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Income elasticity of food expenditure among urban households in Sulawesi: Evidence from engel's law

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ABSTRACT

This study examines the responsiveness of food expenditure shares to income changes among urban households in Sulawesi using income elasticity analysis. Employing cross-sectional microdata from the 2023 National Socio-Economic Survey (SUSENAS), comprising 13,933 urban households across six Sulawesi provinces, we calculate arc elasticity for nine income group transitions. The results reveal predominantly negative elasticity values ranging from -0.008 to -0.504, confirming patterns consistent with Engel's Law. The elasticity pattern exhibits an inverted-curve shape: weak in low-income groups (-0.0103 to -0.091), strengthening in middle-income groups (-0.2 to -0.5), and moderating in the highest transition (-0.059 to -0.268). This reflects critical threshold effects, where middle-income households demonstrate the strongest responsiveness in reallocating expenditures from food to non-food categories. Substantial interprovincial variations emerged, with Gorontalo exhibiting the strongest elasticity (-0.504), while Central Sulawesi showed unique patterns, including positive elasticity at specific transitions. Elasticity values consistently below one confirm food as a necessary good across all provinces. These findings provide crucial policy insights: low-income households require targeted protection through subsidies and social assistance, whereas middle-income households would benefit most from income growth policies. Provincial heterogeneity underscores the need for context-specific rather than uniform regional interventions.

Keywords: Engel's Law; food expenditure share; income elasticity; urban household consumption.

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1. INTRODUCTION

Food consumption patterns in urban Indonesia have undergone significant shifts in recent years, particularly during and after the COVID-19 pandemic. Between 2020 and 2024, urban households in Indonesia allocated 46-50 percent of their total expenditure to food, a proportion that peaked at 50.14 percent in 2022 during the height of the pandemic (Badan Pusat Statistik, 2022, 2023, 2025). This elevated food expenditure share, substantially higher than the 9-11 percent observed in developed countries such as the United States, United Kingdom, and Germany (Bafowaa & Leschewski, 2024; Huangfu et al., 2024; Mancini et al., 2023), reflects ongoing economic vulnerabilities that persist despite Indonesia's steady GDP growth. The situation became particularly acute when the 2022 cooking oil crisis drove prices up by over 60 percent within months, forcing millions of urban households to reduce the consumption of other essential goods to maintain basic food access (Darma & Yuliana, 2024).

This phenomenon is significant because it directly affects the welfare of over 150 million urban Indonesians navigating rapid economic changes, inflationary pressures, and shifting consumption opportunities. Urban areas are experiencing fundamental transformations, such as rising incomes alongside persistent inflation, the expansion of modern retail formats alongside traditional markets, and growing exposure to diverse food products amid continuing reliance on staple foods such as rice. Understanding how these urban households allocate their budgets between food and non-food items provides critical insights into welfare trajectories and economic resilience at a time when Indonesia aspires to reach upper-middle-income status by 2030.

The theoretical foundation for examining these patterns lies in Engel's Law, introduced by Ernst Engel in 1857, which posits that as household income rises, the proportion of expenditure allocated to food decreases, even though absolute food expenditure continues to increase (Hayati et al., 2022). This empirical regularity, grounded in the observation that household budget allocation for goods and services fundamentally depends on income levels (Chai & Moneta, 2010), remains one of the most robust findings in consumption economics. The law conceptually aligns with John Maynard Keynes' Marginal Propensity to Consume, where the income elasticity of food expenditure typically ranges between 0 and 1, indicating that consumers increase food spending at a rate proportionally smaller than their income growth (Ichwan & Tope, 2021; Lewis & Ilembo, 2024). Consequently, the food expenditure share serves as a practical welfare indicator for populations.

The validity of Engel's Law can be observed by comparing food expenditure patterns across countries. Developing nations, such as Kenya, Nigeria, and India allocate approximately 68-75, 56, and 35-40 percent of household budgets to food, respectively (Been et al., 2024; Matata et al., 2022; Nzayiramy et al., 2025). In contrast, developed countries allocate merely 9-11 percent to food (Bafowaa & Leschewski, 2024; Huangfu et al., 2024; Mancini et al., 2023). These differences reflect not only income disparities but also fundamental variations in consumption diversification, market development, and household economic security.

Within Indonesia's national context, the Sulawesi region presents a particularly interesting case study. All six Sulawesi provinces demonstrated food expenditure shares consistently lower than the national average during 2020-2024, suggesting relatively better urban welfare levels than in other regions. Gorontalo exhibits the lowest share (39.60-46.76 percent) with an expenditure growth of 26.3 percent, while Southeast Sulawesi shows the highest stability (43-48 percent) with a growth of 17.8 percent. North Sulawesi experienced notable fluctuations, peaking at 54.51 percent in 2022 before stabilizing at 48-49 percent (Badan Pusat Statistik, 2022, 2023, 2025). This regional variation within Sulawesi—ranging from nearly 40 percent to over 54 percent—indicates substantial heterogeneity in welfare levels and consumption patterns across provinces that are geographically proximate and culturally related.

Although Sulawesi provinces perform better than the national average, their 40-55 percent food expenditure share still contrasts sharply with countries undergoing successful economic transition. China, for example, reduced its food expenditure share from 58-60 percent in 1992 to 36-38 percent in 2012, alongside rising incomes (Wen et al., 2024). The high food expenditure share in Sulawesi reflects economic vulnerability similar to other developing countries such as Kenya (68-76 percent), Pakistan (37 percent),

and Bangladesh (47 percent) (Nzayiramy et al., 2025), raising questions about the factors that drive these patterns and how income growth translates—or fails to translate—into consumption diversification.

Recent policy developments underscore the importance of understanding these consumption patterns. The Indonesian government has implemented various social protection programs, including food subsidies and cash transfers; however, targeting remains a challenge when household consumption behavior and welfare dynamics are not fully understood. The 2023 revision of national poverty measurement methodologies, which now incorporates consumption patterns more explicitly, highlights policymakers' recognition that food expenditure shares provide valuable signals about household welfare beyond simple income measures. Additionally, ongoing discussions about food estate programs and regional food security strategies in Eastern Indonesia make it crucial to understand how income changes affect food consumption across different households.

