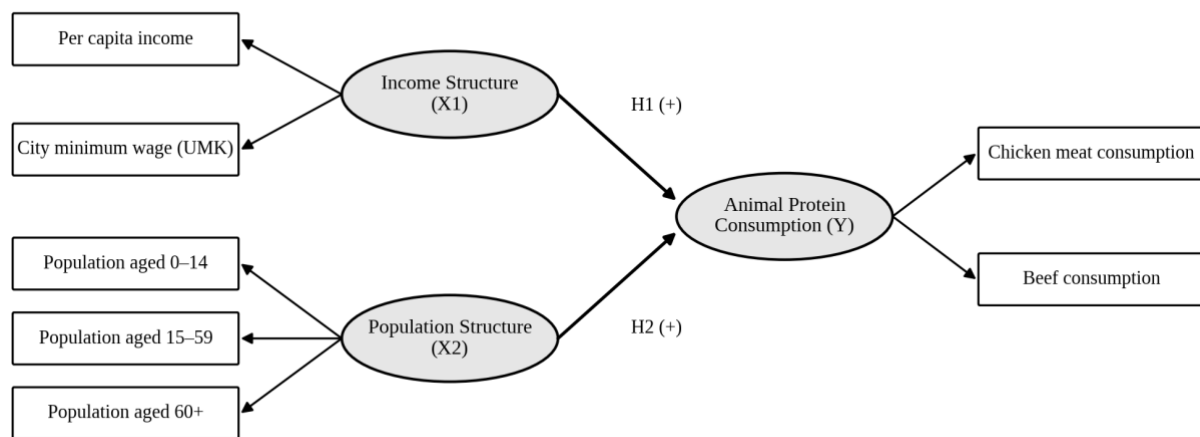
**Table 1.** Operational definitions of research variables

| Variable                       | Operational definition                                                                                                                   | Indicators                                         | Unit                          |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-------------------------------|
| Income Structure (X1)          | Income conditions of the population in Samarinda, Balikpapan, and Bontang during 2020–2025, represented by per capita income and the UMK | Per capita income; city minimum wage (UMK)         | IDR/person/year;<br>IDR/month |
| Population Structure (X2)      | Composition of the population of Samarinda, Balikpapan, and Bontang during 2020–2025 by age group                                        | Population aged 0–14; 15–59; and 60 years and over | Persons                       |
| Animal Protein Consumption (Y) | Volume of animal protein consumption in the form of beef and chicken meat in Samarinda, Balikpapan, and Bontang during 2020–2025         | Beef consumption; chicken meat consumption         | kg/year                       |

Source: Compiled by the authors based on research variables and data sources (2026)

Income structure reflects the economic capacity of the population in each city: per capita income describes the average economic condition of the region in a year, while the UMK

represents the minimum wage standard for formal workers. Population structure captures differences in the demographic composition of the three cities. Animal protein consumption represents aggregate consumption at the city level rather than individual consumption. The conceptual framework of the study is shown in Figure 1.



**Figure 1.** Conceptual framework of the study

The data were analysed using Partial Least Squares–Structural Equation Modeling (PLS-SEM) with SmartPLS 4 (Ringle et al., 2024). All three constructs were specified as reflective, meaning that each construct is reflected by its indicators. The analysis was carried out in two stages. The first stage evaluated the measurement (outer) model, comprising convergent validity (outer loading > 0.70 and average variance extracted, AVE > 0.50), construct reliability (Cronbach’s alpha and composite reliability > 0.70), discriminant validity (Fornell–Larcker criterion and heterotrait–monotrait ratio, HTMT < 0.90), and indicator collinearity (variance inflation factor, VIF). The second stage evaluated the structural (inner) model through the path coefficients, the coefficient of determination ( $R^2$ ), effect size ( $f^2$ ), predictive relevance ( $Q^2_{\text{predict}}$ ), and model fit (SRMR and NFI) (Hair et al., 2019). The structural model is expressed as follows:

