



# Determinants of gold ownership among households in Indonesia: The role of economic activity across provinces

Aditya Idris<sup>1,\*</sup>

<sup>1</sup> Department of Economic Development and Planning, Faculty of Economics and Business, Universitas Hasanuddin, Makassar, South Sulawesi 90245, Indonesia.

\*Correspondence: latervilla@gmail.com

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## ABSTRACT

**Background:** Gold has long remained a key financial asset, despite increasing financial inclusion and economic modernization, household gold ownership in Indonesia persists across regions. Existing studies emphasize income and macroeconomic conditions but often fail to capture real economic dynamics at the regional level. This study aims to examine the relationship between regional economic activity and household gold ownership in Indonesia, with particular attention to heterogeneity across regions with different levels of gold ownership. **Methods:** This study employs provincial-level panel data for 34 Indonesian provinces covering the period 2014–2024. Economic activity is measured using a combination of satellite-based Night-time Lights and gross regional domestic product per capita. The analysis applies a moment quantile regression framework to capture distributional heterogeneity in household gold ownership, while controlling for demographic and structural factors. **Findings:** The results reveal that economic activity has a heterogeneous effect on household gold ownership across quantiles. Night-time lights exhibit a positive and statistically significant association with gold ownership at lower quantiles, indicating that increased real economic activity supports initial gold accumulation in regions with low ownership levels. Gross regional domestic product per capita shows a consistently positive and significant relationship, highlighting the dominant role of formal income capacity in sustaining higher levels of gold ownership. **Conclusion:** The study concludes that household gold ownership in Indonesia is shaped by multidimensional economic activity and exhibits strong regional heterogeneity. These findings underscore the importance of distribution-sensitive analysis in understanding household financial behavior and offer policy-relevant insights for the development of gold-based financial services. **Novelty/Originality of this article:** This study contributes novel empirical evidence by integrating satellite-based economic activity measures with conventional income indicators and applying a quantile-based panel approach to analyze household gold ownership.

**Keywords:** bullion business; economic activity; household economic resilience.

## 1. Introduction

Gold has long held a unique position in household financial behavior, particularly in developing countries and emerging economies (Pokorny et al., 2019), where financial market development remains uneven, and income volatility is relatively high (Tanin et al., 2021; Gomis-Porqueras et al., 2022). Beyond its cultural and symbolic value, gold serves as a store of value, a hedge against economic uncertainty, and a liquid asset households can mobilize when they face short-term liquidity needs (Chiang, 2022). Gold is not only viewed as a commodity, but as a household financial instrument that plays an important role in risk management and wealth accumulation strategies (Kazak et al., 2025; Nguyen et al., 2025).

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Economic and household finance theories explain that asset ownership decisions are strongly influenced by economic conditions and income dynamics. Household asset allocation theory emphasizes that asset accumulation reflects households' rational response to income levels, income stability, and expectations of future economic conditions (Hu et al., 2025; Chen, 2024; Owusu et al., 2023). The economy is characterized by income uncertainty and financial market imperfections, so households tend to choose tangible and relatively liquid assets to protect their wealth from economic shocks (Ettman et al., 2025). Gold has unique characteristics because it combines wealth storage, liquidity, and a high perception of security.

Several empirical studies show that economic conditions play an important role in shaping household savings and asset-ownership behavior. Higher income levels generally correlate positively with asset accumulation, while economic instability increases demand for precautionary assets (Coccia & Russo, 2025; Mdingi & Ho, 2021; Colombaarolli & Lersch, 2023). Most previous studies still rely on conventional economic indicators, such as gross domestic product or per capita income, to represent economic activity. Although these indicators are informative, they often fail to fully capture the dynamics of the real economy at the local level, especially in regions with a large proportion of informal economic activity.

Recent developments in development economics and spatial economics highlight the importance of utilizing alternative data sources to measure economic activity. Satellite-based nighttime light intensity data, in this case referred to as Night-Time Lights (NTL), has been widely used as a proxy for real economic activity because it reflects the spatial distribution of production, consumption, and infrastructure use between regions (Pei et al., 2025; Pérez-Sindín et al., 2021). Various studies show that Night-Time Lights are able to capture both formal and informal economic activity and complement conventional income indicators, especially in developing countries that face limitations in the quality and timeliness of official statistics (McCord & Rodriguez-Heredia, 2022; Liang et al., 2020; Afrianto, 2022). When combined with measures of regional income, such as gross regional domestic product per capita, Night-Time Lights provide a more spatially comprehensive picture of economic activity.

The relationship between economic activity and decisions about gold ownership is ambiguous in theory and remains relatively limited in empirical evidence. Increased economic activity and income can encourage households to accumulate gold as savings and for long-term wealth preservation (Masyithah et al., 2023; Harahap et al., 2022). However, improved economic conditions and the growing availability of alternative financial instruments may reduce households' reliance on gold as a preferred asset. These competing mechanisms indicate that the influence of economic activity on household gold ownership is not uniform across regions and levels of economic development (Liu, 2025; Nyakuwanika & Panicker, 2025).

