



PARAGUAY

SELECTED ISSUES PAPER

September 2026

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PARAGUAY

SELECTED ISSUES

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Approved By
Western Hemisphere
Department

Prepared By Maximiliano Appendino, Pablo Alonso (both WHD), Emanuel Kopp (ICD), Lisa Kolovich, Vivian Malta (both SPR), and Duncan MacDonald (FAD).

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DRIVERS AND SUSTAINIBILITY OF CREDIT GROWTH IN PARAGUAY¹

Paraguay's financial system is bank dominated and currently liquid, profitable, and well capitalized. Credit growth has been strong in recent years—outpacing regional peers—in the context of robust economic activity. While it has moderated more recently, consumer credit continues to expand more rapidly, supported by digitalization, strong economic activity, and greater financial inclusion. Although NPLs remain close to historical lows, this raises questions about potential vulnerabilities, especially if combined with other shocks, such as droughts. For instance, in 2019 and 2022, Paraguay experienced two droughts, which coincided with periods of flat economic growth, owing to their negative impact on agricultural and hydroelectric production, as well as river navigation. The particularly severe drought in 2022 reduced agricultural output by 33.6 percent in the first half of the year and was followed by a significant increase in NPLs over the subsequent year.

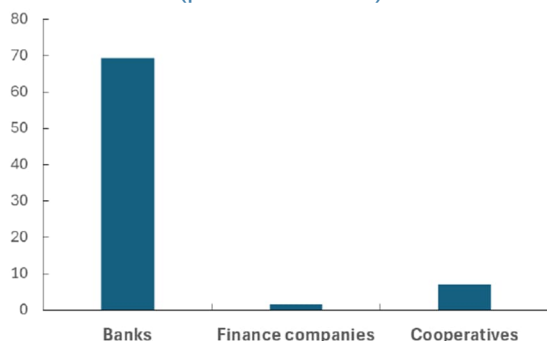
To examine these questions, this paper uses a macro financial modeling tool developed by the IMF Institute for Capacity Development customized for the case of Paraguay. Staff considered two shock scenarios: a drought calibrated to the experiences in 2019 and 2022, and an asset quality deterioration in addition to the endogenous deterioration due to the drought. The results suggest that Paraguay's financial system is resilient to these scenarios, with buffers sufficient to sustain the provision of credit—and thereby supporting economic growth—even under combined shocks. However, more severe shock combinations could generate amplification effects, including as banks' efforts to rebuild buffers would be associated with tighter financial conditions. These findings underscore the importance of close supervisory monitoring and strengthening the supervision of climate-related risks. Development of the macroprudential policy toolkit, especially of borrower-based tools (e.g., DSTI limits), would also increase the room of maneuver to contain vulnerabilities from the expansion of consumer credit.

A. The Financial System in Paraguay

1. Paraguay's financial system is bank dominated, with rising but lower than regional peers' concentration. Banks' assets accounted for around 70 percent of GDP in 2025, while financial companies represented a much smaller share (around 1.5 percent of GDP). The Superintendency of Banks (SIB) at the Central Bank of Paraguay (BCP) supervises these two types of institutions. Cooperatives of savings and credit accounted for about 7 percent of GDP in assets and are supervised by the Instituto Nacional de Cooperativismo (INCOOP). The INCOOP is an autonomous public institution whose governance includes representatives from the cooperative sector and members appointed by the Executive Branch (see Figure 1). In recent years, a series of mergers among banks with significant asset shares has led to an increase in market concentration, but it is still below LA5 average (see Figure 2).

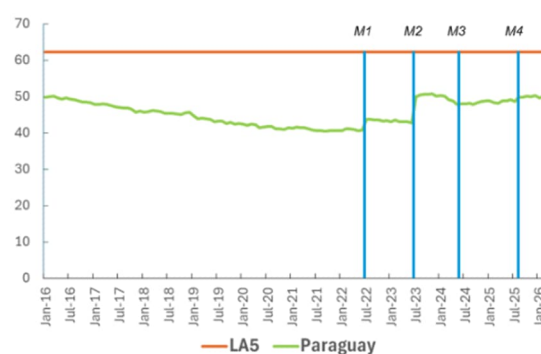
¹ Prepared by Maximiliano Appendino (WHD), Pablo Alonso (WHD), and Emanuel Kopp (ICD).

Figure 1. Paraguay: Total Assets of Financial Intermediaries, 2025 (percent of GDP)



Sources: Central Bank of Paraguay; and IMF staff calculations.
Note: Assets include loans, BCP assets, investments in public and private securities, cash and bank balances (available funds), other investments, and other assets as of June, 2025.

Figure 2. Paraguay: Top 3 Banks' Assets (percent of system assets)



Sources: Central Bank of Paraguay; and IMF staff calculations.
Note: LA5 is the simple average 2016–2021 of share top 3 bank assets from Global Financial Development Database of the World Bank for Brazil, Chile, Colombia, Mexico, and Peru.
Merge 1: GNB – BBVA (July 2022)
Merge 2: Sudameris – Regional (July 2023)
Merge 3: UENO – Visión (June 2024)
Merge 4: Continental – Río (August 2025).

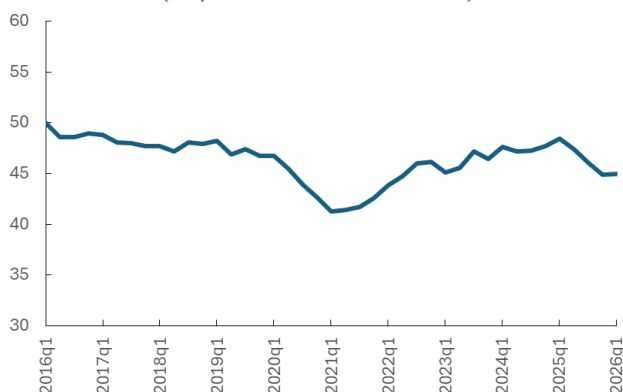
2. Credit has been largely funded by deposits, while dollarization has declined modestly. Loans have grown slightly faster than deposits, with the loan-to-deposit ratio rising marginally above 100 percent (see Figure 3), while deposits remain the main source of funding, accounting for around 78 percent of total liabilities in 2025. At the same time, overall credit dollarization has declined by about 5 percentage points over 2016–2026Q1 (see Figure 4), while dollarization in the primary, secondary, tertiary, and consumer sectors has increased moderately (see Figure 5). This was driven mainly by a reduction in the share of lending to the primary sector (see Figure 6) as well as the appreciation of the Guaraní in 2025.²

Figure 3. Paraguay: Total Loans to Deposits (percentage)



Sources: Central Bank of Paraguay; and IMF staff calculations.

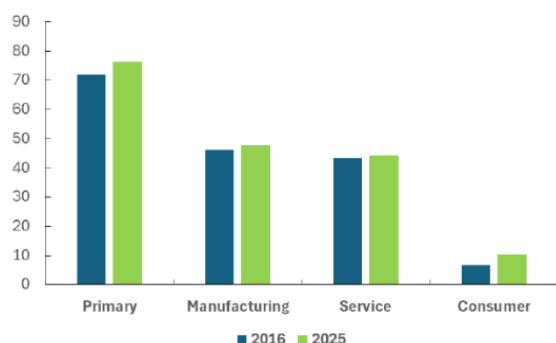
Figure 4. Paraguay: Credit in Foreign Currency (in percent of total credit)



Sources: Central Bank of Paraguay; and IMF staff calculations.