$$Y = \beta_1 X_1 + \beta_2 X_2 + \zeta \quad (1)$$

where Y is animal protein consumption,  $X_1$  is income structure,  $X_2$  is population structure,  $\beta_1$  and  $\beta_2$  are the path coefficients, and  $\zeta$  is the error term. The significance of each path was tested using bootstrapping with 5,000 subsamples, with the t-statistic calculated as follows:

$$t = \beta / SE(\beta) \quad (2)$$

where  $\beta$  is the path coefficient and  $SE(\beta)$  is its bootstrap standard error. A hypothesis is accepted when the t-statistic exceeds 1.96 or the p-value is below 0.05 at a 95 percent confidence level (two-tailed). Preliminary data processing and tabulation were performed using Microsoft Excel.

## RESULTS AND DISCUSSION

### *Descriptive Statistics*

Table 2 presents the descriptive statistics of the seven indicators used in the study, based on the panel of three cities over six years (18 observations).

**Table 2.** Descriptive statistics of research indicators (n = 18)

| Indicator                           | Mean        | Median      | Minimum    | Maximum     | Std. dev.  |
|-------------------------------------|-------------|-------------|------------|-------------|------------|
| Per capita income (IDR/person/year) | 106,070,600 | 107,925,876 | 54,398,136 | 156,812,339 | 36,490,290 |
| UMK (IDR/month)                     | 3,333,295   | 3,275,312   | 3,069,316  | 3,778,000   | 237,529    |
| Population aged 0–14 (persons)      | 145,136     | 184,340     | 47,815     | 204,500     | 69,832     |
| Population aged 15–59 (persons)     | 401,217     | 494,770     | 119,754    | 595,200     | 204,816    |
| Population aged 60+ (persons)       | 38,888      | 43,400      | 10,705     | 65,920      | 21,500     |
| Beef consumption (kg/year)          | 2,862,222   | 2,835,000   | 1,860,000  | 4,010,000   | 695,672    |
| Chicken meat consumption (kg/year)  | 19,688,890  | 24,200,000  | 5,400,000  | 32,100,000  | 10,137,870 |

Source: Data processed by the authors from BPS of Samarinda, Balikpapan, and Bontang, and the East Kalimantan Office of Industry, Trade, Cooperatives, and SMEs (2026)

The mean per capita income was IDR 106,070,600, with a minimum of IDR 54,398,136 (Samarinda, 2020) and a maximum of IDR 156,812,339 (Bontang, 2025). Its large standard deviation (IDR 36,490,290) indicates a wide spread across cities and years. In contrast, the UMK was far more homogeneous (standard deviation IDR 237,529), consistent with its administratively determined nature: the UMK in all three cities was frozen in 2020–2021 owing to the national postponement of minimum wage increases during the COVID-19 pandemic and only rose again after the enactment of Government Regulations Number 36 of 2021 and Number 51 of 2023 on Wages. Among the population indicators, the 15–59 age group had the highest mean (401,217 persons), and the medians of the 0–14 and 15–59 age groups were considerably higher than their means because Samarinda and Balikpapan have much larger populations than Bontang. Chicken meat consumption averaged 19,688,890 kg per year, far exceeding beef consumption (2,862,222 kg per year); the minimum beef consumption was recorded in Bontang in 2022 and the maximum in Samarinda in 2025. At the construct level, the standardised scores had a mean of approximately zero and a standard deviation of one, with skewness ranging from  $-0.60$  to  $-0.21$ . Overall, the three cities differ greatly in scale, although their annual growth patterns tend to move in the same, increasing, direction.

### *Measurement Model Evaluation*

The results of the convergent validity and construct reliability tests are presented in Table 3. All indicators have outer loadings above 0.70 with t-statistics well above 1.96 ( $p < 0.001$ ), so all indicators are valid in measuring their respective constructs. Per capita income has the highest loading on income structure (0.948) compared with the UMK (0.877). The three age-group indicators show very high and nearly uniform loadings (0.947–0.979), and beef consumption (0.971) and chicken meat consumption (0.963) contribute in a balanced way to the consumption construct. The AVE values of all constructs exceed 0.80, far above the 0.50 threshold. Cronbach's alpha, rho\_a, and rho\_c of all constructs also exceed 0.70, indicating that the measurement model is internally consistent.