Indonesia is characterized by high regional heterogeneity in economic activity, income levels, and development trajectories (Suparman & Muzakir, 2023; Kurniawan et al., 2019). Some provinces have experienced rapid economic growth and structural transformation, while others still depend on the informal sector and have relatively lower income levels (Nanga & Widjaja, 2024; Santoso et al., 2022). At the same time, household involvement with gold, both as a savings instrument and as a monetizable asset, remains widespread throughout Indonesia (Robiyanto et al., 2021; Elsasari & Sukardi, 2022).

This phenomenon is empirically reflected in the development of household gold ownership in Indonesia over the past decade. Figure 1 shows that the percentage of households owning gold in the 2015–2024 period tended to be stable, with relatively moderate fluctuations (Statistics Indonesia, 2025). Although there were declines in certain years, particularly during periods of economic slowdown, household gold ownership did not show a sharp downward trend. Instead, the data indicate that gold ownership remains part of household financial strategies in Indonesia. This descriptive fact suggests that households' decisions to save gold are not solely driven by short-term factors, but are related to more structural and sustainable economic conditions.

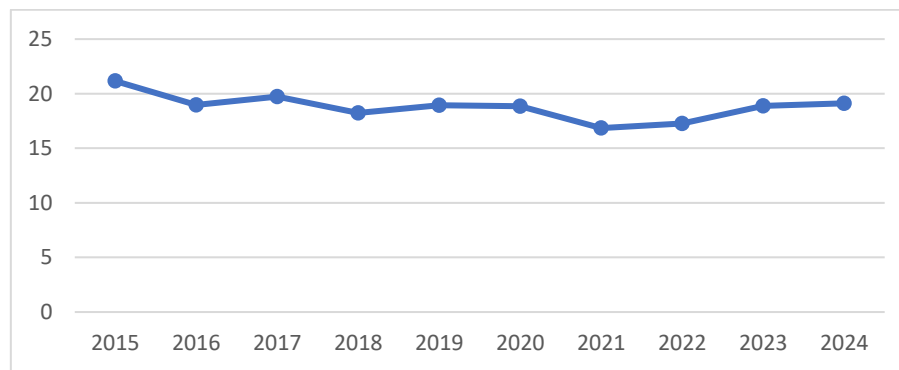


Fig. 1. Percentage of waste and leftover food produced in each stage of supply (Statistics Indonesia, 2026)

Although gold plays a relatively prominent role in Indonesian household finances, empirical evidence that systematically examines the regional economic determinants of household gold ownership remains limited. Most previous studies have focused on national trends or specific socio-demographic factors, such as income, education, and cultural preferences. Very few studies have explored how variations in economic activity across regions influence household decisions to own gold using spatially disaggregated data. In addition, the integration of satellite-based measures of economic activity with conventional regional income indicators in the analysis of household asset behavior is still rare. This gap limits our understanding of how economic development processes translate into household financial decisions at the regional level.

Based on this background, this study aims to fill the literature gap by analyzing the relationship between economic activity and household gold ownership in Indonesia using provincial-level panel data. Specifically, this study combines Night-Time Lights indicators and gross regional domestic product per capita to represent regional economic activity more comprehensively. By utilizing this approach, this study captures not only the formal income dimension but also the intensity of real economic activity that is often not fully reflected in conventional statistics.

The main objective of this study is to analyze how variations in economic activity between regions in Indonesia affect the proportion of households that own gold. This study also aims to identify whether this relationship is heterogeneous between regions with different levels of gold ownership. This study is expected to provide a deeper understanding of the role of economic conditions in shaping household gold ownership behavior in Indonesia.

Based on the theoretical framework and empirical findings discussed, this study formulates the following hypotheses. First, higher levels of regional economic activity, as reflected in the intensity of Night-Time Lights, are hypothesized to have a positive effect on household gold ownership, as increased economic activity strengthens households' ability to accumulate assets. Second, higher regional per capita income is hypothesized to increase household gold ownership, reflecting greater savings capacity and opportunities for asset diversification. Third, control variables such as population, pawnshop credit, digital index, and labor productivity influence the percentage of gold asset ownership in various regions in Indonesia. This hypothesis is formulated as one-tailed, in line with the theoretical expectation that improved economic conditions increase households' tendency to save gold as a financial asset.

By examining the relationship between economic activity and household gold ownership in a regional framework, this study contributes to the literature on household finance and regional economic development. The findings are expected to provide relevant insights for policy formulation and the development of gold-based financial services in Indonesia, particularly in strengthening the role of gold as a household asset and a pillar of financial resilience amid diverse regional economic dynamics.

## 2. Methods

### 2.1 Data and variables

This study uses panel data from Indonesian provinces for 2015–2024 to examine the relationship between regional economic activity and household gold ownership. The dataset covers 34 provinces over 10 years, resulting in 340 province-year observations. In the panel notation, (i) denotes the province and (t) denotes the year; therefore, province (i) in year (t) refers to the observation for a specific province in a specific year. We obtained data on household gold ownership, gross regional domestic product per capita (GRDP per capita), population, Pegadaian credit participation, and household digital access from Statistics Indonesia (BPS), and satellite-based Night-Time Lights (NTL) data from Google Earth Engine (GEE). We processed the satellite data to obtain annual average NTL values for each province.