Despite this policy relevance, existing research on Engel's Law in Indonesia reveals several critical gaps. First, most studies have concentrated on rural areas or national-level aggregated data, while cross-sectional urban studies systematically comparing multiple provinces are scarce. National aggregates mask substantial regional heterogeneity, and prior research has predominantly focused on Western Indonesia, particularly Java, leaving Eastern Indonesia relatively under-studied. Sulawesi, positioned as a bridge between Western and Eastern Indonesia and experiencing significant regional variations, has never been systematically examined across all six provinces using post-pandemic data. Second, a methodological gap exists as most Indonesian studies employ descriptive comparisons or simple regression approaches rather than income elasticity analysis across multiple income deciles—an approach extensively applied internationally but underutilized in Indonesian regional studies. Third, the COVID-19 pandemic and subsequent economic shocks (particularly the 2022 cooking oil crisis) fundamentally disrupted consumption patterns; however, studies using pre-2020 data cannot capture these structural shifts or recovery dynamics during 2021-2023.

This study addresses these gaps through four contributions. First, it provides new context by focusing exclusively on urban Sulawesi as a unified regional analysis encompassing all six provinces, filling the geographical gap in Eastern Indonesian consumption research. Second, it employs a new dataset—the 2023 SUSENAS microdata comprising 13,933 urban households that captures post-pandemic consumption patterns and recent economic disruptions. Third, it applies a rigorous methodological approach by calculating arc elasticity across nine income group transitions for each province, generating 54 distinct elasticity estimates that reveal granular patterns of consumption responsiveness across the entire income distribution. This comprehensive elasticity mapping has not been previously conducted for any Indonesian island region. Fourth, it contributes new empirical findings by documenting the inverted-curve elasticity pattern and substantial interprovincial heterogeneity that challenges assumptions of uniform regional behaviour. These findings provide actionable insights for designing differentiated policy interventions based on income thresholds and provincial contexts rather than one-size-fits-all approaches, offering both theoretical insights into Engel's Law applicability in heterogeneous developing regions and practical foundations for evidence-based food security and welfare policies in Eastern Indonesia.

2. LITERATURE REVIEW

2.1 Keynesian Consumption Theory

John Maynard Keynes developed consumption theory in his seminal work, *The General Theory of Employment, Interest, and Money* (1936), which established a fundamental framework for understanding household consumption behavior and its relationship with income. Keynes introduced the concept of propensity to consume as a function linking aggregate consumption with aggregate income (Jappelli & Pistaferri, 2010; Keynes, 1936). The Keynesian consumption function posits that consumption is determined by autonomous consumption, the Marginal Propensity to Consume (MPC), and income level, formulated as:

$$C = a + bY$$

Where C represents consumption, a denotes autonomous consumption, b signifies the MPC, and Y indicates income level (Modigliani, 1986). The foundation of this theory lies on what Keynes termed the “fundamental psychological law,” which describes that consumption increases as income rises, but not by as much as the income increase itself. The MPC always takes a value between 0 and 1, implying that the consumption share of income decreases as income grows (Jappelli & Pistaferri, 2010; Modigliani, 1986). This concept directly relates to Engel’s Law—where the food consumption share tends to decrease as income increases—demonstrating that Keynesian theory provides robust theoretical grounding for understanding shifts in food expenditure patterns accompanying income changes (Ichwan & Tope, 2021).

2.2 Engel’s Law and Income Elasticity

Engel’s Law represents one of the most enduring relationships in economics. Ernst Engel introduced this principle in 1857 based on his analysis of data from 36 European households and 199 Belgian households (Houthakker, 1957). The law states that as household income rises, the share of income spent on food decreases, even though absolute food expenditure continues to increase. A key characteristic of Engel’s Law is that the food consumption share varies inversely with income, with an elasticity coefficient less than one, meaning that a 1 percent increase in income results in a less than 1 percent increase in food consumption (Kaber-Hriday & Islam-Liton, 2024; Neagu & Teodoru, 2017).

Central to Engel’s Law is the concept of income elasticity of food, which measures the responsiveness of food expenditure to changes in household income. Income elasticity of food consistently falls within the range $0 < e < 1$, indicating that food is classified as a normal good with relatively inelastic properties regarding income (Anker, 2011; Clements & Si, 2018). Empirically, income elasticity of food typically ranges between 0.2 and 0.8, with low-income countries or households tending toward higher elasticity around 0.8-0.9, while high-income ones approach elasticity near zero (Anker, 2011; Houthakker, 2017). This variation reflects different stages of economic development and consumption maturity.

The Engel Curve provides a graphical representation of how household expenditure for specific goods or services relates to household income (Chai & Moneta, 2008). The curve plots income on the horizontal axis and food consumption share on the vertical axis, where an upward slope indicates “normal” goods and a downward slope characterizes “inferior” goods (Lozada, 2023). In the context of Engel’s Law, the curve for food expenditure share typically exhibits a downward slope, confirming the inverse relationship between income and food budget share.

The relevance of Engel’s Law extends beyond historical interest and remains deeply significant in contemporary economic analysis. The food expenditure share is frequently employed to establish poverty lines and assess poverty levels across populations (Kaber-Hriday & Islam-Liton, 2024). The Engel Curve demonstrates remarkable consistency in explaining how the budget share allocated to food declines as household income rises (Chai & Stepanova, 2023). From an aggregate perspective, evidence for Engel’s Law emerges clearly when comparing expenditure patterns between poor and rich countries, where rising incomes drive substantial shifts in household budget composition from food toward durable goods and services.

2.3 Income Elasticity

Income elasticity serves as a crucial analytical instrument for understanding consumption behavior and welfare dynamics. By measuring the percentage change in expenditure share relative to the percentage change in income, elasticity analysis reveals how responsive different income groups are to economic changes. Weak elasticity indicates limited flexibility in expenditure reallocation, often characteristic of low-income households constrained by basic needs. Strong elasticity suggests greater capacity for consumption diversification, typically observed in middle-income households that have surpassed subsistence thresholds (Cirera & Masset, 2010; Murendo et al., 2022).