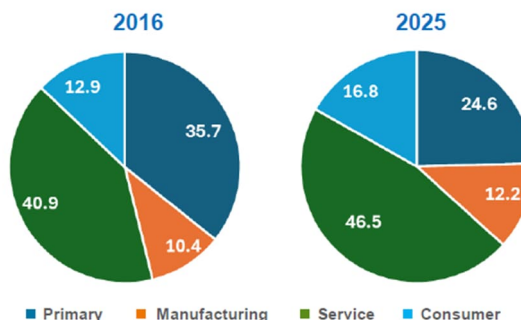
² The Guaraní appreciated 16 percent over 2025. Relative to end-2025, it appreciated by 1.1 percent in the 2026Q1, and by 9.1 percent as of April. Consumer credit dollarization remains limited, accounting for less than 10 percent of total consumer lending. Overall dollarization is instead driven by foreign-currency exposure in the primary sector, which is largely mitigated by a natural hedge, as revenues in this sector are predominantly linked to U.S. dollar-denominated exports.

Figure 5. Paraguay: Foreign Currency Credit (in percent of total credit by sectors)



Sources: Central Bank of Paraguay; and IMF staff calculations.

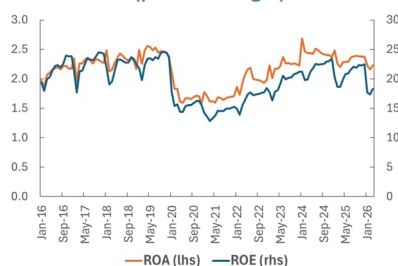
Figure 6. Paraguay: Share Total Credit (percentage)



Sources: Central Bank of Paraguay; and IMF staff calculations.

3. The financial system remains robust, with strong profitability, adequate liquidity buffers, and solid capital. Bank profitability has recovered from recent shocks and remains broadly stable, with return on assets (ROA) at 2.2 percent and return on equity (ROE) at 18.3 percent in March 2026 (see Figure 7). Liquidity levels have declined gradually from pandemic-related highs supporting recent credit expansion with liquid assets standing at 24.6 percent of total liabilities in the same period at adequate levels (see Figure 8).³ The system is well capitalized, with capital adequacy ratios at 17.8 percent (Tier 1 plus Tier 2) and 12.6 percent (Tier 1) in March 2026, above regulatory minimums of 12 percent and 8 percent, respectively (see Figure 9).⁴

Figure 7. Paraguay: Profitability (percentage)



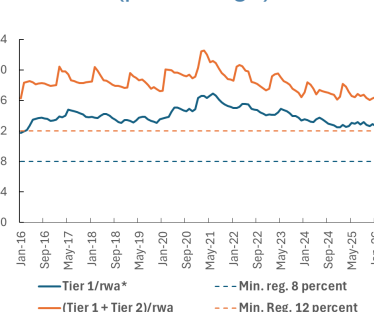
Sources: Central Bank of Paraguay; and IMF staff calculations.

Figure 8. Paraguay: Liquidity (in percent of total liabilities)



Sources: Central Bank of Paraguay; and IMF staff calculations.
Note: Liquidity includes cash and short-term investments. Liabilities include deposits, loans from financial institutions (domestic and foreign), obligations and bonds (private sector bonds), and other liabilities.

Figure 9. Paraguay: Capital Adequacy (percentage)



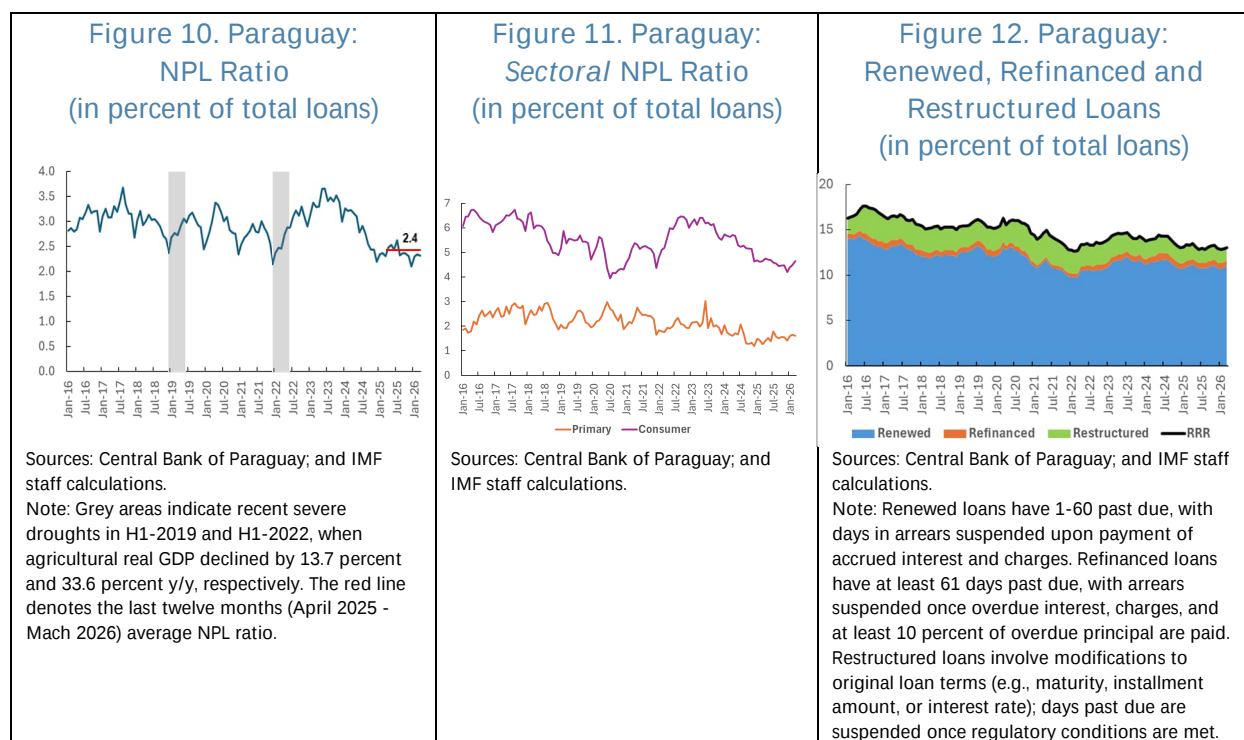
Sources: Central Bank of Paraguay; and IMF staff calculations.
Note: rwa is risk-weighted assets.

4. BCP's Financial Soundness Indicators point to strong asset quality after a series of shocks. With the 2019 drought Non-performing loan (NPL) ratios rose from 2.7 percent in January

³ See Banco Central del Paraguay (2026).

⁴ Banks' capitalization has remained comfortably above regulatory minimums, consistent with the system being viewed by observers as largely self-insured.

to an average of 3.3 percent by the second quarter of 2020, the more severe 2022 drought, right after the pandemic, started with NPL ratio at 2.4 percent and resulted in a higher peak, with NPLs reaching 3.7 percent by the second quarter of 2023 (May–June). NPL ratios have declined since then, and, in March 2026, the NPL ratio for total credit stood at 2.3 percent (see Figure 10), below its historical average of 2.9 percent over 2016–2026Q1. Sectoral NPL display similar dynamics. For instance, consumer credit exhibits higher NPL ratios than other sectors and its NPL ratio declined to 4.7 percent in March 2026, compared with a historical average of 5.5 percent (see Figure 11). Broader measures of asset quality display a similar pattern. For instance, renewed, refinanced, and restructured loans have remained close to historical minima, averaging 13.1 percent over 2025–2026Q1, well below the 14.8 percent average recorded over 2016–2026Q1 (see Figure 12).