Table 1. List of variables used in the model

| Variable Name                              | Symbol  | Description                                                                                                                                                           | Data Source                              |
|--------------------------------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| Household Gold Ownership                   | GoldOwn | Percentage of households owning gold in province (i) in year (t). This variable represents household gold ownership as a financial asset.                             | Statistics Indonesia (Household Surveys) |
| Night-Time Lights                          | NTL     | Average intensity of satellite-based night-time lights at the provincial level, used as a proxy for real economic activity capturing both formal and informal sectors | NOAA/VIIRS/DNB/MO NTHLY_V1/VCMSL         |
| Gross Regional Domestic Product per-Capita | GRDPC   | Gross regional domestic product per capita at constant prices in province (i) in year (t), representing the level of formal economic welfare                          | Statistics Indonesia                     |
| Population                                 | POP     | Total population in province (i) in year (t). This variable controls for regional demographic scale.                                                                  | Statistics Indonesia                     |
| Pegadaian Credit Participation             | Credit  | Percentage of households receiving credit from Pegadaian in province (i) in year (t), capturing access to gold-backed pawn-based financial services.                  | Statistics Indonesia (Household Surveys) |
| Household Digital Access                   | Digital | Percentage of households with internet access in province (i) in year (t), used as a proxy for digital and financial inclusion.                                       | Statistics Indonesia (Household Surveys) |
| Labor Productivity                         | ProdLab | Gross regional domestic product per worker in province (i) in year (t), reflecting labor productivity and income quality.                                             | Statistics Indonesia                     |

The dependent variable is household gold ownership (GoldOwn), measured as the percentage of households owning gold in province *i* in year *t*. The two main explanatory variables are NTL and GRDP per capita. NTL captures the intensity of regional economic activity through satellite-observed nighttime illumination, while Gross Regional Domestic Product (GRDP) per capita reflects formal regional economic activity and economic welfare. We include population (POP), Pegadaian credit participation (Credit), household digital access (Digital), and labor productivity (ProdLab) as control variables to account for demographic, financial, digital, and labor-market characteristics that may be associated with household gold ownership. We compiled the variables into a province-year panel dataset. Where applicable, we transformed and normalized variables before estimation to ensure comparability across indicators with different measurement scales (Gibson & Boe-Gibson, 2021; Yang et al., 2022). Table 1 presents the complete definitions, measurement

units, symbols, and data sources. The empirical specification is designed to examine whether regional economic activity and formal economic conditions are systematically associated with household gold ownership after accounting for relevant provincial characteristics. This framework allows us to assess the relationship between economic activity, economic welfare, and household gold ownership within a consistent province-year panel setting.

## 2.2 Empirical model and estimation strategy

The empirical analysis consists of three sequential stages. First, a cross-sectional dependence (CSD) test determines whether observations across Indonesian provinces are interdependent. Second, panel unit root tests (URTs) assess the stationarity properties of the variables. Third, panel quantile regression (PQR) examines whether the relationship between regional economic activity and household gold ownership varies across different points of the conditional distribution of gold ownership.

Panel quantile regression is employed because the objective is not limited to estimating the average conditional relationship between the explanatory variables and household gold ownership. Unlike ordinary least squares (OLS), which estimates the conditional mean effect, quantile regression allows the analysis to examine relationships at different points of the conditional distribution of the dependent variable (Lee et al., 2024). This approach is therefore useful for identifying whether the association between economic activity and household gold ownership differs between provinces with relatively lower and higher levels of gold ownership. The general panel data model can be expressed as follows (Paddu et al., 2024):

$$y_{it} = x_{it}\beta + \alpha_i + u_{it}, i = 1, 2, \dots, N; t = 1, 2, \dots, T \quad (\text{Eq. 1})$$

Where  $i$  represents different sample individuals,  $t$  represents the random error term,  $\beta$  represents the coefficient vector of the explanatory variables, and  $\alpha_i$  represents the unobservable random effect of the  $i$ -th sample (Xu, 2023). The quantile regression method can also be used to estimate the parameters of the panel data model. For that. The quantile equation is established under the following conditions.

$$Q_{y_{it}}(\tau_j | x_{it}, \alpha_i) = x'_{it}\beta(\tau_j) + \alpha_i, i = 1, 2, \dots, N; t = 1, 2, \dots, T \quad (\text{Eq. 2})$$

The quantile equation above assumes that the individual effects are fixed. For this equation, Koenker (2004) pointed out that when the number of individuals  $N$  is large, and the number of observations contained by each individual is relatively small, appropriate contraction control of the individual effect can effectively reduce the variance  $\alpha_i$  due to estimation. For the linear quantile loss function  $\rho_T(\mu)$ , in order to maintain the linear characteristics of the objective function,  $1_i$  linear penalty term can be considered, that is.