**Table 3.** Convergent validity and construct reliability

| Construct / indicator                 | Outer loading | t-statistic | Cronbach's alpha | rho_a | rho_c | AVE   |
|---------------------------------------|---------------|-------------|------------------|-------|-------|-------|
| <b>Income Structure (X1)</b>          |               |             | 0.808            | 0.906 | 0.909 | 0.833 |
| Per capita income                     | 0.948         | 53.128      |                  |       |       |       |
| UMK                                   | 0.877         | 10.969      |                  |       |       |       |
| <b>Population Structure (X2)</b>      |               |             | 0.964            | 0.983 | 0.977 | 0.933 |
| Population aged 0–14                  | 0.979         | 10.608      |                  |       |       |       |
| Population aged 15–59                 | 0.972         | 9.568       |                  |       |       |       |
| Population aged 60+                   | 0.947         | 9.241       |                  |       |       |       |
| <b>Animal Protein Consumption (Y)</b> |               |             | 0.931            | 0.941 | 0.967 | 0.935 |
| Chicken meat consumption              | 0.963         | 44.456      |                  |       |       |       |
| Beef consumption                      | 0.971         | 70.478      |                  |       |       |       |

Source: Data processed using SmartPLS 4 (2026); all loadings significant at  $p < 0.001$

Discriminant validity was assessed using the Fornell–Larcker criterion and the HTMT ratio (Table 4). The square root of the AVE of each construct (diagonal) is greater than its correlations with other constructs: 0.967 for consumption, 0.913 for income structure, and 0.966 for population structure. The negative correlation between income structure and population structure (−0.162) indicates that the two constructs are distinct and do not overlap. All HTMT values are below 0.90, namely 0.795 for income structure–consumption, 0.453 for population structure–consumption, and 0.321 for population structure–income structure. The consistency of the two methods confirms that the three constructs have good discriminant validity.

**Table 4.** Discriminant validity (Fornell–Larcker criterion and HTMT)

| Construct                      | Y            | X1           | X2           | HTMT with Y | HTMT with X1 |
|--------------------------------|--------------|--------------|--------------|-------------|--------------|
| Animal Protein Consumption (Y) | <b>0.967</b> |              |              | –           | –            |
| Income Structure (X1)          | 0.715        | <b>0.913</b> |              | 0.795       | –            |
| Population Structure (X2)      | 0.439        | −0.162       | <b>0.966</b> | 0.453       | 0.321        |

Source: Data processed using SmartPLS 4 (2026); bold diagonal values are the square roots of AVE

Collinearity was examined at the indicator (outer) and construct (inner) levels (Table 5). The VIF values of the consumption indicators (4.146) and the income indicators (1.848) are below the ideal threshold of 5. The age-group indicators show higher VIF values, namely 11.996 (0–14), 8.942 (15–59), and 5.192 (60+); the 0–14 age group slightly exceeds the critical threshold of 10, reflecting the naturally high correlation among age groups, as population growth in one age group is almost always accompanied by proportional growth in the others within the same city. At the inner-model level, the VIF of both paths is 1.027, far below 5, indicating that the path coefficients are not distorted by multicollinearity between predictors.

**Table 5.** Collinearity statistics (VIF)

| Outer model (indicator)  | VIF    | Inner model (path) | VIF   |
|--------------------------|--------|--------------------|-------|
| Chicken meat consumption | 4.146  | X1 → Y             | 1.027 |
| Beef consumption         | 4.146  | X2 → Y             | 1.027 |
| Per capita income        | 1.848  |                    |       |
| UMK                      | 1.848  |                    |       |
| Population aged 0–14     | 11.996 |                    |       |
| Population aged 15–59    | 8.942  |                    |       |
| Population aged 60+      | 5.192  |                    |       |

Source: Data processed using SmartPLS 4 (2026)

