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Bullion business and regional welfare: An empirical analysis

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ABSTRACT

Background: The development of bullion business and its increasing digitalization are widely promoted as instruments for financial inclusion and regional welfare enhancement, yet empirical evidence on their actual welfare effects remains limited and spatially heterogeneous. This study aims to examine whether bullion business development, particularly through digital access, contributes to regional welfare in West Java and to identify the conditions under which such development strengthens resilience without generating new systemic risks. Building on theories of asset-based welfare, financial resilience, and digital finance adoption. **Methods:** The research employs a mixed quantitative approach combining macro-financial indicators, provincial and municipal welfare data, and household-level survey evidence. The analysis utilizes monthly national gold price data, inflation, interest rates, exchange rates, provincial economic indicators, and a structured survey of respondents representing all 27 regencies and municipalities in West Java, complemented by spatial clustering and scenario-based stress testing. **Findings:** The findings indicate that gold ownership functions primarily as a risk-mitigation asset rather than a growth driver, with welfare effects becoming more pronounced during inflationary and income-shock periods. Physical gold holders demonstrate higher crisis utilization rates than digital users, reflecting stronger behavioral resilience despite lower liquidity. Digital bullion access improves transaction efficiency and inclusion in regions with high digital readiness but amplifies volatility transmission and welfare reversals under stress scenarios, particularly in urbanized areas. Spatial analysis reveals uneven welfare outcomes, where digitally advanced municipalities benefit during price appreciation phases yet face sharper contractions during crises, while low digital readiness regions display greater stability through reliance on physical bullion. **Conclusion:** The study concludes that bullion digitalization contributes to regional welfare only under conditional designs incorporating hybrid access, spatial differentiation, and crisis-mode governance. **Novelty/Originality of this article:** The originality of this article lies in empirically positioning bullion access as a spatial welfare variable and demonstrating that digital efficiency does not automatically translate into systemic resilience.

KEYWORDS: bullion business; regional welfare; West Java.

1. Introduction

Gold occupies a unique and enduring position within modern economic systems, simultaneously functioning as a financial asset, a cultural store of value, and a socio-economic stabilizer during periods of uncertainty (Naddiya, 2023; Beckert, 2022). Despite the evolution of fiat monetary regimes and the proliferation of complex financial instruments, gold continues to assert its relevance whenever macroeconomic volatility intensifies, institutional trust weakens, or household vulnerability increases (Singh et al., 2026; Sahadudheen & Kumar, 2025; Yeniley, 2025). The Indonesian experience in 2025 vividly illustrates this phenomenon. Amid declining benchmark interest rates, persistent

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inflationary pressures, exchange rate volatility, and global geopolitical uncertainty, domestic gold prices surged sharply, recording an annual compound growth rate exceeding 70 percent with volatility levels that are atypically high for a non-yielding asset.

This surge is not merely a market anomaly. Rather, it reflects a deeper structural dynamic in which households and firms increasingly resort to gold as a hedge against inflation, a protection against currency depreciation, and a liquidity buffer in the face of uncertain income prospects. Such behavior reinforces the idea that gold should not be analyzed solely through the lens of commodity price movements or portfolio optimization. Instead, gold must be understood as an integral component of household financial strategies and regional economic resilience; particularly in emerging economies where access to formal financial instruments remains uneven (Capoani et al., 2025; Katnic et al., 2024; Trippl et al., 2023). However, while national-level gold price dynamics are widely documented, significantly less attention has been paid to their regional transmission mechanisms and distributional consequences. In large, heterogeneous economies such as Indonesia, macroeconomic shocks do not propagate uniformly. Regional disparities in income levels, employment structures, education attainment, digital infrastructure, and financial access mediate how households respond to price volatility and policy adjustments (Qian et al., 2025; del Carpio et al., 2022; Luo & Li, 2022). Consequently, the welfare implications of gold price movements and of bullion business expansion more broadly are likely to differ sharply across regions and population groups (Bala, 2025; Harriss-White, 2024; Susai & Daniel, 2024).

Within this context, West Java Province represents an analytically compelling and policy-relevant case. As one of Indonesia's largest provincial economies, West Java contributes substantially to national output while simultaneously exhibiting pronounced internal heterogeneity. The province encompasses dense metropolitan centers integrated into global value chains, industrial manufacturing zones, semi-urban transitional areas, and rural regions where economic activity remains closely tied to agriculture and informal sectors. These spatial contrasts are mirrored in socio-economic indicators: While poverty rates have declined steadily and human development indicators have improved, income inequality, unemployment disparities, and uneven digital readiness persist across regencies and municipalities.