B. Evolution of Credit in the Financial System in Paraguay

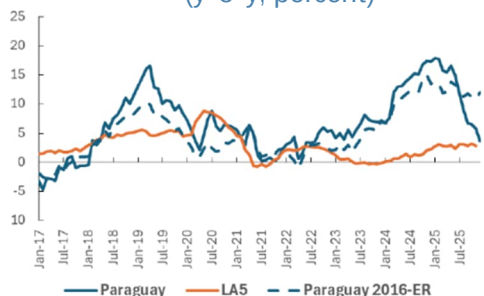
5. Credit in Paraguay has exhibited solid dynamism in recent years, surpassing its peers. Credit growth in Paraguay has been more volatile and, in the post pandemic period, expanded at a faster pace than in regional peers. Total real credit growth averaged around 11.8 percent y-o-y in 2025, compared to 2.8 percent y-o-y in average for LA5 countries.⁵ More recently, however, this divergence has diminished, with overall credit growth converging closer to the regional rates of around 3 percent as aggregate credit dynamics moderated in late 2025 and early 2026 (see Figure 13).⁶ Consumer credit growth, by contrast, has been sustained in Paraguay, averaging

⁵ Credit is expressed in real terms using country-specific CPI deflators.

⁶ Figure 13 also shows that the depreciation and appreciation of the Guarani have played a role on the volatility of credit growth in Paraguay, due to the dollarization of its financial system. Adjusting for the 2016 average exchange rate, total credit continues to grow at around 14 percent y-o-y in real terms in early 2026.

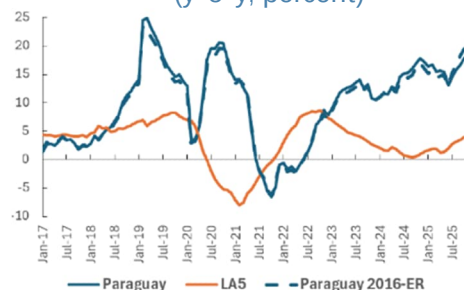
16 percent y-o-y in 2025 versus 2.7 percent y-o-y in LA5 peers, and standing at around 20 percent y-o-y by 2026Q1, compared with 4.5 percent y-o-y in the region (see Figure 14).⁷

Figure 13. Paraguay: Real Total Credit (y-o-y, percent)



Sources: Haver Analytics; national authorities; and IMF staff calculations.
Note: LA5 is the simple average of the real credit growth rates for Brazil, Chile, Colombia, Mexico, and Peru. In Paraguay 2016-ER, foreign-currency credit is adjusted to the 2016 average exchange rate.

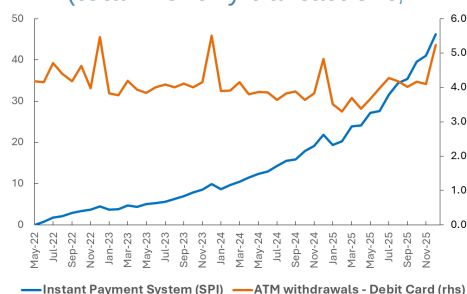
Figure 14. Paraguay: Real Consumer Credit (y-o-y, percent)



Sources: Haver Analytics; national authorities; and IMF staff calculations.
Note: LA5 is the simple average of the real credit growth rates for Brazil, Chile, Colombia, Mexico, and Peru. In Paraguay 2016-ER, foreign-currency credit is adjusted to the 2016 average exchange rate.

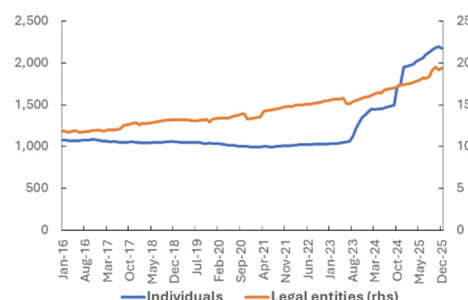
6. Ongoing digitalization has strengthened the payment system and supported financial inclusion, contributing to consumer credit dynamism. The modernization of the digital payment infrastructure through legal and technological reforms have supported the digitalization of payment systems and have contributed to a reduction in cash usage (see Figure 15).⁸ Improved access to financial services, supporting broader financial inclusion and facilitating the expansion of formal credit to both individuals and firms (see Figure 16).⁹ The expansion of the borrower base may have contributed to the rapid growth of the consumer credit segment.

Figure 15. Paraguay: Digitalization and Use of Cash (total monthly transactions; million)



Sources: Central Bank of Paraguay; and IMF staff calculations.

Figure 16. Paraguay: Agents with Credit (thousand)



Sources: Central Bank of Paraguay; and IMF staff calculations.

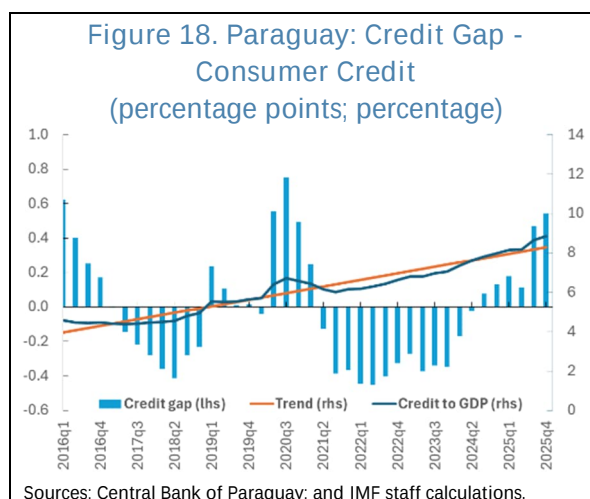
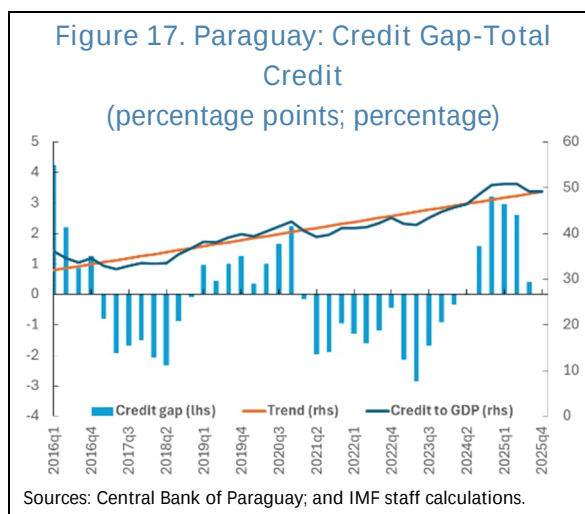
⁷ Adjusting for the 2016 average exchange rate presents smaller differences in the case of consumer credit as it is largely in domestic currency.

⁸ For instance, in 2025, Law 7503 of the National Payment System replaced the 2012 law enhancing the BCP's supervisory and regulatory role for the clearing, settlement, and custody of payments and securities, focusing on security, efficiency, interoperability, and financial inclusion. In 2022, Paraguay launched the retail fast payment system (SPI, Sistema de Pagos Instantáneos) as part of the Paraguay Payment System (SIPAP, Sistemas de Pagos del Paraguay), managed by the BCP. SIPAP's infrastructure is being upgraded continually, and the BCP relaunched its brand in April 2026.

