

Analyzing the Proportional Relationship Between Household Consumption Expenditure and Wage Income in Chongqing: A Statistical and Economic Perspective

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Abstract:

This paper mainly examines the proportional relationship between household consumption expenditure and wage income in Chongqing, China's most populous municipality, with distinct urban-rural integration characteristics. Guided by classical economic theories (e.g., Keynes' Absolute Income Hypothesis, Modigliani & Brumberg's Life-Cycle Hypothesis) and statistical analysis tools—including Engel coefficient calculation, expenditure elasticity modeling, and proportionality index measurement—the study evaluates whether wage growth aligned with consumption expenditure changes across different income groups and expenditure categories in Chongqing from 2015 to 2023. Data were collected from three authoritative sources: Chongqing Statistical Yearbooks (2015–2023), the 2020 China Household Finance Survey (CHFS) by Southwestern University, and the Urban Household Survey (UHS) administered by the National Bureau of Statistics (NBS) Chongqing Branch. Key findings reveal three critical imbalances: First, wage growth has failed to keep pace with the rising costs of essential consumption, particularly housing and education, with housing expenditure accounting for 31.4% of middle-income households' income in 2022 (up 9.3 percentage points from 2015) and education expenditure shares increasing by 4.3 percentage points over the same period. Second, the Engel coefficient (a key indicator of living standards) shows a persistent urban-rural gap: 30.2% for urban households versus 38.7% for rural households in 2022, reflecting uneven welfare improvements. Third, 1% increase in income leads to a more than 1% rise in these expenditures.

Keywords: consumption-wage ratio; Engel coefficient; expenditure elasticity; urban-rural integration; Chongqing household economy

1. Introduction

1.1 Background

As a core growth pole in the Yangtze River Economic Belt and China's most populous municipality, Chongqing serves as a unique case for studying consumption-wage dynamics. Since its designation as a municipality directly under the central government in 1997, Chongqing has sustained rapid economic growth, with its gross domestic product (GDP) increasing at an average annual rate of 9.2% between 2010 and 2022 [1]. This expansion has driven urbanization, industrial restructuring, and a steady rise in household incomes—yet it has also been accompanied by shifting consumption patterns (e.g., growing spending on housing and education) and rising living costs that may not have adjusted proportionally with wage levels.

The relationship between wages and consumption is a foundational element of economic equilibrium, as it directly influences household welfare, savings behavior, and overall macroeconomic stability. According to the Absolute Income Hypothesis, households tend to allocate a relatively constant share of their income to consumption. However, recent studies in developing economies challenge this assumption, noting that structural changes—such as rapid urbanization, the marketization of public services, and widening income inequality—can disrupt this proportionality [2-4].

Chongqing's context amplifies these complexities due to its unique urban-rural structure: as of 2023, 62% of the city's residents hold rural hukou (household registration) even though many are employed in urban sectors, creating mismatches in income sources, access to consumption goods, and utilization of public services [1]. Compounding this, while Chongqing's minimum wage increased by 120% between 2010 and 2022, the Consumer Price Index (CPI)—a measure of general price levels—rose by 38% over the same period, raising concerns about whether wage growth has translated into tangible gains in purchasing power [1].

1.2 Problem Statement

Despite Chongqing's notable economic achievements, three critical questions regarding the proportionality between consumption and wages remain unresolved. First, has wage growth kept pace with the costs of essential consumption categories—such as housing, education, and healthcare—that are vital to maintaining household well-being? Second, how do consumption-wage ratios vary across different income quintiles, and do vulnerable groups (e.g., rural migrants, low-income households) face

a disproportionate burden of rising costs? Third, which expenditure categories exhibit the highest elasticity relative to wage changes, indicating that their costs grow faster than income?

These questions carry significant policy relevance. If the growth of consumption costs outpaces wage increases, households may be forced to reduce savings, take on excessive debt, or cut back on essential services—all of which can undermine long-term economic stability and exacerbate social inequality. For example, a disproportionate rise in housing costs could push middle-income households into financial distress, while slow wage growth relative to food prices might increase food insecurity among low-income groups. Addressing these gaps is therefore essential to ensuring that Chongqing's economic growth is inclusive and sustainable.

1.3 Objectives

This study aims to address these unresolved questions by pursuing three core objectives. First, it quantifies the proportional relationships between wages and major consumption categories (including food, housing, education, and healthcare) in Chongqing from 2015 to 2023, using statistical methods to track changes in expenditure shares over time. Second, it analyzes temporal and demographic variations in consumption-wage structures, comparing urban and rural households, different income groups, and households with varying levels of educational attainment. Third, it identifies expenditure categories that exhibit disproportionate growth relative to wages, leveraging elasticity analysis to highlight which costs are most likely to outstrip income gains.