At the same time, West Java has experienced a rapid expansion of bullion-related economic activities. The proliferation of pawnshop outlets, the increasing availability of gold-based financial products, and the growing penetration of digital gold platforms have transformed gold from a predominantly passive savings instrument into an actively traded financial asset. This transformation raises a fundamental policy question: Does the growth of bullion business activity enhance regional welfare and economic resilience, or does it primarily benefit already-advantaged groups while leaving vulnerable populations exposed to new risks? Addressing this question requires moving beyond aggregate indicators and engaging directly with household behavior. Macroeconomic data can reveal price trends, volatility, and correlations with inflation or interest rates, but they cannot explain how households interpret these signals, how they adjust their financial decisions, or how trust and accessibility shape their responses. For this reason, the present study explicitly integrates survey-based micro-level evidence into its analytical framework.

The inclusion of survey respondents serves three critical purposes. First, it allows the study to capture heterogeneity in gold ownership and usage across income groups, education levels, and employment types. In West Java, gold ownership is not confined to high-income investors. It spans informal workers, salaried employees, small entrepreneurs, and households that view gold as an intergenerational savings instrument. Understanding these distinctions is essential for assessing whether bullion markets function as inclusive financial mechanisms or as segmented instruments favoring specific socio-economic strata.

Second, respondent-level data provide insights into behavioral dimensions that are invisible in administrative statistics. Variables such as transaction frequency, purpose of gold ownership (saving versus investment), preference for digital versus physical formats, and trust in financial platforms directly influence how gold markets operate in practice.

These behavioral factors are especially relevant in periods of stress, when liquidity needs rise and confidence in institutions becomes a decisive determinant of economic outcomes.

Third, the survey enables an explicit examination of gold usage during crisis conditions. Gold's reputation as a safe haven is often assumed rather than empirically tested. By asking respondents whether and how they rely on gold during economic distress, the study evaluates whether gold genuinely functions as a shock absorber at the household level or whether its role is constrained by access, liquidity, or trust-related barriers. This distinction is crucial for designing policy interventions aimed at strengthening economic resilience. The respondent framework is deliberately aligned with the study's broader analytical structure. Survey variables including income level, education attainment, employment type, gold ownership status, transaction intensity, usage purpose, digital preference, platform trust, and crisis utilization are mapped onto macroeconomic and regional indicators. This mapping allows the research to trace causal pathways from macroeconomic shocks to household decisions and, ultimately, to regional welfare outcomes.

Importantly, the study situates respondent behavior within a spatially explicit context. West Java's 27 regencies and municipalities differ not only in economic structure but also in digital readiness and financial infrastructure density. The availability of pawnshop outlets, the penetration of digital platforms, and the quality of digital skills shape how households engage with bullion markets. Urban respondents in digitally advanced cities may prioritize convenience and transaction speed, while rural respondents may place greater emphasis on tangibility and institutional familiarity. These spatially differentiated behaviors have direct implications for the effectiveness and risks of bullion digitalization.

The theoretical foundation of this research draws on three interconnected strands of literature: Gold as a hedge against macroeconomic instability, household financial behavior under uncertainty, and financial inclusion and digital transformation. Previous studies have established that gold prices tend to rise during periods of inflation and currency depreciation, reinforcing its role as a store of value (Aprizal & Harahap, 2025; Coelho et al., 2025; Binh, 2024; Chai et al., 2021). Separately, behavioral finance research highlights that household responses to economic shocks are shaped by income constraints, risk perceptions, and trust in institutions (Abdul-Rahim et al., 2022; Bufe et al., 2022, de Leon et al., 2022; Dennison & Turnbull-Dugarte, 2022).

More recent work on digital finance emphasizes that technological adoption can enhance efficiency and inclusion, but only when supported by adequate literacy, infrastructure, and governance (Abdulkareem & Oladimeji, 2024; Holl & Rama, 2023; Rego et al., 2021; James, 2020). Despite these advances, a clear gap remains. Existing studies rarely integrate gold price dynamics with region-specific welfare indicators and micro-level behavioral evidence within a single empirical framework. Moreover, few analyses explicitly test how bullion markets perform under adverse scenarios, particularly in subnational contexts where institutional capacity and digital readiness vary widely.

This study addresses these gaps by combining macroeconomic analysis, spatial data, and respondent-level surveys with scenario-based stress testing. The central objective of this research is therefore threefold. First, it seeks to quantify the relationship between gold price dynamics and regional economic conditions in West Java. Second, it aims to examine how households across different socio-economic and spatial contexts engage with gold as a financial instrument. Third, it evaluates whether the ongoing digitalization of bullion markets enhances or undermines regional welfare and economic resilience under both normal and stress conditions. By grounding its analysis in empirical data and explicitly incorporating household perspectives, this study contributes to a more nuanced understanding of bullion business expansion in emerging economies. Rather than treating digitalization as an inherently beneficial innovation, the research adopts a critical, evidence-based stance, recognizing both its potential and its limitations. In doing so, it offers policy-relevant insights into how gold markets can be structured to support inclusive growth, mitigate inequality, and strengthen resilience at the regional level.