⁹ The 2014 Financial Inclusion Strategy contributed to these results and an updated strategy is expected this year in the context of the Paraguay 2050 National Development Plan.

7. The solid dynamism of credit in recent years has been consistent with robust economic activity. Total credit growth stood at 6.8 percent y-o-y (nominal) in December 2025, following a marked acceleration in the first quarter of 2025, when average growth reached around 22 percent y-o-y. This moderation is reflected in the evolution of the credit gap, that reached about 3 percentage points above its trend level in the first quarter of 2025 and closed by the end of the year with the credit-to-GDP ratio at around 50 percent (see Figure 17).¹⁰ Credit growth across the primary, secondary, and tertiary sectors has likewise narrowed their respective credit gaps over the course of the last year.¹¹

8. By contrast, consumer credit has continued to expand at a faster pace. Consumer credit growth averaged around 21 percent y-o-y in the first quarter of 2025 and remained elevated at 21.7 percent y-o-y in December, bringing the consumer credit to GDP ratio to 8.5 percent in 2025. As a result, the consumer credit gap remained positive, at around 0.5 percentage points above its trend level by the end of the year (see Figure 18).¹² While these developments partly reflect strong domestic



¹⁰ Credit-to-GDP ratio for total and by sectors is calculated as total credit from the last month of each quarter to four-quarter-moving total nominal seasonally-adjusted GDP in quarterly data, and trend and credit gap are calculated following BIS (2010). The results are very similar under the methodology proposed by Barrail et al., 2024, which also uses moving-averages for EMDE cases and are also broadly consistent with the credit gap presented in the Central Bank of Paraguay's financial stability reports.

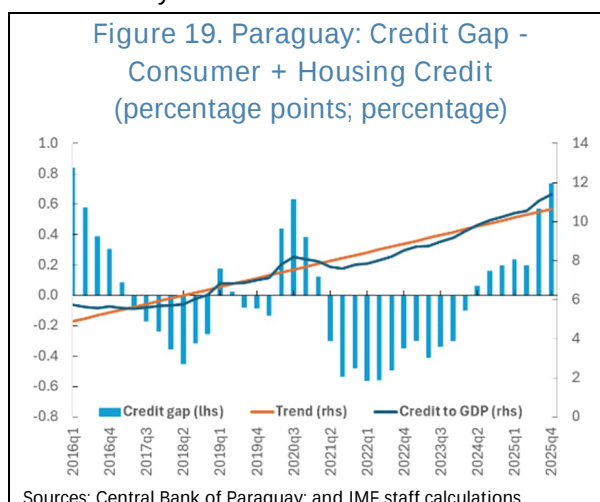
¹¹ Credit is grouped into consumer and non-consumer categories, following the classification of the data published by the SIB, with the latter comprising three subsectors based on the supply-side classification: the primary sector (including agriculture and livestock sectors), the secondary sector (manufacturing and construction sectors), and the tertiary or services sector (the remaining non-consumer sectors that include wholesale trade, retail trade, services, financial intermediation, housing, real estate activities, public administration, and other). As consumer credit continued to expand at a rapid pace, it recorded the largest positive credit-to-GDP gap as of 2025Q4, at 0.5 percentage point above its trend level. This was offset by negative gaps in the overall non-consumer sectors, where dispersion across subsectors—particularly in the primary and manufacturing sectors whose credit gaps added up to -0.7 percentage point—resulted in a combined credit-to-GDP gap of around -0.5 percentage point relative to its trend level. Within this segment, credit to the services sector followed the same broad pattern of acceleration until mid-2025 and subsequent deceleration, but at a slower pace than other non-consumer subsectors, allowing it to maintain a positive credit-to-GDP gap of 0.2 percentage point above its trend level by year-end.

¹² Total credit, exchange rate adjusted (2016 average), presents a positive gap by end 2025 driven mainly by consumer credit gap. Consistently, total credit excluding consumer presents a closed gap with and without exchange rate adjustment.

demand and improved access to credit, the persistence of a positive gap underscores the importance of continued monitoring of consumer credit dynamics.¹³

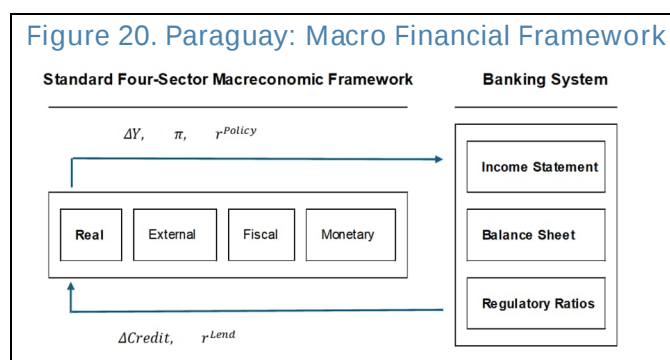
C. Modeling Macro-Financial Dynamics in Paraguay

9. With broadly sustainable aggregate credit growth, this section asks how resilient the banking sector is to adverse shocks. It asks how recurrent weather shocks such as droughts, a key exogenous risk in Paraguay, could affect macroeconomic and financial conditions, and whether rapid consumer credit growth represents an additional source of vulnerability. A last question is how these risks might interact if both, a drought and a deterioration in consumer credit quality, were to materialize simultaneously.



10. Staff address these questions by modeling macro-financial linkages, allowing for two-way feedback between the real economy and financial sector. To this end, the analysis relies on a framework (Elekdag and others, 2026, forthcoming), in which the banking system is an endogenous propagator of shocks rather than a passive intermediary. Real shocks affect bank income, capital, and balance-sheet positions; the resulting changes in bank capitalization then feed back into the real economy through credit conditions. This two-way feedback allows assessing how an initially well-capitalized banking system absorbs and propagates shocks over the medium term, and how this response affects the real economy.

11. The architecture mirrors real-life macro-financial transmission across three recursive blocks (Figure 20).¹⁴ A real-economy block governs the output gap, credit demand, and monetary policy. A banking-system block projects the aggregate income statement, balance sheet, and capital adequacy ratios using accounting identities and IMF Financial Soundness Indicators (IMF FSI).¹⁵ A lending-conditions block closes the loop by feeding



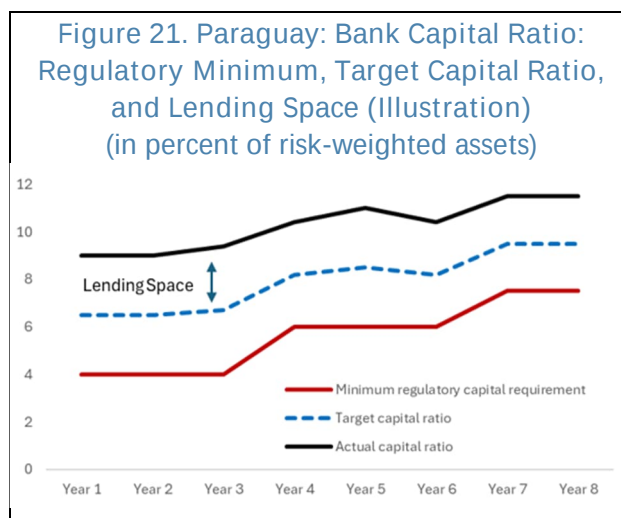
¹³ Mortgage lending remains small in Paraguay—accounting for less than 5 percent of total credit—and cannot be separately identified in publicly available data. In our analysis, mortgage loans are embedded within housing credit, which is classified under the tertiary (services) sector. If this sector was added to the consumer credit instead, all the results would remain robust. Consumer + housing credit-to-GDP ratio would reach 10.9 percent in 2025, and the consumer credit gap would remain around 0.7 percentage point above its trend level by year-end (see Figure 19).