$$P(\alpha) = \sum_{i=1}^n |\alpha_i| \quad (\text{Eq. 3})$$

Therefore, based on the variables used, the quantile regression model is given by

$$Q_{\tau}(\text{GoldOwn})_{it} | X_{it} = \beta_0(\tau) + \beta_1(\tau)NTL_{it} + \beta_2(\tau)LnGRDPC_{it} + \beta_3(\tau)LnPOP_{it} + \beta_4(\tau)Credit2_{it} + \beta_5(\tau)Digital_{it} + \beta_6(\tau)ProdLab_{it} + \varepsilon_{it}(\tau) \quad (\text{Eq. 4})$$

Equation 4 is the main analytical framework in this study, which analyzes the relationship between the percentage of gold ownership and the independent and control variables in the model. The equation and model provide an in-depth understanding of the interrelationships between the variables in this study. By estimating the model across different conditional quantiles of household gold ownership, the analysis captures potential heterogeneity in the relationships across provinces with relatively low, medium, and high

levels of gold ownership. This approach provides a more comprehensive assessment of how regional economic activity and other covariates are associated with household gold ownership beyond the average conditional relationship.

### 3. Results and Discussion

#### 3.1 Descriptive statistics

The descriptive statistics indicate substantial variation in household gold ownership and regional economic conditions across the 340 observations. Household gold ownership (GoldOwn) has a mean of 18.33, with values ranging from 5.53 to 43.79, indicating considerable variation across regions and periods. Economic activity also exhibits substantial heterogeneity. Night-Time Lights (NTL) has a mean of 1.34 and ranges from 0.01 to 32.67, while gross regional domestic product per capita (GRDP per capita) has a mean of 43,300.38 and ranges from 11,088 to 201,315. The wide ranges of these indicators indicate considerable differences in regional economic activity across the observed provinces.

The control variables likewise show notable variation. Population ranges from 578.70 to 50,345.20, credit from 0.12 to 26.65, digitalization from 8.98 to 89.26, and labor productivity from 0.08 to 17.32. Several variables are positively skewed, particularly NTL (5.59), GRDP per capita (2.53), population (2.61), and labor productivity (2.64), indicating that observations are unevenly distributed across regions and periods. Overall, the descriptive statistics demonstrate substantial heterogeneity in household gold ownership, economic activity, and the supporting socioeconomic conditions included in the analysis. The complete descriptive statistics are provided in Appendix A.

The substantial variation in household gold ownership and regional economic indicators provides an important descriptive basis for examining relationships among the variables. Differences in NTL and GRDP per capita across observations suggest that economic activity varies considerably across regions, while variation in the control variables indicates differences in the broader socioeconomic conditions in which households accumulate assets. These patterns warrant further examination of whether household gold ownership is systematically associated with the selected measures of regional economic activity. The correlation analysis therefore examines the direction and strength of the bivariate relationships among household gold ownership, the two main economic activity indicators, and the control variables. In particular, the analysis considers whether GoldOwn is positively or negatively associated with NTL and GRDP per capita and assesses the relationships among the explanatory and control variables. The complete correlation matrix is provided in Appendix B.

#### 3.2 Pre-estimation diagnostic test

This analysis is expected to reveal inter-error dependence across provinces, particularly given ongoing economic integration among provinces in Indonesia. If not handled properly, this cross-sectional dependence (CSD) has the potential to produce biased or inconsistent estimates in analyzing the relationship between the variables.

Based on the results presented in Table 2, the findings of this study provide strong evidence of cross-sectional dependency (CSD) in all variables analyzed. The significant values in the Breusch–Pagan LM, Pesaran Scaled LM, and Pesaran CD tests indicate that the assumption of cross-sectional independence among 34 provinces during the 2015–2024 period is not met. These results confirm the increasingly strong interconnection and similarity of structural characteristics among Indonesian economies, which influence the level of gold ownership. Therefore, the existence of CSD emphasizes the importance of using unit root and second-generation panel cointegration tests, such as the CIPS approach, to ensure the robustness and reliability of subsequent empirical estimates, while avoiding potential biases inherent in first-generation techniques. The CIPS test results are presented in Table 3. The subsequent stationarity analysis therefore accounts for the detected cross-

sectional dependence rather than assuming that provinces evolve independently over time. This approach provides a more appropriate basis for determining the integration properties of the variables before proceeding to the panel regression analysis.

Table 2. Cross-sectional dependency test

| Variables |           | Breusch-Pagan LM | Pesaran Scaled LM | Pesaran CD |
|-----------|-----------|------------------|-------------------|------------|
| GoldOwn   | Statistic | 1,955.308        | 41.62578          | 38.76612   |
|           | Prob.     | 0.0000           | 0.0000            | 0.0000     |
| NTL       | Statistic | 4,156.006        | 107.3256          | 63.16269   |
|           | Prob.     | 0.0000           | 0.0000            | 0.0000     |
| LnGRDPC   | Statistic | 3,819.216        | 97.27102          | 57.69295   |
|           | Prob.     | 0.0000           | 0.0000            | 0.0000     |
| LnPOP     | Statistic | 3,313.838        | 82.18343          | 45.75045   |
|           | Prob.     | 0.0000           | 0.0000            | 0.0000     |
| Credit    | Statistic | 2,840.874        | 68.06353          | 50.59498   |
|           | Prob.     | 0.0000           | 0.0000            | 0.0000     |
| Digital   | Statistic | 5,402.051        | 144.5251          | 73.41805   |
|           | Prob.     | 0.0000           | 0.0000            | 0.0000     |
| ProdLab   | Statistic | 1,422.108        | 25.70759          | 21.68710   |
|           | Prob.     | 0.0000           | 0.0000            | 0.0000     |