2. Methods

This study adopts a mixed-method quantitative research design that integrates macroeconomic time-series analysis, household-level survey data, and spatial–regional mapping. The methodological architecture is deliberately constructed to capture the multi-layered transmission mechanism through which gold price dynamics influence household financial behavior and, in turn, regional welfare outcomes. By aligning macro-financial indicators with micro-level behavioral responses and spatial heterogeneity, the research design ensures analytical coherence while preserving sensitivity to regional variation.

At the macroeconomic level, the analysis examines national gold price movements alongside inflation, policy interest rates, exchange rates, and economic growth as the primary sources of aggregate shocks affecting asset valuation and household decision-making. Monthly gold price data in Indonesian rupiah per gram are derived from a Bank Indonesia and London Bullion Market Association (LBMA) proxy, while inflation, policy interest rates, exchange rate data, and economic growth indicators are obtained from Statistics Indonesia and Bank Indonesia. Gold price volatility is measured using the standard deviation of monthly prices, and long-term price dynamics are captured through compound annual growth rate estimation. These indicators jointly represent uncertainty, opportunity cost, and appreciation incentives faced by households.

At the microeconomic level, primary data are collected through a structured household survey conducted across all 27 regencies and municipalities in West Java. The survey is designed to reflect socio-economic diversity across income, education, and employment categories, allowing the study to capture heterogeneity in financial behavior. Key variables include household income level, educational attainment, employment type, gold ownership status, transaction frequency, the purpose of gold holding, digital preference, trust in digital platforms, and the use of gold during periods of economic stress. The survey instrument explicitly links behavioral indicators to prevailing macroeconomic conditions, enabling inference regarding gold's role as a household-level stabilizing asset rather than merely a speculative instrument. Respondent selection follows a stratified purposive sampling strategy to ensure proportional representation across geographic location, urban–rural classification, and income group (Ahmad & Wilkins, 2025; Rado & Nuchpiam, 2024; Hossan et al., 2023). This approach is employed to mitigate the urban and digital bias commonly observed in studies of digital finance. Respondent distribution is aligned with population size and economic activity, resulting in higher representation in metropolitan municipalities such as Bandung City, Bekasi City, and Depok City, while maintaining sufficient coverage in rural and agrarian regencies to capture access constraints and informal financial practices.

Econometric analysis is structured to isolate distinct transmission channels linking gold prices, household behavior, and welfare outcomes. Macroeconomic determinants of gold prices are examined using interaction models incorporating inflation and interest rate effects to capture both hedging and opportunity-cost mechanisms. Household gold ownership is estimated using binary logistic regression to identify socio-economic drivers of participation, while digital bullion adoption is analyzed through ordered logit models reflecting latent adoption propensity. Regional welfare effects are proxied using changes in poverty rates, income distribution indicators, gold asset penetration per capita, and transaction accessibility indices, with interaction terms used to evaluate how gold ownership moderates income volatility.

To assess resilience under adverse conditions, the study employs scenario-based stress testing commonly used in financial stability analysis (Nazemi et al., 2024; Barbieri et al., 2022). Baseline, moderate shock, and severe shock scenarios simulate simultaneous movements in gold prices, inflation, policy interest rates, and exchange rates. Household welfare responses are evaluated by adjusting asset values, purchasing power, and liquidity access under each scenario, allowing direct comparison of physical, digital, and hybrid bullion access modalities. The robustness of the findings is ensured through multicollinearity testing using variance inflation factors, the application of robust standard

errors to address heteroskedasticity, sensitivity analysis of stress-test parameters, and spatial robustness checks conducted by excluding metropolitan regions. Together, these procedures strengthen the validity of the empirical results and support their relevance for both financial stability analysis and regional development policy.

3. Results and Discussion

3.1 Macroeconomic gold dynamics and household behavioral responses

Empirical evidence indicates that 2025 constitutes a structural break in Indonesia's gold market. Monthly gold prices increased sharply from approximately IDR 1.42 million per gram in January to IDR 2.32 million per gram by December, generating an annual compound growth rate of around 71.02 percent. This magnitude of appreciation far exceeds historical averages and repositions gold from a conventional store of value into a dominant financial asset during periods of heightened macroeconomic uncertainty. However, this rapid appreciation was accompanied by substantial price volatility, as reflected in a standard deviation of IDR 278,816 per gram, equivalent to about 15.3 percent of the mean price. This combination of strong upward momentum and elevated volatility implies that gold in 2025 functioned neither as a passive hedge nor as a purely speculative instrument, but rather as a liquid refuge asset that is highly sensitive to macroeconomic signals. From a welfare perspective, such volatility produces asymmetric outcomes, as households with early access to gold benefit disproportionately, while late adopters face significantly higher entry costs.

Inflation dynamics further reinforce gold's attractiveness during the study period. National inflation increased from 0.76 percent at the beginning of the year to 2.86 percent by October, indicating a clear upward trajectory in consumer prices. This inflationary trend coincided with a loosening monetary stance, as the BI Rate declined from 5.75 percent to 4.75 percent by year-end. The resulting policy configuration weakened the opportunity cost of holding non-yielding assets, creating a negative real interest rate environment in which gold emerged as a rational asset choice even for non-speculative households. Survey responses strongly corroborate this mechanism, as a substantial share of respondents identified protection against rising prices, rather than capital gains, as their primary motivation for holding gold. This pattern suggests that inflation expectations, rather than short-term price speculation, play a central role in shaping household behavior.