¹⁴ See the Anex for technical details of the model.

¹⁵ Data for this block is from the Financial Soundness Indicators database at published at [IMF Data portal](https://data.imf.org/).

banking-sector conditions back to the real economy via a monetary conditions index that combines the policy rate and the lending rate. The blocks are solved sequentially within each period; financial conditions affect output with a one-period lag, all other effects are contemporaneous.¹⁶

12. The framework's distinctive contribution is the non-linear regime that activates once lending space exhausts — that is, once the Tier-1 ratio falls through the target (Figure 21). At that point, rebuilding capital through retained earnings or new equity is too slow or too costly to be the only response. In the model, banks compress balance sheets directly, shrinking risk-weighted assets through tighter underwriting and lower credit supply; the model also activates a non-linear amplification of the lending-rate response and an asymmetric, sharper cut to dividend payouts to retain earnings. Under normal conditions (absent of large negative shocks and with capital sufficiently above the target; i.e. with a positive capital gap), these mechanisms are silent and the model behaves linearly. Under large negative shocks, however, the mechanisms become active and reinforce the financial accelerator, generating the threshold-driven dynamics that distinguish macro-financial dynamics under large negative shocks from smaller, more frequent ones.¹⁷



13. We apply shocks stemming from a drought and an additional deterioration in asset quality. The application of the framework is calibrated to a steady state close to the current state of Paraguay's macroeconomy. This is a natural assumption given the output gap is only slightly positive, the fiscal deficit expected to return to the fiscal responsibility law ceiling in the near term, and inflation expected to converge this year to the Central Bank's target with well-anchored expectations. Against this baseline, we consider two shocks: a drought-related contraction of the output gap and an exogenous deterioration in asset quality, applied either separately (Scenario 1) or in combination (Scenario 1 and 2):

- Scenario 1. A drought reflects a recurrent supply-side shock that affects agricultural and electricity production as well as logistical costs as river navigation becomes more difficult and costly. We model it as centered at 4pp to steady-state GDP growth, considering a severity sweep of ± 2 pp. This calibration follows the experience in the 2019 and 2022 droughts.¹⁸

¹⁶ The impact of the financial conditions on the real economy and its feedback is the financial accelerator. Without this financial accelerator, recovery is faster overall.

¹⁷ Without financial accelerator the capital gap channel is absent, and the lending rate does not respond to movements in the capital gap, and recovery is faster overall.

¹⁸ In 2019, after growing 4 percent per year in 2017-18, the drought led to a contraction of 0.4 percent, driven by agricultural GDP reduction by 13.7 percent y-o-y in the first half of the year. In 2022, after growing by 1 percent per year in 2019-2021, real GDP did not change driven by agricultural output contraction of 33.6 percent in the first half of the year.

- Scenario 2. Asset quality deterioration layered on top of the endogenous NPL increase caused by the drought. We model this exogenous shock with a +3pp increase in the banking system's NPL ratio. We rationalize it with 1.5–2pp from the drought in the previous scenario, and 0.5–1pp from consumer credit deterioration and increase of its share of total credit.¹⁹ The two shocks together define the combined scenario.

14. Paraguay's banking system as a whole appears to have sufficient buffers to continue the provision of financial services and credit to support economic growth even under adverse conditions (Figure 22).²⁰ In these simulations we set the Tier-1 target capital ratio at 12 percent. This value is 4pp above the regulatory minimum and actual Tier-1 capital ratio has remained above this value since mid-2016 despite the repeated shocks.²¹ The results in Figure 22 show that under a drought shock to the output gap, the capital ratio is likely to remain above the 12 percent target capital ratio.²² Once we add the 3pp additional NPL shock in Scenario 2 due to additional asset quality deterioration on top of the endogenous NPL increase from the drought shock in Scenario 1, Tier-1 capital declines more significantly and the actual ratio falls below the target ratio. This result triggers non-linear amplification as banks constrain credit supply by increasing the lending rate to rebuild their capital buffers above their target, rendering credit more expensive and curbing demand for bank loans.²³

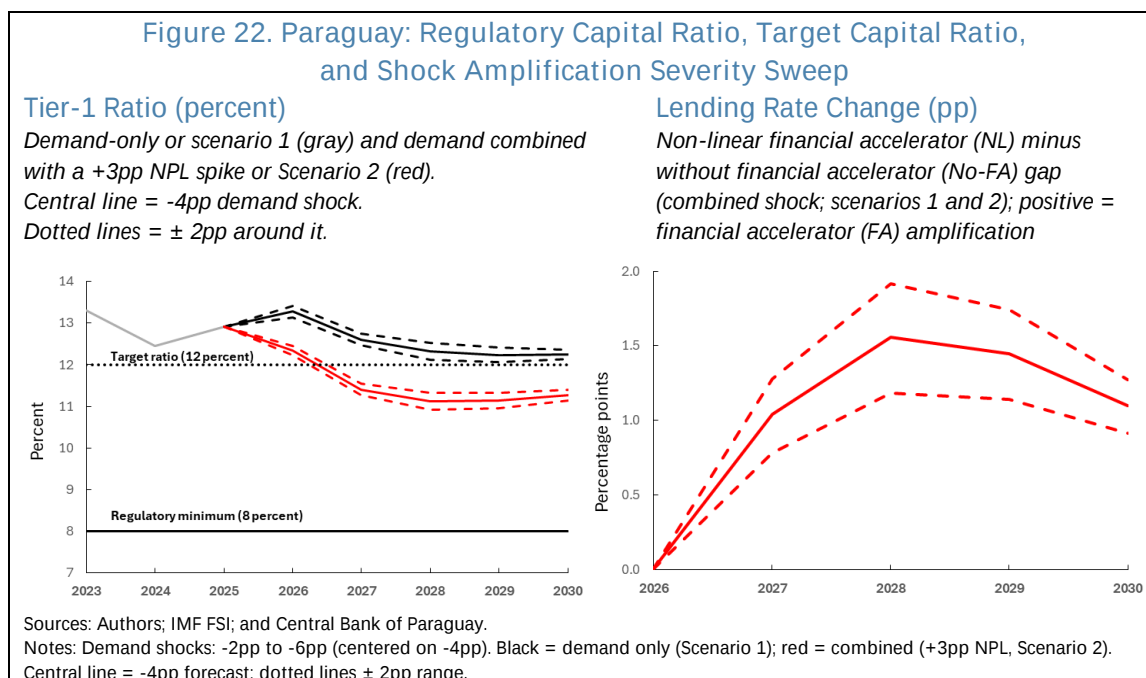
¹⁹ First, for total NPL ratio during droughts, see the discussion of Figure 10 above. These variations of the NPL ratio are likely understated because of timebound and targeted regulatory measures following these episodes in 2019 and 2022, as well as the pandemic in 2020. Second, the consumer credit NPL ratio ranges by 1.8 pp in the annual series and 2.8 pp in the monthly series. The share of consumer credit in total credit increased from 12.9 percent in 2016 to 16.8 percent in 2025; extrapolating recent sectoral trends, the share of consumer credit would double roughly every five years. Lending standard deterioration could lead to similar shocks to asset quality.