In the second stage of analysis, we used the Center for Indonesian Policy Studies (CIPS) unit root test to assess the stationarity of the variables used in this study. As shown in Table 3, several variables, such as GoldOwn, GRDPC, and digital, were not stationary at level under the specification (no trend), indicating a unit root in their initial values. However, after including the constant and trend components in the model, all variables became statistically significant, confirming that they were stationary after first differencing. This finding shows that the variables analyzed have the same order of integration, namely  $I(1)$ . This result confirms the importance of differencing in subsequent estimations to ensure valid inferences, especially under cross-sectional dependence.

Table 3. CIPS unit root tests results

| Variables | No Trend   | Constant    | Constant and trend |
|-----------|------------|-------------|--------------------|
| GoldOwn   | -1.84903   | -1.76116    | -3.36375***        |
| NTL       | -2.46082*  | -3.14943*** | -18.31512***       |
| LnGRDPC   | -0.07003   | 0.38577     | -9.77608***        |
| LnPOP     | -2.06551*  | -2.81160*** | -6.52000***        |
| Credit    | -2.70364** | -3.52903*** | -9.15705***        |
| Digital   | -1.10290   | -1.95210    | -2.27402**         |
| ProdLab   | -2.56417** | -3.39854*** | -7.75799***        |

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

### 3.3 Estimation results of moment quantile regression

Table 3, supported by Figure 2, presents the estimation results using the Moment Quantile Regression framework, which allows analysis of the relationship between economic activity and household gold ownership across different quantiles of the gold ownership distribution. The estimation results show strong heterogeneity between quantiles, indicating that the influence of explanatory variables is not uniform across regions. In other words, economic factors affect household gold ownership differently between regions with low, medium, and high levels of gold ownership.

For the Night-Time Lights (NTL)-based economic activity indicator, the results show a positive and significant effect on the lower to middle quantiles, particularly on quantiles with relatively low gold ownership. This indicates that higher real economic activity in regions with limited gold ownership is associated with a higher share of households that have started owning gold. However, the effect of NTL tends to weaken and become insignificant in the higher quantiles, indicating that in regions with relatively high gold

ownership, additional economic activity no longer plays a major role in driving household gold ownership.

Gross regional domestic product per capita (GRDP per capita) shows a consistently positive and significant effect in almost all quantiles. This pattern indicates that formal economic welfare more consistently explains variation in household gold ownership than indicators of real economic activity. The increasingly strong influence of GRDP per capita in the middle to upper quantiles suggests that in regions with higher gold ownership, income and formal economic capacity are the main determinants of gold accumulation as a household asset.

Control variables show more diverse patterns. Population tends to have a positive effect in the lower to middle quantiles but loses significance in the higher quantiles, indicating that demographic scale matters more in regions where gold ownership is still developing. Pawnshop credit has a negative effect in the middle to upper quantiles, indicating that in regions with high gold ownership, greater participation in pawnshop credit is associated with a decline in net household gold ownership. Meanwhile, digitization and labor productivity begin to show a stronger influence on the upper quantiles, reflecting the role of structural factors and economic modernization in shaping gold ownership behavior in regions with relatively high levels of gold ownership.

The relationship between economic activity and household gold ownership in Indonesia is non-linear and highly contextual across regions. The quantile approach shows that the determinants of gold ownership work differently in regions with low levels of gold ownership compared to regions with high levels of ownership. Real economic activity plays a stronger role in driving gold ownership in the early stages of asset accumulation, while formal economic welfare becomes a more dominant factor at higher levels of ownership. This pattern shows that gold functions as both a transitional and accumulative asset, depending on households' and regions' economic position. These findings emphasize the importance of a distributional approach to analyzing household financial behavior, as average-based analysis can obscure differences in the economic mechanisms at work at different levels of gold ownership.