Exchange rate dynamics introduce an additional channel reinforcing gold demand. The rupiah's projected depreciation, averaging IDR 15,275 per US dollar with stress episodes approaching IDR 17,000, heightened currency risk at the household level. In this context, gold priced in global markets and converted into domestic currency, operates as an implicit hedge against exchange rate depreciation. Households appear to internalize this mechanism behaviorally. Even respondents with limited formal financial literacy reported a shift toward gold ownership during periods of exchange rate volatility, supporting the interpretation of gold as a de facto currency-substitute asset within household portfolios. West Java provides a particularly relevant empirical setting for examining these dynamics due to its economic scale, diversity, and pronounced internal heterogeneity. With quarterly regional output exceeding IDR 759 trillion and growth stabilizing above 5.2 percent year-on-year, the province closely mirrors national economic momentum while simultaneously exhibiting deep intra-regional inequality. Despite steady growth, welfare indicators reveal persistent structural vulnerabilities, with poverty declining only gradually to 7.02 percent, unemployment stagnating at around 6.77 percent, and the Gini ratio remaining elevated at 0.416. This combination indicates that aggregate growth does not automatically translate into welfare security, thereby creating fertile ground for alternative asset strategies such as gold accumulation.

Household survey data reveal clear socio-economic gradients in gold ownership. Participation rates are highest among middle-income households, while very low-income groups remain largely excluded due to entry cost constraints. Education plays a particularly

decisive role, as respondents with tertiary education exhibit higher ownership probabilities and more diversified motives, combining precautionary savings with investment considerations. Employment structure further sharpens this pattern. Gold ownership is significantly more prevalent among informal workers, self-employed individuals, and micro-entrepreneurs, groups characterized by income volatility and limited access to formal financial instruments. For these households, gold functions less as a speculative asset and more as a self-insurance mechanism against income shocks. Transaction behavior reinforces this interpretation. Gold transaction intensity rises markedly during periods of macroeconomic stress, and households that actively mobilize gold during crises also report higher levels of trust in bullion platforms. Gold is therefore not held passively, but is sold, pledged, or rebalanced in response to income disruptions, medical emergencies, and inflation spikes. This behavior confirms gold's role as a liquidity buffer rather than merely a vehicle for long-term wealth preservation.

Preferences regarding digital versus physical gold reveal further layers of heterogeneity. Digital adoption is strongly associated with higher education levels, urban residency, and institutional trust. Nevertheless, digital gold does not fully displace physical holdings. Many households exhibit hybrid behavior, using digital platforms for accumulation while retaining physical gold for psychological security. This duality underscores that digital bullion primarily extends accessibility and liquidity rather than replacing traditional forms of ownership. Across all groups, trust emerges as the binding constraint. Respondents with low institutional trust overwhelmingly reject digital gold regardless of income or education, highlighting that technological availability alone is insufficient without credible governance and consumer protection frameworks.

Taken together, the convergence of macroeconomic volatility and micro-level behavioral responses yields a critical insight. Gold ownership operates as an informal welfare stabilizer, particularly for households exposed to labor market risk, inflationary pressure, and currency volatility. However, access to these stabilizing benefits remains uneven. In the absence of targeted institutional intervention, the welfare gains associated with gold accumulation risk reinforcing existing inequalities rather than mitigating them.

Table 1. Reported macroeconomic and regional indicators

Indicator	Value reported in manuscript	Reference period/interpretation
Domestic gold price, January	Approximately IDR 1.42 million/g	January 2025
Domestic gold price, December	Approximately IDR 2.32 million/g	December 2025
Gold-price standard deviation	IDR 278,816/g; approximately 15.3% of mean	2025 monthly price series
Inflation	0.76% at beginning of year; 2.86% by October	2025; reported observations
BI Rate	5.75% to 4.75%	2025
West Java poverty rate	7.02%	Period not specified in discussion
West Java unemployment rate	Approximately 6.77%	Period not specified in discussion
West Java Gini ratio	0.416	Period not specified in discussion

3.2 Rationale of spatial analysis

Aggregate provincial indicators tend to conceal substantial intra-provincial disparities in welfare conditions, digital readiness, and household financial behavior. This limitation is particularly salient in West Java, which consists of 27 administrative units comprising both regencies and cities with highly heterogeneous economic structures. These range from dense metropolitan service centers and industrial corridors to agrarian hinterlands and

peripheral tourism regions. As a result, province-level averages obscure unequal access to bullion markets, mismatches between digital infrastructure and household capability, and divergent welfare consequences of financial innovation. Spatial analysis is therefore essential to assess whether bullion-based financial instruments function as tools of inclusion or, conversely, risk amplifying existing regional inequality.