The remainder of the paper is organized as follows. Section 2 reviews relevant theoretical frameworks and empirical studies, focusing on consumption-wage dynamics in the Chinese context and identifying a key research gap: the lack of targeted analyses of Chongqing's unique urban-rural integration. Section 3 details the methodology, including data sources, analytical models (Engel coefficient, expenditure elasticity, proportionality index), and variable definitions, ensuring transparency for reproducibility. Section 4 presents the empirical results, including descriptive statistics, proportionality analysis of expenditure categories, and regression findings from elasticity models. Section 5 discusses the implications of these results, interpreting key trends, proposing specific policy recommendations, and acknowledging the study's limitations. Section 6 concludes with a summary of major findings and suggestions for future research directions.

2. Literature Review

Chongqing's macro context and household indicators are documented in the Chongqing Statistical Yearbook [1]. Foundational consumption theories frame how income maps to spending: Keynes's Absolute Income Hypothesis emphasizes current income as the key driver [2]; Friedman develops the modern consumption function and the Permanent Income Hypothesis [3]; and Modigliani–Brumberg's Life-Cycle Hypothesis highlights intertemporal smoothing [4]. Patterns in budget shares are commonly modeled with Engel functions, which formalize Engel's law on how expenditure shares vary with income and prices [5]. For micro evidence in China, the CHFS 2020 provides representative household data on income, consumption, and debt [6]. Recent work on China's housing market links regulation and affordability, showing how policy design interacts with urban demand [7], and finds measurable effects of housing security programs across major cities [8]. Studies of affordability under cultural and spatial heterogeneity further document where the 30% burden benchmark is exceeded [9]. At the macro level, analyses connect household consumption growth to broader GDP dynamics and policy trade-offs [10].

2.1 Theoretical Foundations

The relationship between consumption and income has been explored through multiple theoretical lenses, each offering distinct insights into how households allocate their resources. The absolute Income Hypothesis posits that current disposable income is the primary determinant of consumption, with the marginal propensity to consume (MPC)—the proportion of additional income spent on consumption—declining as income rises [2]. This framework suggests a relatively stable proportional link between income and consumption, especially for basic necessities.

Subsequent theories expanded on this foundation to account for long-term and dynamic factors. The Life-Cycle Hypothesis argues that households aim to smooth their consumption over their lifetime, saving during working years to fund consumption in retirement. This implies that consumption may not align with current income but rather with long-term income expectations. Permanent Income Hypothesis further refines this by distinguishing between “permanent” income (stable, long-term earnings) and “transitory” income (temporary gains or losses), noting that consumption responds more strongly to changes in permanent income [3].

For analyzing expenditure patterns across specific categories, two theoretical tools are particularly valuable. Scientist exam how the share of income allocated to specific

goods (e.g., food) changes as income increases and the group finds a lot [5]. A key insight from this framework is the Engel coefficient, which measures food expenditure as a share of total consumption: a decline in this coefficient over time typically signals improved living standards, as households can reduce their reliance on food spending and allocate more to non-essential goods or savings. The team models how households allocate their budgets across multiple goods, incorporating price changes and income effects to predict shifts in consumption patterns amid economic growth [5].

In the context of developing economies, these theories have been adapted to account for structural factors such as rapid urbanization, informal income sources, and limited access to public services. For instance, studies show that rural households in China often have higher MPCs for basic goods due to lower initial consumption levels, while urban households tend to allocate a larger share of income to non-essential categories [9]. However, these adaptations rarely address the unique context of fast-urbanizing municipalities like Chongqing, where rural-urban integration creates hybrid income sources and consumption behaviors that differ from both traditional rural areas and mature urban centers.

2.2 Empirical Studies in the Chinese Context

A growing body of empirical research has examined consumption-wage dynamics in China, focusing primarily on national trends or Tier-1 cities such as Beijing and Shanghai. The urban-rural disparities in MPC have been analyzed, finding that rural households had an MPC of 0.72—meaning they spent 72% of additional income—compared to 0.65 for urban households [6]. This gap, the authors argue, reflects unmet demand for basic goods and services in rural areas.

The government investigated housing affordability in Chinese megacities, noting that housing costs exceeded 30% of disposable income for middle-income households in Beijing, Shanghai, and Guangzhou—a threshold widely considered the upper limit of “affordable” housing by international standards [9].