Table 4. Estimating results from the moment quantile regression framework

|       | NTL                      | LnGRDPC                   | LnPOP                     | Credit                     | Digital                 | ProdLab                    |
|-------|--------------------------|---------------------------|---------------------------|----------------------------|-------------------------|----------------------------|
| 0.1QR | 0.270121**<br>(0.135192) | 5.374812***<br>(0.988234) | 2.114166***<br>(0.341158) | 0.137187<br>(0.112112)     | 0.032010<br>(0.032998)  | -0.170096<br>(0.400244)    |
| 0.2QR | 0.171020**<br>(0.155227) | 5.873815***<br>(1.387904) | 1.883494***<br>(0.432831) | 0.095924<br>(0.123189)     | 0.035404<br>(0.030995)  | -0.107674<br>(0.551472)    |
| 0.3QR | 0.169989**<br>(0.140842) | 6.450014***<br>(1.541420) | 0.920811*<br>(0.492626)   | 0.040695<br>(0.126046)     | 0.017162<br>(0.032681)  | -0.282414<br>(0.517782)    |
| 0.4QR | 0.101362*<br>(0.107609)  | 8.156081***<br>(1.416500) | 0.692328*<br>(0.432833)   | 0.069692<br>(0.116757)     | 0.015245<br>(0.028076)  | -0.363250<br>(0.330955)    |
| 0.5QR | 0.020690<br>(0.079615)   | 9.691691***<br>(1.496094) | 0.334050*<br>(0.398749)   | -0.193610**<br>(0.09236)   | 0.037560<br>(0.027024)  | -0.474562<br>(0.332108)    |
| 0.6QR | -0.040187<br>(0.068880)  | 10.92147***<br>(1.516833) | -0.094487<br>(0.397201)   | -0.21634***<br>(0.0749885) | 0.037655<br>(0.025396)  | -0.639070*<br>(0.344521)   |
| 0.7QR | -0.063153<br>(0.064969)  | 12.60395***<br>(1.263547) | -0.384430<br>(0.371785)   | -0.25512***<br>(0.065221)  | -<br>(0.023369)         | -<br>(0.231581)            |
| 0.8QR | -0.124058<br>(0.079936)  | 13.35250***<br>(1.705032) | -0.45534<br>(0.498726)    | -0.23309***<br>(0.104334)  | -<br>(0.25116)          | -1.084988***<br>(0.281677) |
| 0.9QR | -0.077869<br>(0.289519)  | 9.413753*<br>(4.938179)   | 1.012076<br>(2.374465)    | 0.069294<br>(0.198539)     | -0.045839<br>(0.043069) | -0.310006<br>(0.351901)    |

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1; Values in parentheses are standard errors

The estimation results reveal substantial heterogeneity in the associations between the explanatory variables and household gold ownership across the conditional distribution. The coefficient of NTL is positive and statistically significant from the 0.1 to 0.4 quantiles,

with its magnitude declining from 0.270 at Q0.1 to 0.101 at Q0.4. From Q0.5 onward, the coefficient becomes statistically insignificant and turns negative from Q0.6 to Q0.9. This pattern suggests that the association between real economic activity and household gold ownership is concentrated among observations with relatively low levels of gold ownership, while the relationship weakens at higher quantiles.

In contrast, GRDP per capita exhibits a consistently positive and statistically significant association across all quantiles, although its magnitude varies considerably. The coefficient increases from 5.375 at Q0.1 to 13.353 at Q0.8 before declining to 9.414 at Q0.9, with the Q0.9 coefficient remaining significant at the 5% level. This relatively persistent pattern indicates that formal economic activity and regional economic capacity have a more stable association with household gold ownership across the distribution than NTL. The contrast between NTL and GRDP per capita is particularly important because it suggests that different dimensions of regional economic activity may operate differently across the gold-ownership distribution.

The control variables also display heterogeneous patterns. Population has a positive and statistically significant association from Q0.1 to Q0.5, but the coefficient becomes statistically insignificant from Q0.6 onward. Credit is statistically insignificant at the lower quantiles but becomes negative and significant from Q0.5 to Q0.8, with the largest negative coefficient observed at Q0.7. Digital access is likewise insignificant at the lower quantiles but becomes negative and statistically significant at Q0.7 and Q0.8. Labor productivity follows a similar pattern, becoming negative and statistically significant at Q0.6–Q0.8. These results indicate that the role of the control variables also varies according to the position of observations within the conditional distribution of household gold ownership.

Taken together, the estimation results indicate that the relationship between regional economic activity and household gold ownership is distributionally heterogeneous rather than uniform. NTL is primarily associated with gold ownership at the lower quantiles, whereas GRDP per capita remains positively and significantly associated across almost the entire distribution. The changing significance and signs of the control variables further show that the socioeconomic factors associated with household gold ownership differ by the level of gold ownership. Accordingly, the moment quantile regression results provide evidence that mean-based estimates alone may not adequately capture the heterogeneous relationships observed across the distribution of household gold ownership.