To capture this heterogeneity, each regency and municipality is analytically positioned along four interrelated dimensions: Economic capacity, welfare status, digital readiness, and bullion adoption potential. Economic capacity is proxied by regional output per capita and growth dynamics, welfare status reflects poverty incidence, unemployment, and human development outcomes, digital readiness is inferred from urbanization and information and communication technology infrastructure as captured by IMDI-related indicators, and bullion adoption potential is derived from observed respondent behavior and preferences. Integrating these dimensions yields a spatial typology that distinguishes regions according to the interaction between welfare conditions and digital preparedness, producing four analytically distinct clusters.

At one extreme, major urban centers such as Bandung, Bekasi, Depok, Bogor, and Cimahi occupy a cluster characterized by relatively high welfare and strong digital readiness. These cities are dominated by service, creative, industrial, and metropolitan economic structures and exhibit very high potential for bullion adoption. Survey evidence from these areas indicates strong institutional trust, frequent transaction activity, and a combination of savings and investment motives. In such contexts, bullion functions primarily as a portfolio diversification instrument rather than as a survival asset, reflecting households' broader access to formal financial alternatives. A second group consists largely of industrial and peri-urban regencies and smaller cities such as Bekasi Regency, Karawang, Bandung Regency, Bogor Regency, Cirebon City, and several secondary urban centers. These regions display moderate welfare outcomes and uneven but improving digital readiness. Households in these areas demonstrate interest in bullion accumulation but continue to show a marked preference for physical gold, indicating asymmetries in trust rather than outright rejection of digital platforms. This cluster represents the highest marginal conversion potential for digital bullion adoption, as relatively modest policy or institutional interventions could substantially shift behavior.

A third spatial pattern emerges in regions that exhibit limited welfare capacity but unexpectedly moderate levels of digital engagement, including areas such as Subang, Purwakarta, Sumedang, and Pangandaran. In these localities, gold ownership is typically motivated by precautionary savings and crisis buffering rather than investment. Although digital platforms are accessible, household purchasing power remains constrained. Consequently, digital bullion products risk becoming regressive if minimum transaction sizes or fee structures are not adapted to local conditions, potentially excluding precisely those households most vulnerable to income and price shocks. The final and most structurally constrained cluster is dominated by large agrarian regencies such as Indramayu, Majalengka, Garut, Tasikmalaya, Cianjur, Sukabumi, Kuningan, and southern Tasikmalaya. These regions are characterized by low welfare indicators, weak digital readiness, and near-absence of bullion adoption. Survey responses reveal minimal ownership, negligible digital usage, and continued reliance on informal savings mechanisms. In these areas, bullion markets are effectively absent rather than underutilized, implying that digital bullion initiatives introduced without targeted intervention would bypass these populations entirely.

Taken together, the spatial evidence demonstrates that bullion-based financial inclusion is geographically unequal by design rather than by household preference. Regions marked by low digital infrastructure, high poverty incidence, and dominance of informal labor are the least capable of absorbing digital bullion instruments, despite being the most exposed to inflationary pressure and income volatility. This spatial mismatch creates a policy paradox in which households with the greatest need for inflation hedging and liquidity buffers face the highest barriers to access. These findings carry direct policy relevance. A uniform, nationwide rollout of digital bullion platforms is inherently inefficient

given regional heterogeneity. Strategies that prioritize urban markets may deepen inequality rather than alleviate it, while hybrid models combining physical access points with digital interfaces appear more spatially appropriate. Crucially, trust infrastructure cannot be centralized or standardized but must be localized to regional socio-economic conditions. This spatial heterogeneity also provides the analytical foundation for subsequent stress-testing exercises. By differentiating regions according to their welfare and digital readiness profiles, simulated scenarios involving inflation shocks, exchange rate volatility, and income contractions can generate more realistic projections of household welfare impacts under adverse macroeconomic conditions.

Table 2. Spatial typology of bullion access across West Java

Analytical cluster	Illustrative areas identified in text	Welfare/digital profile	Bullion implication
Urban, high-readiness	Bandung, Bekasi, Depok, Bogor and Cimahi cities	Relatively high welfare; strong digital readiness	Higher digital preference and portfolio-diversification use
Industrial/peri-urban transition	Bekasi, Karawang, Bandung and Bogor regencies; Cirebon City	Moderate welfare; uneven/improving digital readiness	Physical preference persists; institutional trust is pivotal
Constrained welfare, moderate digital exposure	Subang, Purwakarta, Sumedang and Pangandaran	Constrained purchasing power; moderate digital exposure	Need accessible pricing, low fees and precautionary-use design
Agrarian/peripheral, lower readiness	Indramayu, Majalengka, Garut, Tasikmalaya, Cianjur, Sukabumi and Kuningan regencies	Lower welfare and weaker digital readiness	Physical access and assisted channels remain important

3.3 Household-level survey evidence and spatially anchored behavioral mechanisms in West Java

Unlike macroeconomic indicators that operate at aggregate levels, household behavior ultimately determines whether bullion business development particularly through digital platforms functions as a mechanism of welfare stabilization, speculative amplification, or distributional divergence. By explicitly anchoring respondent data to each administrative unit, this analysis ensures that conclusions regarding digital bullion are grounded in spatially representative behavioral evidence rather than abstract assumptions about technological adoption.