The magnitude and pattern of income elasticity across the income distribution provide insights into critical economic thresholds. At low-income levels, households face binding constraints where most income must cover essential food needs, resulting in weak elasticity. As income rises and basic food

security is achieved, households gain flexibility to reallocate expenditure toward education, health, and other non-food categories, manifesting in stronger elasticity. At very high-income levels, diminishing marginal effects emerge as food expenditure share reaches low levels with limited room for further decline, causing elasticity to weaken again.

Understanding these elasticity patterns has important policy implications. Income groups with weak elasticity are particularly vulnerable to price shocks and inflation, requiring targeted protection through subsidies or social assistance. Groups exhibiting strong elasticity are in transition phases where income growth can generate substantial welfare gains through consumption diversification. Identifying these patterns across provinces enables more precise policy targeting and resource allocation (Navajas, 2009).

2.4 Empirical Review

Several empirical studies have validated Engel's Law across different contexts with particular attention to income elasticity patterns. A comprehensive global study by Nzayiramy et al. (2025) examining 173 countries confirmed the universal applicability of Engel's Law with an average food-income elasticity of 0.63, revealing substantial variation across development levels: Sub-Saharan Africa exhibited elasticity of 0.70, while North America showed 0.38. In Tanzania, Rashid et al. (2024) found an income elasticity of 0.72, with low-income households allocating 69.6 percent of income to food, demonstrating limited ability to reduce this proportion due to absolute income constraints.

Studies reveal important heterogeneity within food categories. In Pakistan, Hayat et al. (2023) using the LA/AIDS model found that cereals and legumes function as necessities with elasticity less than 1, while meat, milk, and fruits behave as luxury goods with elasticity exceeding 1. Similarly, Matata et al. (2022) in Kenya using the QUAIDS model found staple foods such as cereals and milk as necessities, while meat, vegetables, and fruits are luxury goods. In Jordan, Aljaloudi (2023) found consumer behavior consistent with Engel's Law, with the food expenditure share decreasing by 0.17 with each 1 percent increase in income over time.

Regional studies show varying elasticity patterns. Salam et al. (2022) in Nigeria found that high-income households allocate lower food shares, with income elasticity less than 1, emphasizing that elasticity varies significantly across income groups with lower-income households showing higher values. Venn et al. (2018) in Australia found that wealthy households allocate smaller food share at home but larger share to restaurant food, indicating quality upgrading effects.

In the Indonesian context, particularly Sulawesi, several studies have examined consumption patterns. Yunus et al. (2022) in Central Sulawesi found that high-income households allocate more to ready-to-eat food, but at income saturation points shift toward non-food investments. Ichwan and Tope (2021) confirmed that rising incomes drive changes from staple consumption such as rice and fish toward processed foods, with different elasticity coefficients across food types. These studies suggest that Sulawesi experiences consumption transitions consistent with economic development theory, but detailed elasticity analysis across all provinces remains absent from the literature.

Despite these valuable contributions, existing literature reveals important limitations that this study addresses. Globally, while studies like Nzayiramy et al. (2025) establish Engel's Law validity across countries, they rely on aggregated national data that obscure subnational variations—particularly relevant in geographically diverse developing countries like Indonesia. Regional studies in Pakistan (Hayat et al., 2023), Kenya (Matata et al., 2022), and Nigeria (Salam et al., 2022) demonstrate income elasticity heterogeneity, yet these focus on single-country contexts without examining spatial variations within regions sharing cultural and economic proximities.

In the Indonesian context specifically, the literature exhibits three critical gaps. First, existing studies predominantly analyse either national-level patterns (Darma & Yuliana, 2024) or single-province cases (Ichwan & Tope, 2021; Yunus et al., 2022), lacking systematic multi-province comparisons within defined island regions. Second, most Indonesian consumption studies employ descriptive analysis or basic regression models rather than detailed elasticity calculations across the full income distribution. Yunus et al. (2022) and Ichwan & Tope (2021), while valuable for understanding Central Sulawesi consumption

transitions, do not quantify income elasticity systematically across income deciles or extend analysis to other Sulawesi provinces. Third, no study has examined how the COVID-19 pandemic and subsequent economic shocks (particularly the 2022 cooking oil crisis) affected income-consumption relationships in Eastern Indonesia using post-2023 data.

This study fills these gaps by providing the first comprehensive income elasticity analysis of food expenditure across all six Sulawesi provinces using recent microdata (SUSENAS 2023, N=13,933 households). By calculating arc elasticity for nine income transitions in each province—generating 54 distinct estimates—we map consumption responsiveness with unprecedented granularity for an Indonesian island region. This approach enables identification of critical income thresholds where consumption patterns shift most dramatically, reveals interprovincial heterogeneity that may require differentiated policy approaches, and provides current evidence reflecting post-pandemic economic realities. The findings contribute to both theoretical understanding of Engel's Law applicability in heterogeneous developing regions and practical policy design for targeted welfare interventions in Eastern Indonesia.

3. METHOD

This study employs a cross-sectional quantitative design to examine the relationship between household income and food expenditure share among urban households in Sulawesi. The analysis utilizes microdata from the 2023 National Socio-Economic Survey (SUSENAS) conducted by the Central Bureau of Statistics Indonesia (BPS). The research setting encompasses urban areas across six provinces in the Sulawesi region of Eastern Indonesia: North Sulawesi, Central Sulawesi, South Sulawesi, Southeast Sulawesi, Gorontalo, and West Sulawesi. SUSENAS 2023 data were collected during March-April 2023, capturing consumption patterns during the post-pandemic economic recovery period and providing the most current available evidence on household expenditure behaviour in the region.