²⁰ The framework focuses on the aggregated banking system, where all individual banks are combined into a representative bank. Importantly, individual institutions are not considered, and this exercise is not a prudential bank or banking sector stress test. The framework thus cannot answer questions pertaining to individual institutions, including with respect to their solvency and liquidity positions, interconnectedness, or ability to withstand shocks. Instead, the focus of the framework is on macro-financial transmission and the banking system's ability to supply the credit demanded by the real economy. Nevertheless, the conclusion from this analysis is consistent with stress tests conducted under a bottom-up approach by the authorities with supervisory data, where they find that the financial system remains adequately capitalized even under the materialization of adverse and extreme (low probability) shocks (Banco Central del Paraguay, 2026).

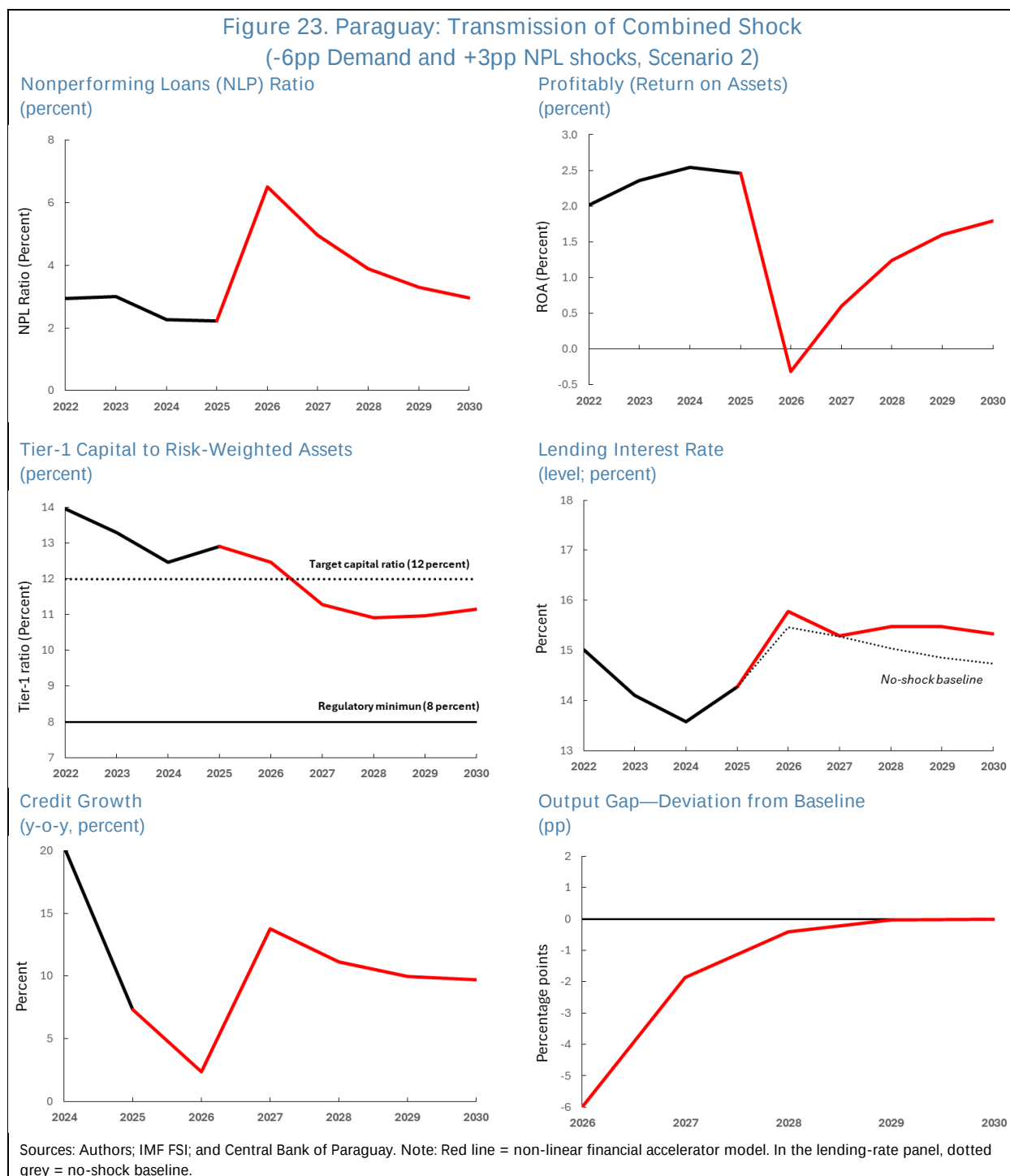
²¹ Unreported results using a target capital ratio of 13 percent yield broadly similar outcomes. However, as the average Tier 1 capital ratio has remained below this threshold over the past two years—when credit dynamics were strong as discussed in the previous section—we retain 12 percent as the baseline parameterization in the model.

²² Capital ratios under every scenario are comfortably above regulatory minimum of 8 percent.

²³ The literature identifies several mutually reinforcing forces that lead banks to target a capital ratio well above the regulatory minimum. First, Basel III's Capital Conservation Buffer triggers automatic distribution restrictions; once a bank's CET1 ratio enters the buffer range, dividends and discretionary compensation become restricted (Couaillier and others, 2022). Second, this behavior is also driven by internal risk appetite, peer benchmarking, rating-agency expectations, and buffers for idiosyncratic losses (Couaillier, 2021). Third, with respect to funding available and cost, banks operating close to the floor face wider CDS and potential rating downgrades, raising its marginal funding cost well before any formal threshold is breached (Berrospide and Edge, 2010; Cohen and Scatigna, 2016; Andreeva and others, 2020). The binding "minimum" for bank decision-making is therefore the internal target capital ratio—typically several percentage points above the regulatory minimum—so capital pressure binds, and lending contracts, well before regulatory thresholds are crossed.



15. The combined shock scenario reveals a banking system that can absorb severe adverse events, but real-financial feedback effects would result in a materially slower economic recovery. Figure 23 traces the transmission of a simultaneous worst (-6pp) drought-induced economic contraction and asset-quality deterioration through six core variables, showing the non-linear financial accelerator model (red). Capital adequacy is preserved throughout: the Tier-1 ratio remains comfortably above the 8 percent regulatory minimum at every horizon and every size of shock considered, and the banking system as a whole never dips below the regulatory minimum. However, the combined shock (worst scenario 1, and 2) does pull Tier-1 below the 12 percent management target, though the system remains well above the 8 percent regulatory minimum.



16. The shock transmits through the banking system in this sequence: rising NPLs, higher provisioning, lower profits, and weaker retained earnings, which narrow the lending space as the capital ratio drops. The additional NPL spike combines with the endogenous rise driven by the negative output gap, pushing asset quality sharply lower on impact in 2026 (top-left).²⁴ Higher

²⁴ The shock in 2026 is set for modeling purposes, as annual data are only available through end-2025. A drought in 2026 is unlikely to materially affect agricultural GDP in that same year—given agricultural performance in the early harvest period following abundant rainfall in the second half of 2025.

provisioning hits in the first period (top-right), leaving little retained income to rebuild capital. As a result, the Tier-1 ratio (middle-left) falls sharply between 2026 and 2028, dropping through the target ratio in 2027. From this point, the system sees its voluntary buffer eroded, which triggers a behavioral response from banks who will want to rebuild voluntary buffers, even if regulatory requirements are still met.