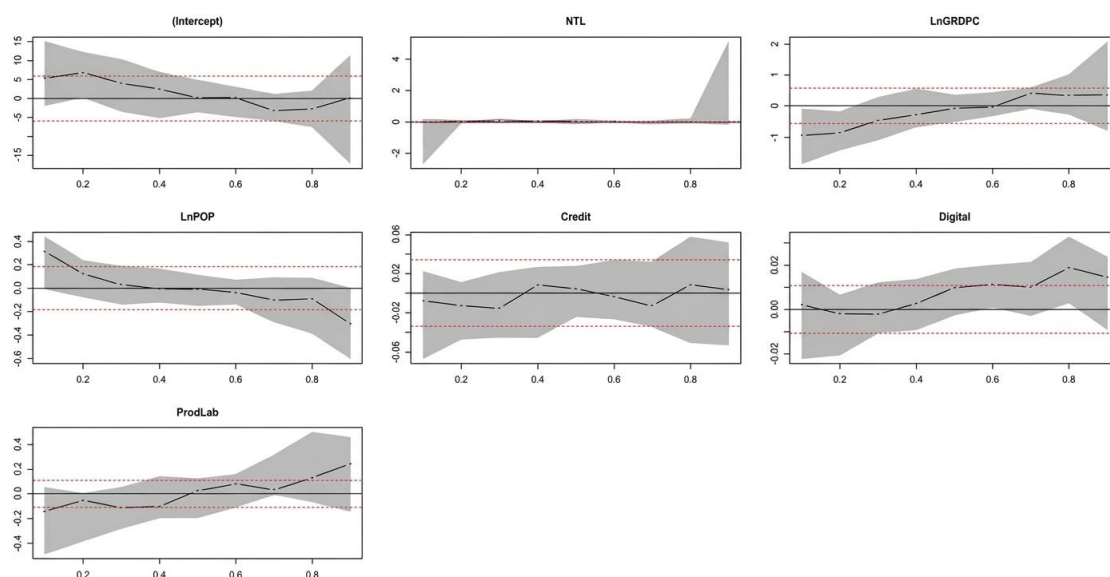


Fig. 2. Moment quantile regression for model

Table 5 presents the robustness check results by comparing estimates from the Pooled Effect Model, Fixed Effect Model, and Moment Quantile Regression at the median quantile. Overall, the results show that the relationship between economic activity and household

gold ownership is consistent across specifications, although the strength and significance of the coefficients differ. The formal economic welfare indicator, gross regional domestic product per capita, consistently shows a positive and significant relationship across all models, confirming the central role of regional income levels in explaining variation in household gold ownership. These findings indicate that the main results are not sensitive to the choice of estimation method and remain valid when regional heterogeneity is accounted for.

In contrast, the real economic activity indicator based on Night-Time Lights shows more varied results across specifications, with significance tending to weaken when unobserved heterogeneity and the distribution of gold ownership are accounted for more explicitly. This pattern suggests that real economic activity's influence on gold ownership is more contextual and sensitive to regional characteristics than formal economic welfare. Control variables change sign and significance across models, confirming their role as supporting factors rather than main determinants. Overall, the results of this robustness check reinforce the conclusion that the study's main findings, particularly the dominant role of formal economic conditions and distributional heterogeneity, are stable and reliable across estimation approaches.

Table 5. Robustness check

| Variables | Pooled effect model       | Fixed effect model         | MMQR (Q0.5)               |
|-----------|---------------------------|----------------------------|---------------------------|
| NTL       | 0.067853<br>(0.087080)    | 0.142847<br>(0.139839)     | 0.020690<br>(0.079615)    |
| LnGRDPC   | 7.230962***<br>(1.107662) | 3.412339***<br>(1.154760)  | 9.691691***<br>(1.496094) |
| LnPOP     | 0.890970**<br>(0.345232)  | 0.143125<br>(0.708096)     | 0.334050*<br>(0.398749)   |
| Credit    | -0.002040<br>(0.0642562)  | -0.033230<br>(0.036755)    | -0.193610**<br>(0.09236)  |
| Digital   | -0.006342<br>(0.020637)   | -0.063926***<br>(0.009553) | 0.037560<br>(0.027024)    |
| ProdLab   | 0.126605<br>(0.203906)    | 0.246820***<br>(0.088160)  | -0.474562<br>(0.332108)   |

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1; Values in parentheses are standard errors

### 3.4 Discussion

The results indicate that the relationship between economic activity and household gold ownership in Indonesia depends on regional conditions and the level of gold ownership. These findings reinforce the view that gold is not merely a passive asset held for cultural reasons, but rather part of a household financial strategy that responds to economic conditions. In developing countries with high regional inequality, such as Indonesia, gold serves as an adaptive instrument that bridges income uncertainty, formal financial market limitations, and household liquidity needs, as Pokorny et al. (2019) and Tanin et al. (2021) also highlight.

The role of real economic activity, as represented by Night-Time Lights, appears more prominent in regions with relatively low gold ownership. This suggests that increased economic activity in these regions creates opportunities for households to begin accumulating gold as a financial asset. This finding aligns with the argument that gold functions as an “entry asset” in household wealth accumulation, especially in regions that previously had limited income and access to formal financial instruments (Masyithah et al., 2023; Harahap et al., 2022). As economic activity grows, gold becomes one of the first assets households choose to store value and manage risk.

Conversely, in regions with higher levels of gold ownership, the influence of Night-Time Lights tends to weaken. This pattern suggests that once gold becomes a relatively established asset in household portfolios, additional increases in real economic activity no longer directly drive increases in gold ownership. This finding supports Liu (2025) and

Nyakuwanika & Panicker (2025), who argue that in more advanced stages of economic development, households diversify their assets and do not rely solely on gold. Thus, gold does not always increase with economic growth; its role changes with the stage of regional development.