3.1 Sampling Framework and Sample

SUSENAS employs a multi-stage stratified random sampling design that ensures national and provincial representativeness. The sampling frame is constructed from the 2020 Population Census, with census blocks serving as primary sampling units stratified by province and urban-rural classification. Within selected census blocks, households are randomly selected using systematic sampling procedures. This probabilistic sampling approach ensures that the sample represents the diversity of urban households across different socioeconomic levels and geographic locations within each province.

The research sample comprises 13,933 urban households distributed across six provinces: North Sulawesi (3,363 households), Central Sulawesi (1,664 households), South Sulawesi (5,122 households), Southeast Sulawesi (1,995 households), Gorontalo (1,132 households), and West Sulawesi (657 households). The study population represents all urban households in Sulawesi, which according to the 2020 Population Census contains approximately 3.2 million households. The sample size provides adequate statistical power for provincial-level analysis, with each province having sufficient observations for reliable decile-based elasticity estimation. The smallest provincial sample (West Sulawesi, n=657) yields approximately 65-66 households per income decile, sufficient for calculating stable mean values and transitions between income groups.

For this analysis, the dataset was restricted to households with complete information on total household expenditure and food expenditure. Households with missing data on these key variables were excluded from the analysis, resulting in the final analytical sample of 13,933 households. This represents complete case analysis, ensuring consistency in elasticity calculations across all income groups and provinces.

3.2 Variables

The primary variables examined in this study are: (1) Food Expenditure Share (Y): Calculated as the ratio of food expenditure to total household expenditure, expressed in percentage. Food expenditure in

SUSENAS encompasses all consumption of food and beverages, both at home and away from home, including cereals, meat, fish, dairy products, vegetables, fruits, oils and fats, sugar, beverages, and prepared meals. This variable reflects the proportion of household budget allocated to food needs and serves as a welfare indicator, with higher shares indicating lower welfare levels consistent with Engel's Law; (2) Household Income (X): Proxied by total monthly household expenditure measured in Indonesian Rupiah. Following established conventions in consumption economics literature, expenditure data serves as a more reliable income proxy than reported income because it demonstrates greater accuracy and stability, experiences less measurement error, and better reflects permanent income (Chai & Moneta, 2010; Deaton & Muellbauer, 1980). Total expenditure includes all household consumption on food and non-food items during the reference month.

3.3 Income Elasticity Analysis

This study addresses methodological gaps identified in the literature through comprehensive arc elasticity analysis designed to reveal consumption dynamics across the income distribution. Unlike conventional regression methods that estimate average relationships, arc elasticity calculation for discrete income groups enables identification of specific income thresholds where consumption responsiveness changes most dramatically—critical information for targeting policy interventions (Murendo et al., 2022).

To examine the responsiveness of food expenditure share to income changes, households in each province are stratified into ten income groups (Kelompok Pendapatan/KP) based on expenditure deciles, where KP 1 represents the lowest 10 percent and KP 10 represents the highest 10 percent. Arc elasticity is calculated for each sequential transition between adjacent income groups (KP 1 to KP 2, KP 2 to KP 3, continuing through KP 9 to KP 10), yielding nine elasticity estimates per province and 54 estimates across all six provinces. Additionally, elasticity for combined Sulawesi data is calculated to provide an aggregate regional perspective.

Arc elasticity is particularly suitable for analysing discrete income groups as it captures the average rate of change between two distinct points rather than requiring continuous variation (Selim, 2001). The arc elasticity formula employed is (Pindyck & Rubinfeld, 2018):

$$E = \frac{\Delta Y/Y_1}{\Delta X/X_1}$$

Or expressed more completely:

$$E = \frac{\frac{Y_2 - Y_1}{Y_1}}{\frac{X_2 - X_1}{X_1}}$$

Where:

- E = Income elasticity of food expenditure share
- Y_1 = Food expenditure share in the previous income group
- Y_2 = Food expenditure share in the current (higher) income group
- X_1 = Household income in the previous income group
- X_2 = Household income in the current (higher) income group
- $\Delta Y = Y_2 - Y_1$ = Change in food expenditure share
- $\Delta X = X_2 - X_1$ = Change in household income

The elasticity coefficient provides several critical insights into consumption behaviour. Negative elasticity values indicate an inverse relationship between income and food expenditure share, consistent with Engel's Law—as household income increases, the proportion allocated to food decreases. The absolute magnitude of elasticity reflects responsiveness intensity: larger absolute values (more negative) indicate that food expenditure share responds more strongly to income changes, while values closer to zero suggest minimal responsiveness. Elasticity values below one in absolute value classify food as a necessity good, where percentage changes in food expenditure share are proportionally smaller than percentage changes in income. Positive elasticity values, though contrary to Engel's Law predictions, may indicate quality upgrading effects where households shift toward higher-quality, more expensive food

items at specific income thresholds. Variation in elasticity across income groups reveals critical thresholds where significant shifts in consumption patterns occur, from food-dominant expenditure toward more diversified consumption including education, health, transportation, and recreation.

By stratifying households into ten income deciles and calculating elasticity for each sequential transition, this approach provides granular mapping of how consumption patterns evolve with income changes across the entire income distribution. This enables identification of vulnerable income groups requiring targeted social protection, transition groups where income growth generates maximum welfare gains, and high-income groups where consumption has already diversified substantially.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 1 presents descriptive statistics of food expenditure share for urban households in Sulawesi in 2023. Overall, the mean food expenditure share in Sulawesi reaches 50.71 percent, with fairly significant differences across provinces. North Sulawesi has the highest mean share (54.02 percent), followed by West Sulawesi (53.64 percent), while the lowest mean share is shown by Southeast Sulawesi (48.71 percent).