### ***Structural Model Evaluation and Hypothesis Testing***

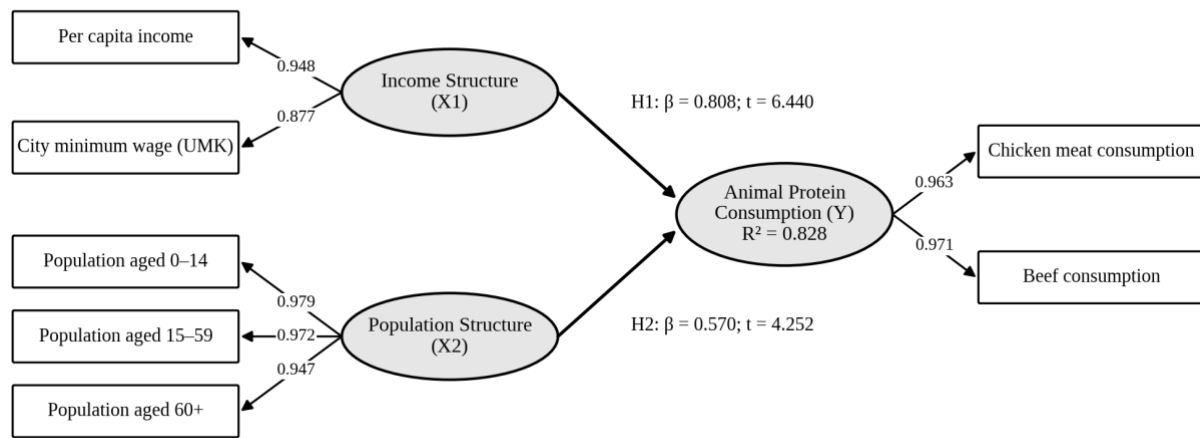
The quality of the structural model is summarised in Table 6. The  $R^2$  value of animal protein consumption is 0.828 (adjusted  $R^2 = 0.805$ ), meaning that income structure and population structure jointly explain 82.8 percent of the variation in animal protein consumption in the three cities, while the remaining 17.2 percent is explained by factors outside the model, such as beef and chicken meat prices, consumer preferences, and supply availability. This value exceeds the strong-category threshold of 0.67 (Chin, 1998), and the small difference between  $R^2$  and adjusted  $R^2$  (0.023) indicates that the explanatory power is not inflated by the number of predictors. The  $Q^2_{\text{predict}}$  value at the construct level is 0.781, with RMSE = 0.523 and MAE = 0.439 on the standardised scale, indicating large predictive relevance; at the indicator level,  $Q^2_{\text{predict}}$  is 0.818 for beef and 0.602 for chicken meat. The RMSE (MAE) of the PLS-SEM predictions is 5,796,027.15 kg (4,790,989.06 kg) for chicken meat and 306,571.70 kg (256,687.19 kg) for beef, lower than those of the linear regression (LM) and indicator average (IA) benchmarks. The Cross-Validated Predictive Ability Test (CVPAT) confirms that PLS-SEM predicts significantly better than the indicator average model ( $t = 2.219$ ;  $p = 0.040$ ).

**Table 6.** Structural model quality

| Criterion                    | Value         | Threshold / interpretation  |
|------------------------------|---------------|-----------------------------|
| $R^2$ (Y)                    | 0.828         | > 0.67: strong (Chin, 1998) |
| Adjusted $R^2$ (Y)           | 0.805         | –                           |
| $Q^2_{\text{predict}}$ (Y)   | 0.781         | > 0.35: large               |
| RMSE / MAE (Y, standardised) | 0.523 / 0.439 | Smaller is better           |
| $f^2$ X1 $\rightarrow$ Y     | 3.690         | > 0.35: large (Cohen, 1988) |
| $f^2$ X2 $\rightarrow$ Y     | 1.836         | > 0.35: large (Cohen, 1988) |
| SRMR                         | 0.129         | < 0.08                      |
| NFI                          | 0.674         | > 0.90                      |

Source: Data processed using SmartPLS 4 (2026)