Unlike real economic activity indicators, regional per capita income shows a more consistent influence on household gold ownership across various distribution levels. This indicates that formal economic capacity and income stability remain the main foundations for household decisions to save gold. These findings are consistent with household asset allocation theory, which emphasizes the importance of income and economic stability in the asset accumulation process (Hu et al., 2025; Chen, 2024; Owusu et al., 2023). In this context, gold functions not only as a protective asset but also as a medium- and long-term wealth storage instrument.

Combining Night-Time Lights and regional per capita income provides a more comprehensive picture of how economic activity influences household gold ownership. Night-Time Lights capture real economic dynamics that are often not reflected in official statistics, especially in regions with large informal sectors, as highlighted by Pei et al. (2025) and McCord & Rodriguez-Heredia (2022). Meanwhile, per capita income reflects a more stable measure of formal economic capacity. These findings confirm that a multidimensional approach to measuring economic activity is important for understanding household financial behavior more accurately.

The persistence of household gold ownership, even amid regional economic dynamics, has important implications for the development of the bullion business and the pawn industry, showing that gold remains a strategic asset in Indonesia's household financial system. For institutions such as Pegadaian, these findings indicate that demand for gold-based services depends not only on poverty levels or short-term economic pressures, but also on the structure of economic activity and regional income capacity. Regions with growing economic activity and increasing incomes are, in fact, an important basis for strengthening the bullion ecosystem.

The results show that access to gold pawn services and digital economic development interact differently with gold ownership across distribution levels. In regions with higher gold ownership, increased use of pawn credit tends to correlate with a decline in net gold ownership, indicating that gold is increasingly used as a liquidity instrument rather than merely a savings asset. This finding aligns with Chiang (2022) and Robiyanto et al. (2021), who argue that gold in the modern context increasingly functions as a "living" asset in the household financial system.

Household gold ownership in Indonesia results from a complex interaction among economic activity, income, and regional structure. Gold plays a dual role: a transitional asset in regions with growing economic activity and an accumulative asset in regions with more established economic capacity. Policies and strategies for developing the bullion business cannot be standardized nationally; they must account for regional heterogeneity and the stage of local economic development. This approach aligns with Pegadaian's goal of strengthening gold's role as a pillar of household financial resilience while supporting sustainable financial inclusion throughout Indonesia.

#### 4. Conclusions

This study provides empirical evidence that household gold ownership in Indonesia is closely related to regional economic activity, but the relationship is heterogeneous and depends on the level of gold ownership itself. By integrating satellite-based Night-Time Lights indicators and regional income indicators, this study shows that gold ownership cannot be explained by a single dimension of economic performance. Instead, household decisions to hold gold reflect a combination of real economic dynamics and varying formal income capacities across regions and stages of economic development. The findings confirm that economic activity plays a different role across the distribution of household gold ownership. In regions with relatively low levels of gold ownership, higher real economic

activity is associated with greater household participation in gold ownership, suggesting that gold serves as a starting asset in household wealth accumulation. Conversely, in regions with higher levels of gold ownership, formal economic capacity becomes a more dominant factor, while additional increases in real economic activity no longer have a strong influence. This pattern shows that gold's role shifts from a transitional asset to a more established component of household wealth as regional economic conditions improve.

A key contribution of this study is its methodological approach. By applying a quantile moment regression framework, this study captures distributional heterogeneity that average-based estimates cannot reveal. This approach shows that the determinants of household gold ownership differ systematically across regions, underscoring the importance of distributional effects in analyzing household financial behavior. Using Night-Time Lights as a proxy for real economic activity complements conventional income indicators and provides a more comprehensive picture of regional economic dynamics, particularly in economies with large informal sectors. This study contributes to the literature on household finance and regional economic development by deepening understanding of gold's role as a financial asset in developing countries. The results confirm that household gold ownership is not merely a cultural phenomenon or a precautionary measure, but a rational response to economic conditions shaped by regional heterogeneity. As the bullion business and gold-based financial services develop, these findings provide an important basis for formulating strategies that are more sensitive to local economic conditions and support strengthening gold's role as a pillar of household financial resilience in Indonesia.

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### **Author Contribution**

The author solely contributed to all aspects of this study, including conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, writing—original draft preparation, writing—review and editing, visualization, supervision, project administration, and funding acquisition.

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### **Ethical Review Board Statement**

Not available.

### **Informed Consent Statement**

Not available.

### **Data Availability Statement**

The data used in this study are publicly available. The supplementary materials and appendices containing the relevant data and additional analysis can be accessed at the following link: <https://bit.ly/47qQcqQ>

### **Conflicts of Interest**

The authors declare no conflict of interest.

## Declaration of Generative AI Use

During the preparation of this work, the author used DeepL.com to help translate the manuscript from Indonesian into English and QuillBot to improve grammar and language clarity. After using these tools, the author reviewed and edited the content as needed and took full responsibility for the publication.

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### Biography of Author

**Aditya Idris**, Department of Economic Development and Planning, Faculty of Economics and Business, Universitas Hasanuddin, Makassar, South Sulawesi 90245, Indonesia.

- Email: [latervilla@gmail.com](mailto:latervilla@gmail.com)
- ORCID: 0009-0008-9283-5908
- Web of Science ResearcherID: N/A
- Scopus Author ID: N/A
- Homepage: N/A