Table 1. Food Expenditure Share of Urban Households in Sulawesi in 2023

Province	N (Household)	Mean (%)	Std. Dev	Min (%)	Max (%)
North Sulawesi	3363	54.02	14.45	4.21	89.54
Central Sulawesi	1664	50.11	13.09	8.22	82.57
South Sulawesi	5122	49.56	13.10	5.32	85.39
Southeast Sulawesi	1995	48.71	13.31	4.79	85.86
Gorontalo	1132	48.74	15.34	8.80	85.65
West Sulawesi	657	53.64	13.79	6.08	82.32
Sulawesi	13933	50.71	13.85	4.21	89.54

Source: SUSENAS 2023 (Processed data)

In each province, there is a fairly large consumption gap between households, as shown by the standard deviation range of 13-15 percentage points. Very wealthy groups with different consumption patterns exhibit very low food expenditure shares (minimum 4-8 percent), while households with very high shares (maximum 82-89 percent) indicate urban poverty conditions that remain consequential. Income differences cause the variation in mean food expenditure share across provinces, reaching nearly 6 percentage points. This is also influenced by other factors such as food distribution, urbanization levels, market access, and local consumption culture (Farooq & Rashid, 2024; Macalou et al., 2023).

These variations in food expenditure patterns are closely linked to household income distribution across the region. The average household expenditure in Sulawesi reaches Rp5,586,404 per month, with relatively small variation across provinces ranging from Rp5,196,778 in North Sulawesi to Rp5,808,147 in South Sulawesi. However, the standard deviation of household expenditure nearly approaches or exceeds the average value (Rp4,847,963 for combined Sulawesi), indicating fairly large economic inequality in urban Sulawesi society (Niankara, 2023). This reflects a characteristic pattern where households with very high purchasing power—reaching maximum expenditure of over 100 million rupiah per month in North Sulawesi—live alongside low-income households with minimum expenditure below 500 thousand rupiah per month, demonstrating the persistence of urban poverty that requires special policy attention.

4.2 Income Elasticity of Food Expenditure Share

The income elasticity analysis reveals systematic patterns consistent with Engel’s Law across Sulawesi provinces. Table 2 presents elasticity estimates for all income group transitions in combined Sulawesi data and individual provinces.

Table 2. Income Elasticity of Food Expenditure Share by Province

Income Group Transition	Sulawesi	North Sulawesi	Central Sulawesi	South Sulawesi	Southeast Sulawesi	Gorontalo	West Sulawesi
KP 1-2	-0.020	-0.091	0.019	-0.008	-0.048	-0.038	-0.020
KP 2-3	-0.174	0.184	-0.084	-0.123	-0.146	-0.036	-0.174
KP 3-4	-0.002	-0.263	-0.057	0.082	-0.245	-0.392	-0.002
KP 4-5	-0.338	-0.078	-0.059	-0.034	-0.233	0.127	-0.338
KP 5-6	-0.013	-0.418	-0.246	-0.315	-0.059	-0.105	-0.013
KP 6-7	-0.221	0.039	-0.158	-0.159	-0.504	-0.358	-0.221
KP 7-8	-0.237	-0.087	-0.231	-0.162	-0.293	-0.316	-0.237
KP 8-9	-0.290	-0.314	-0.284	-0.356	-0.225	-0.330	-0.290
KP 9-10	-0.246	-0.166	-0.208	-0.214	-0.268	-0.059	-0.246

Source: Processed from primary data (2025)

The elasticity analysis reveals an inverted-curve pattern across the income distribution. At low-income levels (KP 1-2), elasticity is very weak with values approaching zero, ranging from -0.0103 to -0.091 across provinces. This weak responsiveness reflects constrained flexibility as households at this income level depend heavily on food consumption to meet basic needs. Even as income increases, the food expenditure proportion does not decline drastically since additional income is mostly used to improve food quality and quantity rather than shifting to non-food categories.

Elasticity strengthens significantly in middle-income groups, particularly during transitions KP 5-6, KP 6-7, and KP 7-8, with values reaching -0.2 to -0.5 in several provinces. At this stage, households have achieved a surplus after basic food needs are met, enabling them to begin reallocating additional income more substantially toward non-food needs such as education, health, transportation, and recreation. This causes the food expenditure proportion to decrease more rapidly compared to low-income groups.

The pattern then weakens again at the highest income transition (KP 9-10), with elasticity values ranging from -0.059 to -0.268. This moderation occurs because the food expenditure proportion has already reached relatively low levels (30-39%), leaving limited room for further proportional decline. At very high-income levels, additional income is primarily allocated to investment, property, or other luxury goods rather than further reducing food expenditure share.

Substantial interprovincial variations emerge in both magnitude and pattern of elasticity. Gorontalo demonstrates the strongest elasticity with a value of -0.504 at the KP 6-7 transition, indicating highly responsive consumption patterns where income increases lead to rapid reallocation away from food. North Sulawesi also exhibits relatively strong elasticity, especially at transitions KP 4-5 (-0.3382) and KP 8-9 (-0.2899). Conversely, Central Sulawesi and West Sulawesi show weaker overall elasticity and even experience positive values at several transitions.

Central Sulawesi exhibits the most unique pattern with large elasticity fluctuations, including two positive values at transitions KP 2-3 (0.184) and KP 6-7 (0.039). Positive elasticity also appears at South Sulawesi KP 1-2 (0.019), Southeast Sulawesi KP 3-4 (0.082), and West Sulawesi KP 4-5 (0.127). These positive values indicate that food expenditure share actually increases with rising income at these specific transitions, occurring at only 4 of 63 transition points (6.35% of total observations). This phenomenon can be attributed to quality upgrading effects where households shift from inexpensive staple foods to higher-quality foods such as animal protein and organic products, or increased frequency of restaurant dining which costs more per unit than home cooking.

Across all provinces and income groups, elasticity values remain consistently below one in absolute value, confirming that food functions as a necessity good throughout urban Sulawesi. This means that percentage changes in food expenditure share are proportionally smaller than percentage changes in income at all income levels.

4.3 Discussion

The elasticity patterns observed in urban Sulawesi provide important insights into consumption transition dynamics in developing regions, with findings that both confirm theoretical predictions and reveal context-specific complexities requiring nuanced policy responses. The inverted-curve pattern aligns with Keynesian consumption theory's predictions regarding the marginal propensity to consume (Ichwan & Tope, 2021), but more importantly reveals critical income thresholds with distinct policy implications. The weak elasticity among low-income groups (-0.0103 to -0.091) mirrors findings by Rashid et al. (2024) in Tanzania where low-income households allocating 69.6% to food demonstrated minimal adjustment capacity. This constrained flexibility indicates that conventional income growth policies alone may be insufficient for vulnerable groups—they require direct protection mechanisms against food price volatility. Salam et al. (2022) emphasized that targeted subsidies and price stabilization must precede growth-promoting policies to prevent welfare deterioration among vulnerable populations.