17. Once the target capital ratio is crossed, the financial accelerator activates and the shock gets amplified through real-financial feedback effects. Banks respond to eroded buffers by raising spreads to rebuild capital faster—this is the self-protective behavior that motivated the 4pp management buffer in the model.²⁵ The lending-rate (middle-right) jumps and stays elevated above its no-shock baseline throughout the horizon.²⁶ Credit growth (bottom-left) collapses in 2026—primarily reflecting the contraction in credit demand from the drought-induced output drop—then rebounds in 2027 as the output gap closes, before settling near its baseline path. These two channels feed back into output with a one-period lag, leading to a recovery that takes two years (bottom-right).

D. Conclusions

18. The banking system as a whole appears robust to a combination of shocks, but real-financial feedback effects could slow the recovery under a combination of severe shocks. As the system is profitable, liquid and with ample capital buffers, even under the most extreme shocks modelled, the banking system as a whole would continue the provision of financial services and credit to support economic growth. However, the more severe combination of shocks, that adds up a drought and a significant deterioration to the system's asset quality, would trigger amplification effects due to banks' intention to rebuild voluntary buffers. These amplification effects would result in a slower recovery of the economy under the severe combination of shocks.

19. The risks associated with the exposure of the economy and the banking system to climate shocks call for continued monitoring and enhancements of risks management and supervisory frameworks. Ensuring that climate-related risks, particularly droughts, are adequately incorporated into banks' risk assessment frameworks remains important. In the context of the recently concluded RSF, the SIB amended the resolution governing credit registry data collection to require banks to provide geographic information on loan portfolios and associated collateral. It also developed a framework to monitor and assess these risks and issued supervisory guidelines for banks to incorporate them into their risk management frameworks, together with timelines for their adoption. Since then, the SIB has been working with financial institutions to support implementation in line with the established regulatory timetable. These efforts should continue to enhance the financial system's ability to measure climate-related risks and mitigate losses when they materialize, thereby reducing potential recapitalization needs for banks.

²⁵ See Figure 9 and footnote 4.

²⁶ Monetary policy in the model responds to the output gap and may mitigate the impact of the shock on lending rates—see equation (3) in Annex I.

20. Rapid consumer credit growth warrants close monitoring, supported by the development of macroprudential tools. Continued monitoring and readiness to act if evidence of weakening underwriting standards emerge, including through moral suasion, would help preserve asset quality. The development of the macroprudential toolkit could further shield the financial system. The current regulatory framework does not establish borrower-level debt-service-to-income (DSTI) limits. While the analysis suggests the system remains resilient even under severe shocks, the development of such tools (e.g., data collection, calibration, and stakeholder consultation) may take time and thus an early start would provide additional tools to the authorities to ensure a sustainable and growth-enhancing provision of credit.²⁷

²⁷ The development of borrower-based macroprudential tools could benefit from leveraging the rich information available from the three active licensed credit bureaus, as well as the Credit Risk Central managed by the BCP.

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Annex I. Model Equations

The model is organized into three recursive blocks: a real-economy block, a banking-system block, and a lending-rate / monetary-conditions block. The model is solved sequentially within each period; financial conditions affect output with a one-period lag via $mci(t-1)$. All equations below follow the specification of Elekdag and others (2026).

A. Block 1: Real Economy

Output Growth Gap (IS curve)

$$\hat{y}_t = \rho_y \cdot \hat{y}_{t-1} - b_{y,mci} \cdot mci_{t-1} + \varepsilon_{ty} \quad (1)$$

Realized real output growth rate (identity)¹

$$g_{ty} = \bar{g}_y + (\hat{y}_t - \hat{y}_{t-1}) \quad (2)$$

Policy Rate

$$r_t = (1 - \rho_r) \cdot \bar{r} + \rho_r \cdot r_{t-1} + b_{Taylor} \cdot \hat{y}_{t-1} + \varepsilon_{tr} \quad (3)$$

Credit-to-GDP Trend (time-varying anchor)

$$\bar{cred}_t = \bar{cred} + g_{cred} \cdot t \quad (4)$$

Credit-to-GDP (cycle form, AR(1) on deviation from trend)²

$$cred_t - \bar{cred}_t = \rho_{cred} \cdot (cred_{t-1} - \bar{cred}_{t-1}) + b_{cred,y} \cdot \hat{y}_t - b_{cred,rL} \cdot (r_{Lt-1} - \bar{r}_L) \quad (5)$$

B. Block 2: Banking System

Asset Trend, BGG Error Correction, and Shortfall Drag³

$$Attrend = A_{t-1}trend \cdot (1 + \bar{\gamma}/100) \quad (6)$$

$$\gamma_t = \bar{\gamma} + (\hat{y}_t - \hat{y}_{t-1}) - b_{ec} \cdot \ln(A_{t-1} / A_{t-1}trend) - b_{\gamma,short} \cdot shortfall_{t-1} \cdot \mathbb{1}_{\{FA \text{ on}\}} \quad (7)$$

¹ The output-growth identity above (equation 2) is not used elsewhere in the model — all subsequent blocks operate directly on the gap $\hat{y}_t$ — but it makes the link between the gap-form IS curve and the more familiar growth-rate representation explicit, and clarifies the origin of the cyclical growth term $(\hat{y}_t - \hat{y}_{t-1})$ that enters the asset-growth equation in Block 2. The symbol $\bar{g}_y$ denotes the steady-state real potential growth rate.

² The cycle-form credit specification is necessary under a moving anchor: a level-form AR(1) would generate a steady-state lag of $\rho_{cred} / (1 - \rho_{cred}) \cdot g_{cred}$ below trend, feeding a permanent negative credit gap into the lending rate. In cycle form, the cycle collapses to zero in steady state and $cred_t$ tracks the anchor exactly, while impulse responses are unchanged.

³ The error-correction coefficient $b_{ec} > 0$ pulls the asset stock back to trend whenever A_{t-1} deviates from $A_{t-1}trend$, disciplining long-run drift in the Tier-1 ratio. The shortfall-drag term $b_{\gamma,short} \cdot shortfall_{t-1}$ captures the asset-side leg of bank deleveraging when capital pressure binds; it is gated on FA (active under both FA and NL configurations) so that the No-FA counterfactual remains a clean benchmark with no capital-pressure feedback. The lagged shortfall specification avoids within-period simultaneity between the capital block and the asset block.

$$A_t = A_{t-1} \cdot (1 + \gamma_t/100) \quad (8)$$

Non-Performing Loans

$$nplt = (1 - \rho_{npl}) \cdot npl + \rho_{npl} \cdot nplt_{t-1} - b_{npl,y} \cdot \hat{y}_t + b_{npl,rL} \cdot (rL_{t-1} - \bar{r}L) + \varepsilon_{tnpl} \quad (9)$$

Loan-Loss Provisions

$$LLPt = b_{llp,npl} \cdot (nplt/100) \cdot A_{t-1} \quad (10)$$

Profits (net-margin specification)

Gross income combines net interest income (NIM share, nim) and non-interest income (χ share), both scaled by lagged assets. Net profits apply the empirically calibrated net margin θ to gross income — absorbing operating expenses and tax jointly — and subtract the excess loan-loss provisions relative to their historical flow $LLPt - \delta_{llp} \cdot GrossInct$:

$$GrossInct = (nim + \chi) \cdot A_{t-1} \quad (11)$$

$$\Pi_t = \theta \cdot GrossInct - b_{\pi,llp} \cdot (LLPt - \delta_{llp} \cdot GrossInct) + \varepsilon_{t\pi} \quad (12)$$