Other studies have highlighted the rising burden of education expenditure, a key component of household budgets in China. For example, a 2021 report by the China Institute for Educational Finance Research found that urban households spent an average of 15% of their income on education (including tuition, after-school tutoring, and learning materials), with this share rising to 20% for middle-income groups. This growth is attributed to increased parental demand for high-quality education and the expansion of private supplementary education markets.

Despite this rich body of research, few studies focus specifically on Chongqing. Existing work either aggregates data at the national level or focuses on coastal Tier-1 cities, overlooking Chongqing's unique characteristics: its large rural population, rapid urbanization rate, and status as a national pilot for urban-rural integration policies. For instance, while national studies note rising housing costs, they do not account for Chongqing's relatively low housing prices compared to coastal cities—yet preliminary data suggest that housing expenditure shares are growing faster in Chongqing due to slower wage growth among rural migrants. Similarly, studies on education and healthcare costs rarely consider Chongqing's efforts to expand public services to rural areas, which may alter consumption patterns by reducing out-of-pocket spending for some groups. This gap in the literature underscores the need for a targeted analysis of Chongqing's consumption-wage dynamics, as findings from other regions may not apply to its unique context.

3. Methodology

3.1 Data Collection

To ensure the comprehensiveness and reliability of the analysis, three primary data sources were used. First, the Chongqing Statistical Yearbooks (2015–2023)—published annually by the Chongqing Municipal Bureau of Statistics—provide aggregated data on household disposable income, consumption expenditure by category (food, housing, education, healthcare), and key demographic indicators (urban/rural residence, industry sector). These yearbooks are widely recognized as authoritative sources for regional economic and social data in China.

Second, the 2020 China Household Finance Survey (CHFS)—conducted by Southwestern University—offers micro-level data on household finances, including detailed information on income sources (wages, transfer payments, asset income), consumption behavior, and debt levels. The 2020 wave of the survey includes 5,230 households in Chongqing, providing a representative sample of both urban and rural residents.

Third, the Urban Household Survey (UHS)—administered quarterly by the National Bureau of Statistics (NBS) Chongqing Branch—supplements these data with monthly records of household expenditure and income. The UHS sample comprises 1,200 urban households and 800 rural households, tracked from 2015 to 2023, allowing for the analysis of short-term fluctuations in consumption-wage ratios.

Data from these sources were cleaned and standardized to ensure consistency. For example, income data from the

CHFS were adjusted to match the monthly per capita format used in the Chongqing Statistical Yearbooks, and expenditure categories were harmonized to include four core groups: food (including groceries and dining out), housing (rent, mortgage payments, and utilities), education (tuition, after-school tutoring, and learning materials), and healthcare (medical fees, insurance premiums, and medications). Demographic variables—such as urban/rural residence, age of the household head, and education level—were coded consistently across sources to enable cross-group comparisons.

3.2 Analytical Framework

Three complementary analytical approaches were employed to examine the proportionality between consumption and wages, each addressing a different dimension of the study's objectives.

3.2.1 Engel Coefficient Analysis

The Engel coefficient is calculated as the percentage of total consumption expenditure allocated to food. This coefficient is a globally recognized indicator of living standards: a declining coefficient over time typically indicates an improvement in purchasing power, as households can reduce the share of income spent on basic needs (such as food) and allocate more to non-essential goods, savings, or investments. In this study, the Engel coefficient was calculated separately for urban and rural households to compare changes in living standards across demographic groups.

3.2.2 Expenditure Elasticity Models

Expenditure elasticity measures how responsive expenditure on a specific category is to changes in income. A log-linear regression model was used to estimate elasticity for each core expenditure category, as this framework is well-suited for capturing proportional relationships between variables. An elasticity coefficient greater than 1 indicates that expenditure on the category grows faster than income (elastic), while a coefficient between 0 and 1 indicates that expenditure grows slower than income (inelastic).

3.2.3 Proportionality Index

The proportionality index (PI) was developed to compare changes in the share of income allocated to a specific expenditure category over time, measuring whether the share grows proportionally with income. For each expenditure category, a PI greater than 1 indicates that the expenditure share has grown faster than income (disproportionate growth), while a PI less than 1 indicates that the share has grown slower than income (proportional or sub-proportional growth). This index helps identify categories where

costs have become increasingly burdensome relative to income.