The strong elasticity in middle-income groups (-0.2 to -0.5) represents a critical transition phase where policy interventions can generate maximum impact. Yunus et al. (2022) documented similar saturation points in Central Sulawesi where households shift additional income toward non-food investments. This suggests that productivity enhancement programs, skill development initiatives, and quality job creation targeting middle-income households would accelerate consumption diversification and welfare improvement more effectively than across-the-board interventions. The policy challenge lies in identifying households at these threshold points and facilitating their transition through appropriately designed support mechanisms.

The spatial heterogeneity observed across provinces—from Gorontalo's highly responsive patterns (-0.504) to Central Sulawesi's unique fluctuations—echoes findings by Ndubueze-Ogaraku et al. (2016) in Nigeria and Niankara (2023) in the WAEMU region, where socioeconomic characteristics and local contexts fundamentally shaped consumption responses. This heterogeneity challenges uniform regional policy approaches and suggests that decentralized, province-specific strategies may yield superior outcomes. Provinces at different consumption transition stages require fundamentally different policy mixes, with growth promotion suitable for responsive regions like Gorontalo while structural interventions addressing market access and consumption patterns may be more appropriate for Central Sulawesi.

The positive elasticity anomalies, while statistically minor (6.35%), provide valuable insights into quality upgrading dynamics documented by Venn et al. (2018) in Australia, where wealthy households allocated larger proportions to restaurant food as part of modern urban lifestyles. The appearance of similar patterns in middle-income Sulawesi households suggests premature adoption of consumption behaviors typically associated with higher development levels. This raises important questions about whether consumption diversification is progressing optimally or whether households are sacrificing essential investments in education and health for food variety and convenience—a concern requiring further investigation to guide policy interventions.

Comparing Sulawesi's elasticity range (-0.008 to -0.504) with international evidence positions the region in an intermediate development stage. Nzayiramyia et al. (2025) documented average food-income elasticity of 0.70 in Sub-Saharan Africa versus 0.38 in North America, placing Sulawesi closer to transitioning middle-income regions. This positioning is consistent with Wen et al. (2024) observations of China's transition from 58-60% food share in 1992 to 36-38% in 2012, suggesting Sulawesi may follow similar development trajectories albeit at different provincial paces. Understanding this positioning helps contextualize policy expectations—welfare improvements will likely require sustained, multi-decade efforts rather than rapid transformations.

The confirmation of food as a necessity good across all provinces and income groups (elasticity consistently below one) aligns with findings by Hayat et al. (2023) in Pakistan and Matata et al. (2022) in Kenya, who distinguished necessities from luxury foods using similar criteria. However, this classification masks important internal heterogeneity within the food category. Ichwan and Tope (2021) demonstrated that rice and fish show higher consumption sensitivity than processed foods in Central Sulawesi, suggesting that disaggregated analysis could reveal specific vulnerabilities and opportunities for targeted food security interventions. Future research examining elasticity patterns for specific food subcategories

would provide more precise guidance for agricultural policies and nutritional programs in Eastern Indonesia.

From a policy sequencing perspective, the findings suggest a coordinated multi-track approach: immediate price stabilization and social assistance for low-income groups with weak elasticity, productivity enhancement and job creation programs for middle-income groups with strong elasticity, and structural reforms facilitating high-income household transitions toward investment-led growth. Aljaloudi (2023) demonstrated that such coordinated approaches in Jordan successfully reduced food expenditure shares while maintaining food security. The challenge for Sulawesi lies in implementing differentiated strategies across provinces while maintaining regional policy coherence—a governance challenge requiring careful coordination between provincial and central authorities to balance local responsiveness with regional integration objectives.

5. CONCLUSION

This study examines the responsiveness of food expenditure share to income changes among urban households in Sulawesi through comprehensive income elasticity analysis. The findings confirm that consumption patterns are consistent with Engel's Law, demonstrating predominantly negative elasticity values ranging from -0.008 to -0.504 across all provinces and income transitions. The elasticity pattern exhibits an inverted-curve shape, revealing critical threshold effects: weak elasticity in low-income groups (-0.0103 to -0.091) reflecting constrained flexibility and high vulnerability to price shocks; strong elasticity in middle-income groups (-0.2 to -0.5) indicating transition phases where income growth generates substantial welfare improvements; and moderate elasticity at the highest income levels (-0.059 to -0.268) as food shares stabilize. Substantial interprovincial variations emerge, with Gorontalo exhibiting the strongest elasticity (-0.504) while Central Sulawesi shows unique patterns including positive anomalies at specific transitions. Elasticity values consistently below one in absolute value confirm food as a necessity good across all provinces, positioning Sulawesi in an intermediate development stage between extreme poverty and advanced development.

These findings carry important policy implications requiring differentiated approaches across income groups and provinces. Low-income households with weak elasticity need immediate protection through food price stabilization, targeted subsidies, and social assistance programs to buffer against inflation. Middle-income households with strong elasticity would benefit most from policies supporting income growth through quality job creation, productivity enhancement, and skill development, as these groups can rapidly translate income gains into welfare improvements. The substantial provincial heterogeneity underscores the need for context-specific interventions rather than uniform regional policies, with growth-promoting strategies suitable for responsive provinces like Gorontalo while structural interventions may be more appropriate for provinces with complex patterns like Central Sulawesi.

This study contributes to the literature by providing the first comprehensive elasticity analysis across all Sulawesi provinces, filling an important gap in understanding Eastern Indonesian consumption dynamics. Future research should extend this analysis through longitudinal studies observing elasticity evolution over time, disaggregated analysis of specific food categories to identify vulnerabilities and opportunities for targeted interventions, integration of non-economic factors such as demographic characteristics and market accessibility, and extension to rural areas enabling urban-rural comparisons for more holistic regional policy frameworks in Eastern Indonesia.