The household survey was designed to achieve full territorial coverage across West Java's eighteen regencies and nine municipalities, capturing urban, peri-urban, and rural dynamics simultaneously. Respondents were selected through stratified sampling based on population size, degree of urbanization, and regional digital readiness as proxied by the Indonesian Digital Society Index classification. The final sample consists of 2,240 respondents, a scale sufficient to support sub-regional inference while maintaining statistical reliability. The distribution of respondents reflects population concentration and economic activity, with larger samples drawn from the Greater Bandung and Greater Jakarta corridors, while still ensuring meaningful representation from peripheral and rural areas such as Pangandaran, Banjar, and Ciamis. This spatial completeness allows household behavior to be directly linked to regional welfare indicators, including poverty incidence, unemployment rates, digital readiness, and inflation differentials discussed earlier in the study.

The socioeconomic composition of respondents mirrors the structural dualism of West Java's economy. In aggregate, middle-income households constitute the largest share of respondents, followed by low-income and high-income groups. Educational attainment is

relatively balanced between primary–secondary and diploma–undergraduate levels, with a smaller but substantial share of postgraduate respondents. Employment status reveals the dominance of formal private-sector workers, alongside a large informal workforce, followed by public-sector employees and self-employed individuals. Regional disaggregation highlights pronounced contrasts: Informal employment and lower educational attainment dominate agrarian regencies such as Garut, Tasikmalaya, and Indramayu, while higher education levels and formal employment are concentrated in urban municipalities including Bandung, Depok, Bekasi, and Bogor. These structural differences are central to understanding heterogeneous responses to bullion access and digitalization.

Gold ownership is widespread across West Java, but its economic meaning varies sharply across income groups and regions. Binary ownership indicators suggest high penetration even among lower-income households, yet transaction behavior reveals fundamentally different usage patterns. Among low-income households, gold functions predominantly as a passive store of value, typically acquired through traditional physical channels or pawn-based accumulation. Transaction frequency is low, indicating that gold is reserved for extreme contingencies rather than active portfolio management. Middle-income households exhibit hybrid behavior, combining precautionary saving with opportunistic transactions during price upswings. High-income households, by contrast, display explicitly financialized behavior, characterized by frequent transactions and portfolio rebalancing in response to gold price movements.

Declared holding purposes further clarify this divergence. Low-income households overwhelmingly identify gold as a precautionary savings instrument, whereas high-income households primarily associate gold with investment and capital appreciation. These findings demonstrate that bullion ownership does not uniformly enhance welfare. Its welfare impact depends critically on whether gold operates as a stabilizing buffer or as a speculative asset. Digitalization fundamentally reshapes access to bullion by reducing transaction costs, increasing price transparency, and accelerating liquidity. However, survey evidence from West Java shows that these technological advantages are mediated by behavioral trust, institutional perception, and spatial readiness. Aggregate responses indicate moderate acceptance of digital bullion accompanied by structurally fragile trust. Respondents generally recognize the functional convenience of digital platforms but remain cautious about their reliability, particularly under non-normal or crisis conditions.

Spatial disaggregation reveals that digital preference increases with regional digital readiness, but this relationship becomes more nuanced when aligned with welfare conditions. In high-welfare, high-readiness urban municipalities such as Bandung, Bekasi, Depok, Bogor, and Cimahi, digital bullion preference is strong and driven by higher education, financial literacy, and dense exposure to formal financial institutions. In these areas, digital bullion is perceived as an extension of existing savings and investment practices rather than as an experimental product. Nevertheless, trust remains conditional. Respondents consistently differentiate between operational convenience during normal periods and uncertainty regarding platform behavior during crises, a distinction that explains why high digital preference does not automatically translate into stable welfare outcomes.

Transitional industrial and urbanizing regions with medium welfare and digital readiness exhibit digital preference levels close to the provincial average. In these areas, adoption is highly sensitive to perceived institutional backing, peer usage, and the clarity of redemption mechanisms. Gold is primarily viewed as a precautionary asset, and digital platforms are approached pragmatically but cautiously. Small improvements in trust infrastructure or regulatory clarity could therefore generate disproportionately large shifts in adoption behavior, making these regions structurally decisive for inclusive bullion development. Regions with constrained welfare but moderate digital exposure display a distinct pattern of ambivalence. Despite some familiarity with digital finance, respondents hesitate to allocate long-term value storage to platforms perceived as opaque or weakly regulated. This trust gap positions such regions as particularly vulnerable to poorly sequenced digitalization policies. In contrast, agrarian regions with low welfare and low

digital readiness remain strongly anchored to physical bullion. Here, resistance to digital gold is driven less by income constraints than by limited digital literacy, weak institutional exposure, and deeply rooted perceptions of safety associated with physical possession, social verifiability, and intergenerational transferability. These regions function as stabilizing but excluded nodes within the provincial bullion system.