The effect size of income structure on consumption ( $f^2 = 3.690$ ) and that of population structure ( $f^2 = 1.836$ ) are both well above the large-effect threshold of 0.35 (Cohen, 1988), with income structure having the greater explanatory contribution. With respect to global fit, the SRMR (0.129) is above the ideal threshold of 0.08 and the NFI (0.674) is below 0.90, so the model does not yet meet the ideal criteria of absolute fit. However, PLS-SEM is a variance-based and prediction-oriented method, and Hair et al. (2019) recommend that SRMR and NFI should not be the sole basis for judging model adequacy but should be considered together with  $R^2$ ,  $f^2$ , and  $Q^2_{\text{predict}}$ . Considering all results, the model remains adequate for explaining and predicting animal protein consumption in the three cities, although the fit indices call for caution in interpretation. The estimated structural model is shown in Figure 2, and the results of hypothesis testing are presented in Table 7.

**Figure 2.** Estimated structural model**Table 7.** Results of hypothesis testing (bootstrapping, 5,000 subsamples)

| Hypothesis | Path                                                       | Path coefficient | t-statistic | p-value | Decision |
|------------|------------------------------------------------------------|------------------|-------------|---------|----------|
| H1         | Income Structure (X1) → Animal Protein Consumption (Y)     | 0.808            | 6.440       | < 0.001 | Accepted |
| H2         | Population Structure (X2) → Animal Protein Consumption (Y) | 0.570            | 4.252       | < 0.001 | Accepted |

Source: Data processed using SmartPLS 4 (2026)

The path from income structure to animal protein consumption has a coefficient of 0.808 with a t-statistic of 6.440 and a p-value below 0.001, so H1 is accepted. The path from population structure to animal protein consumption has a coefficient of 0.570 with a t-statistic of 4.252 and a p-value below 0.001, so H2 is also accepted. The positive coefficients mean that an increase of one unit in the standardised score of income structure is followed by an increase of about 0.808 units in the standardised score of animal protein consumption, holding population structure constant, and an increase of one unit in the standardised score of population structure is followed by an increase of about 0.570 units. Income structure thus exerts a stronger effect than population structure, both in terms of path coefficient (0.808 versus 0.570) and t-statistic (6.440 versus 4.252).

### ***The Effect of Income Structure on Animal Protein Consumption***

The positive and significant effect of income structure indicates that the higher the income of the population in a city, the greater the amount of beef and chicken meat consumed by households. This finding is consistent with the Keynesian consumption theory, which holds that the marginal propensity to consume lies between zero and one, so that part of every additional income is spent on consumption, including nutritious food (Keynes, 1936). The pattern is also in line with the concept of real income, whereby the ability to purchase goods and services is largely determined by the level of income received. The large effect size ( $f^2 = 3.690$ ) confirms that income structure is the most dominant predictor of animal protein consumption in the model.

This finding is consistent with Rochaida and Haliza (2022), who found that income affects beef demand in Samarinda; as both studies were conducted in the same location over different periods, the positive income–meat consumption relationship appears to be a recurring pattern rather than a coincidental finding. Further support comes from Lestari (2016), who found that respondents' income has a positive and significant effect on household consumption ( $t = 4.397$ ;  $p = 0.000$ ), and Ningsih et al. (2012), who found that household earnings contribute significantly to protein consumption ( $p = 0.013$ ). Studies using aggregate city data and individual household data therefore consistently show the same direction: higher income drives greater food consumption. Rising income also tends to shift consumption patterns towards more nutritious food, including from carbohydrates to animal protein, which is relevant to the consistent increase in per capita income and meat consumption in the three cities over the past six years.

The contributions of per capita income and the UMK to income structure are not equal. Per capita income reflects the real economic condition of a city as a whole, encompassing formal and informal workers as well as entrepreneurs, whereas the UMK only reflects an administratively determined wage floor for formal workers that tends to be uniform across cities and follows central government regulations. Since many residents of Samarinda, Balikpapan, and Bontang work in the informal, mining, or industrial sectors with wages well above the UMK, per capita income exerts a stronger influence on consumption decisions. Bontang, which consistently records the highest per capita income owing to its large liquefied natural gas and fertiliser industries, shows relatively high per capita animal protein consumption, whereas Samarinda, with the lowest but fastest-growing per capita income, also shows the fastest growth in per capita consumption. Consequently, policies aimed at broadly increasing economic productivity are potentially more effective in encouraging animal protein consumption than merely raising the minimum wage standard.