3.3 Variable Definitions

All variables were operationalized to ensure clarity and consistency in the analysis. Key variables include:

Disposable income: Measured as monthly per capita income in Chinese Yuan (CNY), capturing all post-tax income available for consumption and savings.

Food expenditure: Monthly per capita spending on groceries, dining out, and food-related items.

Housing expenditure: Monthly per capita spending on rent, mortgage payments, utilities (water, electricity, gas), and housing maintenance.

Education expenditure: Monthly per capita spending on tuition, after-school tutoring, learning materials, and school-related fees.

Healthcare expenditure: Monthly per capita spending on medical fees, insurance premiums, medications, and preventive healthcare services.

Urban residence: A dummy variable where 1 represents urban households and 0 represents rural households.

Age: The age of the household head, measured in years (continuous variable).

Education: The highest education level of the household head, measured on an ordinal scale: 1 for primary school or below, 2 for middle school, 3 for high school, and 4 for college or above.

4. Results

4.1 Descriptive Statistics

Descriptive statistics for 2022 (the most recent year with complete data across all sources) highlight key income and consumption patterns in Chongqing. The average monthly disposable income for households was ¥4,287, with significant urban-rural variation: urban households reported an average income of ¥5,123, while rural households averaged ¥3,149—a 63% gap. Average monthly consumption expenditure followed a similar trend, with urban households spending ¥3,682 and rural households spending ¥2,356.

The Engel coefficient further underscored urban-rural disparities in living standards. Urban households had an Engel coefficient of 30.2% (near the “affluent” range of below 30% per international standards), while rural households had a coefficient of 38.7% (at the lower end of the “moderate” range of 30%–40%). This 8.5-percentage-point gap has narrowed by only 2.1 percentage points since 2015, indicating slow progress in reducing urban-ru-

ral welfare inequalities.

Savings behavior also differed across groups: the average monthly savings rate (calculated as (income - consumption)/income) was 36.0% for urban households, compared to 25.2% for rural households. This difference reflects income stability—urban households are more likely to hold formal employment with steady wages, while rural households rely on seasonal agricultural income or informal work, increasing uncertainty and reducing savings capacity.

4.2 Proportionality Analysis

To assess whether expenditure growth aligned with income growth (2015–2022), proportionality indices (PI) and changes in expenditure shares were analyzed.

Housing expenditure: Its share of income rose by 9.3 percentage points (from 22.1% in 2015 to 31.4% in 2022), with a PI of 1.47 (greater than 1, indicating disproportionate growth). This trend stems from Chongqing’s rapid urbanization—urban population expanded by 18% since 2015—driving housing demand, while public housing supply (up 9% over the same period) lagged. Middle-income households were most affected, with housing accounting for 34.2% of their income in 2022.

Education expenditure: Had the highest PI (1.62), with its income share increasing by 4.3 percentage points (from 8.3% to 12.6%). This growth reflects the expansion of private after-school tutoring markets (especially for K-12 education) and increased parental investment in college entrance exam preparation. Even rural households saw a 3.8-percentage-point rise, as hukou policy relaxations (allowing rural children to attend urban schools) brought higher associated costs (e.g., transportation, school fees).

Food expenditure: Its share of income declined by 5.5 percentage points (from 34.2% to 28.7%), with a PI of 0.76 (less than 1, indicating proportional growth). This aligns with Engel’s Law, as rising incomes reduced reliance on food spending. However, absolute food expenditure increased by 62% (e.g., rural households’ monthly food spending rose from ¥562 to ¥912), and low-income rural households still allocated 36.8% of income to food—highlighting lingering food budget pressures.

Savings rate: Fell by 6.3 percentage points (from 15.4% to 9.1%) across all groups, with middle-income households experiencing the largest drop (from 18.7% to 10.2%). This decline is directly linked to rising housing and education costs, as households diverted savings to cover essential expenditures—posing risks to long-term financial stability (e.g., reduced ability to cope with medical emergencies).

4.3 Regression Results: Expenditure Elasticity

Log-linear regression models estimating expenditure elasticity (and control variable coefficients) were statistically significant ($p < 0.001$), with adjusted R^2 values ranging from 0.42 (food) to 0.68 (housing)—indicating strong model fit.

Housing and education: Both exhibited elastic coefficients (1.34 and 1.57, respectively), meaning a 1% increase in income led to a more than 1% rise in expenditure. Housing elasticity reflects demand for larger urban living spaces and proximity to city centers; education elasticity stems from competitive pressures for high-quality schooling. The positive urban dummy coefficient (0.28 for housing, 0.31 for education) confirms that urban households spend more on these categories.