Across all spatial clusters, education consistently emerges as a stronger predictor of digital preference than income. Respondents with higher educational attainment exhibit significantly higher digital preference and trust levels even within regions of moderate or low digital readiness. This finding reinforces the conclusion that the regional digital divide in bullion access is driven primarily by capability and institutional confidence rather than affordability alone. The most striking behavioral asymmetry emerges in the analysis of gold usage during crisis conditions. Despite the superior technical liquidity of digital bullion platforms, physical gold holders are substantially more likely to mobilize their assets during periods of inflation spikes, income shocks, or acute financial stress. Physical gold is cognitively framed as a last-resort buffer, with tangibility reinforcing certainty, control, and immunity from platform failure or cyber risk. During crises, when uncertainty dominates rational calculation, households gravitate toward instruments that minimize ambiguity rather than maximize speed.

Digital gold users, by contrast, frequently delay liquidation despite possessing technically superior liquidity. Survey responses indicate that hesitation is driven by uncertainty regarding redemption mechanisms, fear of adverse price execution during volatility, and doubts about platform solvency or regulatory protection. These concerns intensify precisely during crises, when price swings widen and institutional stress becomes salient. Even among digital users, crisis utilization rises sharply with trust levels, yet still does not exceed the usage rates observed among physical gold holders. This confirms that the underperformance of digital bullion during crises is institutional and behavioral rather than technological. From a welfare perspective, this distinction is decisive. Assets that cannot be mobilized during crises fail to perform their primary stabilizing function, regardless of their efficiency during normal times. In this sense, digital bullion behaves more like a pro-cyclical financial asset, enhancing liquidity and participation in stable markets while losing effectiveness precisely when households need it most. Physical gold, by imposing temporal friction, dampens herd behavior, reduces synchronized selling, and preserves its role as a stabilizing asset.

When survey evidence is overlaid with regional welfare indicators, a coherent pattern emerges. High digital readiness urban regions benefit from digital bullion during stable or appreciating price regimes but experience sharper welfare reversals during crises due to synchronized liquidation and volatility amplification. Lower-readiness rural regions, while less digitally integrated, demonstrate greater resilience because physical bullion enforces slower, more deliberate liquidation. Ultimately, household behavior mediates the welfare impact of bullion development more strongly than price dynamics alone. Digitalization alters the transmission channel of gold from a stabilizing asset into a potentially destabilizing one unless institutional safeguards and trust infrastructures are firmly established.

3.4 Econometric stress test and welfare simulation of bullion business

The econometric stress testing framework quantitatively evaluates whether the bullion business, particularly its digitalized segment, operates as a welfare stabilizer or instead amplifies household vulnerability under macroeconomic shocks. Using a balanced panel of 27 regencies and cities in West Java over a twelve-month horizon, the model links regional welfare outcomes—poverty rates, open unemployment, and Human Development Index (HDI) sub-indices—to real gold prices, inflation, policy interest rates, and regional income per capita. A bullion access indicator differentiates regions with effective physical or digital gold usage, while an interaction term between gold prices and digital access captures amplification or dampening effects. All nominal variables are deflated using Consumer Price

Index (CPI) to ensure real welfare interpretation. Gold price volatility is explicitly modeled, reflecting a 2025 standard deviation of approximately 15.3 percent relative to the mean price level. Inflation enters the model with observed annualized rates ranging from 2.8 to above 5 percent in stress conditions, while income shocks are simulated as a 10 percent contraction in real PDRB per capita for crisis scenarios. In a stable environment, where gold price movements are limited to ±5 percent and inflation remains near 2–3 percent, the estimated coefficient on gold ownership is small and statistically insignificant across welfare indicators, with changes in poverty and unemployment remaining below 0.2 percentage points.

When gold prices increase by roughly 30 percent, the interaction between gold prices and digital access becomes positive and significant, with an estimated coefficient of about +0.18. This translates into an average 1.6–2.1 percent improvement in consumption smoothing for digitally connected households in high-readiness regions, while the corresponding reduction in poverty remains below 0.5 percentage points, indicating weak distributional effects. Welfare gains are therefore concentrated rather than inclusive. Under the crisis scenario, combining a 20 percent decline in gold prices, inflation exceeding 5 percent, and a 10 percent income contraction, welfare impacts intensify. Unemployment in informal-sector-dominated regions increases by 1.8–2.4 percentage points, while poverty rises by 1.2–1.9 percentage points. The gold–digital interaction term turns negative and statistically significant at approximately −0.22, indicating that digital bullion accelerates shock transmission. Physical gold holders maintain consumption for an estimated 2–3 months longer than digital users, reflecting delayed liquidation and higher behavioral resilience. Quantitatively, the results show that bullion supports welfare only under specific macroeconomic stress, while digitalization improves liquidity at the cost of greater volatility transmission. Hybrid physical–digital configurations consistently yield smaller welfare losses, reducing crisis-induced poverty increases by roughly 0.6–0.8 percentage points compared to digital-only regimes, underscoring their superior stress resilience.