### ***The Effect of Population Structure on Animal Protein Consumption***

The positive and significant effect of population structure means that the larger the population of a city, particularly the productive-age group, the greater the total consumption of beef and chicken meat. The mechanism is straightforward: every additional resident adds to the number of people who must be fed daily, so the total food requirement of a city automatically rises with population growth. The productive-age group is the largest contributor because this group generally has higher physical activity and energy requirements than the young and elderly groups. The large effect size ( $f^2 = 1.836$ ) shows that population structure is a strong factor, although not the most dominant one in the model.

This finding is supported by Rochaida and Haliza (2022), who concluded that beef demand in Samarinda is influenced by both income and population, and by Ikhlas et al. (2021), who showed that broiler chicken demand in Samarinda is influenced by factors including the consumer population. The much larger volume of chicken meat consumption compared with beef in the three cities suggests that population growth is absorbed more by increased consumption of affordable chicken meat than by that of far more expensive beef. Umaroh and

Vinantia (2018) likewise showed that household size is one of the factors affecting animal protein consumption in Indonesian households; the same principle applies when the unit of analysis is expanded from households to cities, with city population replacing household size as the main driver of total food consumption. Population growth in the three cities cannot be separated from IKN-related migration. Balikpapan recorded the fastest population growth (1.92 percent per year), followed by Bontang (1.76 percent) and Samarinda (0.89 percent), and its productive-age population increased by about 43,120 people over six years, in line with the consistent increase in its beef and chicken meat consumption. Without adequate anticipation, the pressure on animal protein demand due to population growth may increase dependence on supply from outside the region, which already reaches 72 percent for beef, thereby increasing the risk of future price fluctuations.

### *Comparison of Consumption Patterns across Cities*

The pooled model shows the average effect across the three cities and may therefore conceal city-specific variations. Table 8 compares the main indicators of the three cities at the beginning and end of the study period.

**Table 8.** Profile of income, population, and animal protein consumption by city, 2020 and 2025

| Indicator                                   | Samarinda 2020 | Samarinda 2025 | Balikpapan 2020 | Balikpapan 2025 | Bontang 2020 | Bontang 2025 |
|---------------------------------------------|----------------|----------------|-----------------|-----------------|--------------|--------------|
| Per capita income (million IDR)             | 54.40          | 72.00          | 99.52           | 125.79          | 139.39       | 156.81       |
| UMK (million IDR/month)                     | 3.11           | 3.72           | 3.07            | 3.70            | 3.18         | 3.78         |
| Population (thousand persons)               | 827.99         | 865.62         | 688.30          | 756.80          | 178.27       | 194.50       |
| Beef consumption (thousand kg)              | 3,560          | 4,010          | 2,780           | 3,320           | 1,940        | 2,280        |
| Chicken meat consumption (thousand kg)      | 24,500         | 32,100         | 21,200          | 27,800          | 5,400        | 7,100        |
| Animal protein consumption (kg/capita/year) | 5.13           | 5.57           | 5.52            | 5.81            | 5.33         | 5.66         |
| Population growth (%/year, 2020–2025)       | 0.89           |                | 1.92            |                 | 1.76         |              |

Source: BPS of Samarinda, Balikpapan, and Bontang, and the East Kalimantan Office of Industry, Trade, Cooperatives, and SMEs, processed by the authors (2026)

Bontang shows a consumption pattern driven more by income than by population. The city consistently records the highest per capita income, while its population is the smallest; although its total beef and chicken meat consumption is the lowest, its per capita animal protein consumption is relatively high (5.33 kg in 2020 rising to 5.66 kg in 2025). Balikpapan shows a different pattern, in which the growth of the productive-age population is a strong driver of consumption; the city has the fastest population growth, driven by labour migration linked to its role as the main logistics gateway to IKN, and the highest per capita animal protein consumption (5.52 kg in 2020 rising to 5.81 kg in 2025). Combined with steadily rising per capita income, Balikpapan faces demand pressure from two directions at once. Samarinda shows a balanced combination of income and population factors: its large population makes its total consumption the highest, but its lowest per capita income limits per capita consumption, which is the lowest among the three cities (5.13 kg in 2020 rising to 5.57 kg in 2025). This pattern is consistent with Rochaida and Haliza (2022) and with Samarinda's character as a

centre of government and trade whose residents have highly diverse income levels, from civil servants and traders to informal workers.