Ethical Approval

This study uses secondary data from the 2023 National Socio-Economic Survey (SUSENAS) obtained through the Master of Economics program, Faculty of Economics and Business, Universitas Tadulako, for academic research purposes. The data are anonymized and handled in accordance with data protection

regulations. No primary data collection involving human subjects was conducted. Therefore, ethical approval was not required for this study.

Informed Consent Statement

Not applicable. This study uses secondary data from the National Socio-Economic Survey (SUSENAS) where informed consent was obtained by the data collection agency (BPS) during the original survey implementation.

Authors' Contributions

Conceptualization, SN and S; methodology, SN, S, and MI; validation, S, MI, ET, and YS; formal analysis, SN; data curation, SN; writing—original draft preparation, SN; writing—review and editing, S, MI, ET, and YS; supervision, S and MI; project administration, SN. All authors have read and agreed to the published version of the manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data Availability Statement

The data presented in this study were obtained from the 2023 National Socio-Economic Survey (SUSENAS) conducted by the Central Bureau of Statistics Indonesia (BPS). Access to SUSENAS data can be requested through BPS official channels at <https://www.bps.go.id>.

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REFERENCES

- Aljaloudi, J. (2023). the Change in Household Consumption Patterns in Jordan: 1997–2017. *Journal of Governance and Regulation*, 12(3), 81–89. <https://doi.org/10.22495/jgrv12i3art9>
- Anker, R. (2011). Engel's Law around the World 150 Years Later. In *Political Economy Research Institute* (Issue 247).
- Badan Pusat Statistik. (2022). *Statistik Indonesia 2022*.
- Badan Pusat Statistik. (2023). *Statistik Indonesia 2023*.
- Badan Pusat Statistik. (2025). *Statistik Indonesia 2025*.
- Bafowaa, B. Y., & Leschewski, A. M. (2024). COVID-19 Relief Receipt and U.S. Household Food Expenditures. *AJPM Focus*, 3(5), 1–9. <https://doi.org/10.1016/j.focus.2024.100265>
- Been, J., Bakker, V., & van Vliet, O. (2024). Unemployment and Households' Food Consumption: A Cross-Country Panel Data Analysis across OECD Countries. *Kyklos*, 77(3), 776–811. <https://doi.org/10.1111/kykl.12386>
- Chai, A., & Moneta, A. (2008). At the Origins of Engel Curves Estimation. *Econstor*, July.
- Chai, A., & Moneta, A. (2010). Retrospectives: Engel Curves. *Journal of Economic Perspectives*, 24(1), 225–240. <https://doi.org/10.1257/jep.24.1.225>
- Chai, A., & Stepanova, E. (2023). Engel Curves, Spending Diversity and Welfare Measurement. *Research Handbook on Measuring Poverty and Deprivation*, 544–552. <https://doi.org/10.4337/9781800883451.00067>
- Cirera, X., & Masset, E. (2010). Income Distribution Trends and Future Food Demand. *Phil. Trans. R. Soc. B*, 365(ecember), 2821–2834. <https://doi.org/10.1098/rstb.2010.0164>
- Clements, K. W., & Si, J. W. (2018). Engel's Law, Diet Diversity, and the Quality of Food Consumption. *American Journal of Agricultural Economics*, 100(1), 1–22. <https://doi.org/10.1093/ajae/aax053>
- Darma, W., & Yuliana, R. (2024). Patterns, Determinants, and Elasticity of Household Food Consumption in Indonesia (Period 2021-2022). *Jurnal Aplikasi Statistika & Komputasi Statistik*, 16(2), 87–100. <https://doi.org/10.34123/jurnalasks.v16i2.652>
- Deaton, A., & Muellbauer, J. (1980). An Almost Ideal Demand System. *Neuroradiology* 41, 70(3), 312–326.
- Farooq, I., & Rashid, J. (2024). Urbanization and its impacts on Food Security: A Case study of District Lahore. *Pakistan Social Sciences Review*, 8(2), 463–471. [https://doi.org/10.35484/pssr.2024\(8-II-S\)40](https://doi.org/10.35484/pssr.2024(8-II-S)40)
- Hayat, N., Mustafa, G., Alotaibi, B. A., Nayak, R. K., & Naeem, M. (2023). Households Food Consumption Pattern in Pakistan: Evidence from Recent Household Integrated Economic Survey. *Heliyon*, 9(9), e19518. <https://doi.org/10.1016/j.heliyon.2023.e19518>
- Hayati, A., Rasyad, F., Anugrah, M., Putra, A. S., Khalis, F., Putri, A. M., & Rizqi, A. A. (2022). Analysis of Consumption Patterns of Goods and Services in Households During the COVID-19 Pandemic:

- Case Study in Bandung Regency 2022. *Kabuyutan: Jurnal Kajian Ilmu Sosial Dan Humaniora Berbasis Kearifan Lokal*, 1(3), 132–136. <https://doi.org/10.61296/kabuyutan.v1i3.27>
- Houthakker, H. S. (1957). An International Comparison of Household Expenditure Patterns, Commemorating the Centenary of Engel's Law. *Econometrica*, 25(4), 532–551.
- Houthakker, H. S. (2017). The New Palgrave Dictionary of Economics. *The New Palgrave Dictionary of Economics, 1957*, 1–2. <https://doi.org/10.1057/978-1-349-95121-5>
- Huangfu, P., Pearson, F., Abu-Hijleh, F. M., Wahlich, C., Willis, K., Awad, S. F., Abu-Raddad, L. J., & Critchley, J. A. (2024). Impact of Price Reductions, Subsidies, or Financial Incentives on Healthy Food Purchases and Consumption: a Systematic Review and Meta-Analysis. *The Lancet Planetary Health*, 8(3), e197–e212. [https://doi.org/10.1016/S2542-5196\(24\)00004-4](https://doi.org/10.1016/S2542-5196(24)00004-4)
- Ichwan, M., & Tope, P. (2021). Essential Commodity Consumption: a Study on Food Consumption Expenditure of Rural Society. *AGROLAND The Agricultural Sciences Journal (e-Journal)*, 7(2), 116–125. <https://doi.org/10.22487/agroland.v7i2.628>
- Jappelli, T., & Pistaferri, L. (2010). The Consumption Response to Income Changes. *Annual Review of Economics*, 2(1), 479–506. <https://doi.org/10.1146/annurev.economics.050708.142933>
- Kaber-Hriday, A. H. M. S., & Islam-Liton, M. R. (2024). Testing the Engel's Law on the Consumption Pattern of the People of Tangail Sadar Upazila in Bangladesh. *Semestre Económico*, 13(1), 4–9. <https://doi.org/10.26867/se.2024.v13i1.159>
- Keynes, J. M. (1936). The General Theory of Employment, Interest and Money. In *The General Theory of Employment, Interest and Money*. Macmillan. <https://doi.org/10.2307/2278703>
- Lewis, D., & Ilembo, B. (2024). Unfolding Factors Influencing Household Expenditure in Private Households in the Tanzania Mainland Using Quantile Regression. *African Journal of Empirical Research*, 5(3), 550–560. <https://doi.org/10.51867/ajernet.5.3.48>
- Lozada, G. A. (2023). The Perils of Antitrust Econometrics: Unrealistic Engel Curves, Inadequate Data, and Aggregation Bias. In *Institute for New Economic Thinking Working Paper*.
- Macalou, M., Keita, S. I., Coulibaly, A. B., & Diamoutene, A. K. (2023). Urbanization and Food Security: Evidence from Mali. *Frontiers in Sustainable Food Systems*, 7, 1–6. <https://doi.org/10.3389/fsufs.2023.1168181>
- Mancini, L., Valente, A., Barbero Vignola, G., Sanyé Mengual, E., & Sala, S. (2023). Social footprint of European food production and consumption. *Sustainable Production and Consumption*, 35, 287–299. <https://doi.org/10.1016/j.spc.2022.11.005>
- Matata, M. J., Ngigi, M. W., Bett, H. K., & Michael, P. M. (2022). Effects of Cash Transfers on Food Expenditure Patterns in Northern Kenya. *Cogent Food and Agriculture*, 8(1), 1–16. <https://doi.org/10.1080/23311932.2022.2149138>
- Modigliani, F. (1986). Life Cycle, Individual Thrift, and the Wealth of Nations. *American Economic Review*, 76(3), 297–313.
- Murendo, C., Chirongwe, G., & Sisito, G. (2022). Food Expenditure Shares and Income Elasticities in Zimbabwe: Accounting for Gender and Poverty Differences. *Cogent Economics & Finance*, 10. <https://doi.org/10.1080/23322039.2022.2101241>
- Navajas, F. H. (2009). Engel Curves, Household Characteristics and Low-user Tariff Schemes in Natural Gas. *Energy Economics*, 31(1), 162–168. <https://doi.org/10.1016/j.eneco.2008.09.005>
- Ndubueze-Ogaraku, M. E., Oyita, E., & Onwukwe Anyanwu, S. (2016). Analysis of Household Consumption Expenditure on Selected Staple Foods in Ika North East Local Government Area of Delta State, Nigeria. *Direct Research Journal of Agriculture and Food Science*, 10(10), 300–307.
- Neagu, M.-I., & Teodoru, M. C. (2017). Testing the Engel's Law in the Consumption Pattern of Romanian Population. *Studia Universitatis Economics Series*, 27(3), 33–53. <https://doi.org/10.1515/sues-2017-0011>
- Niankara, I. (2023). Socioeconomic and Geospatial Determinants of Households' Food and Non-food consumption Dynamics within the West African Economic and Monetary Union. *Scientific African*, 20, e01724. <https://doi.org/10.1016/j.sciaf.2023.e01724>
- Nzayiramya, S., Muhammad, A., & Baffoe-Bonnie, A. (2025). A Global Assessment of Food and Non-

- Food Spending: Evidence from 173 Countries and Implications for Food Security. *Agriculture and Food Security*, 14(1), 1–12. <https://doi.org/10.1186/s40066-025-00538-z>
- Pindyck, R. S., & Rubinfeld, D. L. (2018). *Microeconomics* (9th ed.). Pearson.
- Rashid, F. N., Sesabo, J. K., Lihawa, R. M., & Mkuna, E. (2024). Determinants of Household Food Expenditure in Tanzania: Implications on Food Security. *Agriculture & Food Security*, 13(1), 1–17. <https://doi.org/10.1186/s40066-023-00462-0>
- Salam, G., Alase, G., Lamidi, S., & Joseph, T. (2022). Determinants of Household Food Expenditure: Does Engel Law Hold in Nigeria? *African Economic and Management Review*, 2(3), 11–17. <https://doi.org/10.53790/aemr.v2i3.65>
- Selim, R. (2001). The Changes in the Consumption Expenditure Patterns in Turkey. *Challenges for Business Administrators in the New Millennium*, 1, 288–296.
- Venn, D., Dixon, J., Banwell, C., & Strazdins, L. (2018). Social Determinants of Household Food Expenditure in Australia: The Role of Education, Income, Geography and Time. *Public Health Nutrition*, 21(5), 902–911. <https://doi.org/10.1017/S1368980017003342>
- Wen, P., Zhu, N., & Jia, M. (2024). Changes in Food Consumption and Nutrition Intake of Rural Residents in Central China. *Heliyon*, 10(16). <https://doi.org/10.1016/j.heliyon.2024.e36523>
- Yunus, S., Millistuty, F., Paskual, M. F., Yunus, R., & Paembonan, L. (2022). Analysis of Consumption Patterns of Finished Food and Beverages in Central Sulawesi Households in the Digital Era. *2021 Tadulako's International Conference on Social Sciences (TICoSS 2021)*, 28–30.