Table 3. Welfare stress-test scenarios and outcomes

Scenario/assumption	Reported results	Interpretation
Baseline: gold price ±5%; inflation ≈2–3%	Gold-ownership coefficient described as statistically insignificant; poverty and unemployment changes below 0.2 percentage points	Limited welfare response in stable conditions
Appreciation: gold price +30%	Gold × digital access coefficient ≈+0.18; consumption-smoothing improvement 1.6–2.1%; poverty reduction below 0.5 percentage points	Digital-access gains concentrated in high-readiness regions
Severe shock: gold price −20%; inflation >5%; real income −10%	Unemployment +1.8–2.4 percentage points; poverty +1.2–1.9 percentage points; interaction ≈−0.22	Amplification of shocks under digitally exposed conditions
Physical versus digital holdings under stress	Physical holders maintain consumption for an estimated 2–3 months longer	Behavioral and redemption certainty matter
Hybrid versus digital-only in crisis	Poverty increase approximately 0.6–0.8 percentage points smaller	Hybrid access potentially moderates welfare losses

4. Conclusions

This study illustrates macroeconomic analysis, spatial welfare mapping across all 27 regencies and municipalities in West Java, household survey evidence, and econometric stress testing to assess the welfare implications of the bullion business in both physical and

digital forms. The results show that gold-based bullion functions primarily as a stabilizing asset rather than a growth driver, with its welfare relevance intensifying during periods of inflationary pressure, exchange-rate volatility, and declining interest rates, as observed in 2025. Gold price appreciation during this period reflected classic safe-haven dynamics, yet its welfare effects were highly uneven across regions. Urban municipalities with higher incomes and stronger digital infrastructure tended to use gold as a portfolio diversification instrument, while peripheral and rural regencies relied on gold as a liquidity buffer and consumption-smoothing tool. This spatial heterogeneity confirms that bullion's welfare role is shaped more by regional socio-economic structure and institutional context than by price movements alone.

Behavioral survey evidence underscores the centrality of trust and access modality. Higher digital literacy does not automatically translate into digital bullion reliance, especially under crisis conditions. Many households revert to physical or hybrid forms of gold ownership when uncertainty rises, prioritizing redemption certainty and institutional credibility over transactional convenience. These behavioral responses explain why digital efficiency does not consistently yield welfare gains. Stress-testing simulations reinforce this asymmetry. Digital bullion improves liquidity in stable environments but, under adverse shocks, accelerates volatility transmission and short-term liquidation pressures. Physical gold, by imposing temporal friction, demonstrates greater resilience and preserves its stabilizing welfare function. Consequently, indiscriminate digitalization risks weakening gold's traditional role as a shock absorber. Overall, the evidence supports a hybrid, spatially differentiated bullion system in which digital access is anchored by guaranteed physical redemption and robust governance. Such a design aligns efficiency gains with household resilience, ensuring that bullion markets continue to contribute to inclusive welfare rather than amplifying regional inequality and systemic fragility.

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Author Contribution

Conceptualization, methodology, data collection design, empirical analysis, interpretation of results, writing of the original draft, and manuscript revision were performed by the author. The author approved the final version of the manuscript and takes full responsibility for the integrity and accuracy of the work.

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Ethical Review Board Statement

Ethical review and approval were not applicable for this study due to the non-invasive nature of the research, which relied exclusively on anonymized survey responses, publicly available secondary data, and aggregate statistical analysis. The study did not involve clinical interventions, experimental manipulation, or the collection of personally identifiable or sensitive personal data, and therefore did not require formal institutional ethical clearance.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study. Participation in the survey was voluntary, anonymous, and conducted with prior explanation of the research purpose. No identifiable personal information was collected, and respondents were free to withdraw at any stage without consequence.

Data Availability Statement

The data supporting the findings of this study consist of a combination of publicly available secondary data and anonymized survey data. Macroeconomic and regional indicators were obtained from publicly accessible sources, including Statistics Indonesia (BPS), Bank Indonesia, and official digital development indices. Due to confidentiality considerations and ethical restrictions related to respondent anonymity, the raw survey dataset is not publicly available. Aggregated and processed data supporting the conclusions of this study are available from the author upon reasonable request.

Conflicts of Interest

The author declares no conflict of interest. The author's institutional affiliation had no role in the design of the study; in the collection, analysis, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Declaration of Generative AI Use

The authors declare that no generative artificial intelligence tools were used in the preparation, writing, analysis, or revision of this manuscript. All content, interpretations, and conclusions are the sole responsibility of the author.

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