These differences in consumption patterns are in line with the economic function of each city. Samarinda, as the provincial capital, accommodates a large population with diverse economic backgrounds; Balikpapan, as an industrial and service city and the gateway to IKN, experiences faster population growth; and Bontang, as a petrochemical industrial city, has an economic structure concentrated in high-wage sectors with a limited population. The variations indicate that animal protein food policies cannot simply be uniform across East Kalimantan, underlining the importance of comparing several cities simultaneously.

### ***Implications for Food Security and Regional Policy***

The findings relate directly to two of the four pillars of food security (FAO, 1996): access to food, reflected in the effect of income, and food availability, reflected in the effect of population. The strong effect of income structure confirms that maintaining purchasing power is an important strategy for the access pillar. However, access to food depends not only on rising incomes but also on affordable prices; given that about 72 percent of the province's beef requirement is still supplied from outside the region, fluctuations in national market prices are directly transmitted to city-level prices. Price stabilisation programmes for beef and chicken meat are therefore urgently needed so that income growth truly translates into higher animal protein consumption rather than being absorbed by price increases.

The strong effect of population structure is in line with Nazarius and Wibowo (2024), who found that demand-side factors, including population, play an important role in explaining the dynamics of the beef market in East Kalimantan, while local production remains far from sufficient. With local food production meeting only about 66.57 percent of provincial needs and large-scale migration projected in connection with IKN, regional governments, particularly in Balikpapan as the main buffer city and logistics gateway of IKN, need to prepare more thorough projections of animal-source food requirements, including beef and chicken meat supply for the next five to ten years based on observed migration trends. In practical terms, Bontang requires a focus on price stability and smooth supply; Balikpapan requires long-term supply planning, including the possible development of new livestock centres around the city to reduce dependence on external supply; and Samarinda requires a combination of income improvement programmes and adequate food supply for its large population.

## **CONCLUSION AND SUGGESTIONS**

This study concludes that income structure, represented by per capita income and the city minimum wage, has a positive and significant effect on animal protein consumption in Samarinda, Balikpapan, and Bontang during 2020–2025 ( $\beta = 0.808$ ;  $t = 6.440$ ;  $p < 0.001$ ). Population structure, represented by the population aged 0–14, 15–59, and 60 years and over, also has a positive and significant effect on animal protein consumption ( $\beta = 0.570$ ;  $t = 4.252$ ;  $p < 0.001$ ). Income structure is the more dominant determinant, and the two constructs jointly explain 82.8 percent of the variation in animal protein consumption, indicating that both

purchasing power and population dynamics must be considered in formulating food security policies in the urban areas of East Kalimantan.

Regional governments in Samarinda, Balikpapan, and Bontang are advised not to rely solely on income-raising policies, such as increases in the UMK, to improve animal protein consumption; such policies need to be complemented by community nutrition education programmes so that increased economic capacity is allocated to nutritious food consumption rather than only to non-food needs. Given the significant effect of population structure, regional governments also need to use population growth projections as a basis for planning the future supply of animal-source food, adjusted to the rate of population growth in each city, so that the availability of beef and chicken meat keeps pace with community needs.

This study has several limitations. The number of observations is limited (three cities over six years), the model fit indices (SRMR and NFI) have not reached the ideal thresholds, and the VIF of the 0–14 age group indicator slightly exceeds 10. Future studies are recommended to increase the number of observations by extending the period or adding more cities, to treat per capita income and the UMK as two separate independent variables so that their respective contributions are clearer, and to include other potentially influential variables such as food commodity prices, consumer preferences, local market supply, and household education levels.

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