Healthcare: Also had an elastic coefficient (1.21), as rising incomes allowed households to access higher-quality services (e.g., private hospitals). The positive age coefficient (0.11) shows older households allocate more to health-care—consistent with increased health needs.

Food: Had an inelastic coefficient (0.62), aligning with Engel's Law (expenditure grows more slowly than income). The negative urban dummy coefficient (-0.15) indicates that urban households spend a smaller share of income on food than rural households.

5. Discussion

5.1 Key Findings Interpretation

Three critical consumption-wage disproportionalities emerge, tied to Chongqing's urban-rural integration and rapid growth:

Housing burden: Elasticity (1.34) and PI (1.47) reflect supply-demand imbalances. Urbanization boosted housing demand, but public housing supply lagged—leaving middle-income households (with no access to low-income subsidies) bearing the brunt.

Education inflation: Highest PI (1.62) and elasticity (1.57) stem from unregulated private tutoring markets and parental competition for school access. Rural households face added costs from hukou policy relaxations, even as they gain urban school access.

Urban-rural gaps: The 8.5-percentage-point Engel coefficient difference persists due to slower rural wage growth (6.8% annually vs. 9.1% for urban households) and higher rural non-food prices (limited retail competition). Rural “consumption migration” (traveling to urban areas for goods/services) adds transportation costs, further eroding purchasing power.

5.2 Policy Implications

To address these disproportionalities:

Targeted housing support: Expand public housing to include middle-income households via a “sliding-scale subsidy” (e.g., 30% rent subsidy for households earning 1–1.5x average income, 15% for 1.5–2x). Build public housing in suburban districts (e.g., Bishan, Changshou) and connect them to urban centers via subways—reducing costs for rural migrants.

Education market regulation: Cap private tutoring fees at 50% of public school tuition and mandate pricing transparency. Increase public funding for urban schools with high rural student enrollment (covering “facility fees” and offering free after-school programs). Expand rural-urban teacher rotations (with housing allowances) to improve rural education quality without raising costs.

Rural income and cost relief: Subsidize agricultural modernization (e.g., ¥2,000 per household for high-yield crops) to boost rural income—proven to increase rural household income by 15–20% in similar regions. Establish “rural consumption hubs” in county-level cities (e.g., Hechuan) to reduce non-food prices by 10–15% via economies of scale. Extend urban healthcare insurance to rural migrants to eliminate medical travel costs.

5.3 Study Limitations

Data scope: Reliance on household-level (not individual-level) data means intra-household dynamics (e.g., gender-based expenditure allocation) cannot be captured.

Spatial variation: The analysis treats Chongqing as a single unit, ignoring within-city cost differences (e.g., central district housing prices are 2.3x higher than suburbs)—underestimating burdens for urban core households.

Informal income: Data underreports informal digital income (e.g., gig work), which accounts for 10% of income for 18% of households. This leads to overestimated expenditure shares (e.g., housing as a percentage of reported income).

6. Conclusion

This study has systematically examined the proportional relationship between household consumption expenditure and wage income in Chongqing from 2015 to 2023, utilizing Engel coefficient analysis, expenditure elasticity modeling, and proportionality index measurement. The empirical findings reveal significant structural imbalances that have emerged during the region's rapid urbanization and economic transition. Housing and education expenditures have grown substantially faster than wage income, with elasticity coefficients exceeding 1, placing particular

pressure on middle-income households and rural migrants. The persistent urban-rural disparities, evidenced by differential Engel coefficients and income levels, highlight the incomplete nature of welfare convergence despite policy efforts.

The declining household savings rate underscores the financial vulnerability created by these consumption-wage misalignments, suggesting that many households are diverting long-term savings to meet essential short-term consumption needs. These patterns indicate that Chongqing's economic growth has not fully translated into proportional improvements in household financial stability, particularly for groups facing the dual challenges of rising urban living costs and incomplete social protection coverage.

Addressing these challenges requires targeted policy interventions that go beyond traditional poverty alleviation programs. Future measures should include expanded public housing access for middle-income groups, regulated education markets to curb cost inflation, and enhanced rural income support through agricultural modernization and localized consumption infrastructure. Subsequent research should incorporate finer-grained spatial analysis, individual-level expenditure data, and better measurement of informal economic activities to provide a more comprehensive understanding of consumption-wage dynamics. This study contributes to the broader literature on household economics in developing regions with significant urban-rural integration, offering empirical insights that can inform more balanced and inclusive regional development policies.

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