Two-Sided Payout Rule with Floor and Ceiling

The dividend payout ratio adjusts in response to the lagged capital gap. The rule has two distinct slopes. When the bank is over-capitalized ($capgapt_{t-1} > capga\bar{p}$), the payout ratio rises by $bdpr$ per percentage point of excess capital, moderating spurious upward drift in the Tier-1 ratio. When the bank is under-capitalized ($capgapt_{t-1} < capga\bar{p}$, i.e. a shortfall is open), the payout ratio is cut by $bdpr, \downarrow$ per percentage point of shortfall. The downside slope is consistent with Basel-style distribution restrictions and the supervisory buffer-rebuilding literature; in the present calibration it is set equal to the upside slope ($bdpr, \downarrow = b_{dpr} = 0.05$), with asymmetry generated by the floor DPR_{floor} that binds only on the downside. The result is clamped between DPR_{floor} and a ceiling of 0.90:

$$DPR\tilde{t} = DPR + bdpr \cdot \max(0, capgapt_{t-1} - capga\bar{p}) - bdpr, \downarrow \cdot \max(0, capga\bar{p} - capgapt_{t-1}) \quad (13)$$

$$DPR_t = \min\{0.90, \max\{DPR_{floor}, DPR\tilde{t}\}\} \quad (14)$$

$$RE_t = (1 - DPR_t) \cdot \Pi_t \quad (15)$$

Capital Accumulation, Capital Gap, Shortfall, and Adjusted Gap

$$K_t = K_{t-1} + RE_t \quad (16)$$

$$capgapt = 100 \cdot K_t / (\omega \cdot A_t) - CAR_{reg} \quad (17)$$

$$shortfall_t = \max\{0, capga\bar{p} - capgapt\} \quad (18)$$

$$capgapt_{adj} = capgapt - \phi \cdot shortfall_t \quad (19)$$

CAR_{reg} is the minimum regulatory capital requirement and ω is the average RWA density. The management buffer $capga\bar{p} > 0$ implies an effective minimum capital ratio of $CAR_{reg} + capga\bar{p}$. When $shortfall_t = 0$, $capgap_{adj} = capgapt$ and the model is in its linear regime. When the shortfall

is positive, the adjusted gap falls further below its steady-state value, amplifying the response of the lending rate. The parameter φ controls the strength of this non-linear amplification.

C. Block 3: Lending Rate and Monetary Conditions

Lending Rate (with regime-dependent capital-gap channel)

The effective capital gap deviation $\text{capga}\tilde{t}$ entering the lending rate depends on the model configuration:

$$\text{capga}\tilde{t} = 0 \quad (\text{without financial accelerator, No-FA})$$

$$\text{capga}\tilde{t} = \text{capgapt} - \text{capga}\bar{p} \quad (\text{linear financial accelerator, FA})$$

$$\text{capga}\tilde{t} = \text{capgaptadj} - \text{capga}\bar{p} \quad (\text{non-linear financial accelerator, NL}) \quad (20)$$

The credit gap is taken contemporaneously and against the time-varying trend anchor $\text{cred}\bar{t}$ defined in Block 1:

$$rL_t = r_t + \eta + br_{L,cred} \cdot (\text{cred}_t - \text{cred}\bar{t}) - br_{L,capgap} \cdot \text{capga}\tilde{t} + \varepsilon_{rL} \quad (21)$$

Monetary Conditions Index

$$\text{mcit} = \text{bmci},r \cdot (r_t - \bar{r}) + (1 - \text{bmci},r) \cdot (rL_t - \bar{r}L) \quad (22)$$

where $\bar{r}L = \bar{r} + \eta$. The model is recursive by construction: financial conditions affect output with a one-period lag via mcit_{t-1} , while capital dynamics and lending conditions react within the period to the current macro state.

D. Summary of transmission Channels

An adverse demand shock raises NPLs, which increases provisioning costs, erodes profits and retained earnings, and gradually depletes the capital gap. With the financial accelerator (FA), this deterioration in bank capitalization operates through two channels: (i) a higher lending rate, as banks raise spreads to rebuild capital buffers; and (ii) once a shortfall opens, a direct asset-side drag on bank balance-sheet growth through by,short . Both push up the MCI and act as a drag on the recovery:

$$\hat{y}_t \downarrow \rightarrow \text{nplt} \uparrow \rightarrow \text{LLPt} \uparrow \rightarrow \Pi_t \downarrow \rightarrow \text{REt} \downarrow \rightarrow K_t \downarrow \rightarrow \text{capgapt} \downarrow \rightarrow r^{\wedge}L_t \uparrow, A_t \downarrow \rightarrow \text{mcit} \uparrow \rightarrow \hat{y}_{t+1} \downarrow$$

Under No-FA both the lending-rate and asset-deleveraging channels are absent, and recovery is faster overall. Under NL, once the Tier-1 ratio breaches the effective minimum, the same chain operates with an amplified lending-rate response through φ and a sharper retained-earnings response through the downside leg of the payout rule (binding bdpr , $\downarrow$ together with the floor DPRfloor), generating the asymmetric, threshold-driven dynamics that characterize episodes of financial stress.

FROM INFORMALITY TO FORMALIZATION: THE ROLE OF FISCAL AND STRUCTURAL POLICIES IN PARAGUAY¹

1. Labor informality remains a structural feature of Paraguay's economy, constraining productivity, revenue mobilization, and inclusive growth. Despite modest improvements in recent years, informality has remained high over 2016–2025 (Figure 1A), pointing to slow structural transformation rather than cyclical factors. Sectoral patterns help explain this rigidity: informality is concentrated in agriculture, where it is near universal, and remains elevated in services and manufacturing (Figure 1B). Together, these patterns suggest that informality is broad-based and deeply embedded across sectors.
2. Informality rates are slightly higher for women than men and vary sharply across locations and sectors. Gender differences are relatively modest, with high informality rates for both men and women in Paraguay (Figure 1C), indicating that informality may be primarily driven by job characteristics and sectoral composition. By contrast, geographic and age disparities are pronounced: rural informality substantially exceeds urban levels (Figure 1D), reflecting the dominance of agriculture and small-scale, low-productivity activities outside major urban centers. A more granular sectoral decomposition for Paraguay reinforces these findings. Agriculture and a wide range of service activities account for the bulk of informal employment for both men and women. The informality rate for men in the construction sector is more than double that for women, as is the informality rate for rural workers in the mining sector compared to urban workers (Figure 1E, F). Informality rates are much higher for those between the ages of 15-24 and 65 and older but are at their lowest those aged 25-34 and 35-44 (Figure 1G).
3. Taken together, these stylized facts point to a dual challenge: informality is both structural-rooted in sectoral composition-and spatial-concentrated in rural and low-productivity segments of the economy. This implies that effective formalization strategies will need to combine economy-wide measures, such as simplifying compliance and strengthening enforcement, with targeted interventions aimed at high-informality sectors and rural labor markets.
4. The authorities have highlighted formalization as a key objective in their reform agenda, including through efforts to streamline procedures, reduce transaction costs, and improve the business climate.² In this context, the policy challenge is framed not only in terms of improved information cross-checks, but also in terms of making compliance simpler and more attractive for firms and workers, while broadening the tax base through better enforcement, digitalization, and streamlined procedures. Understanding how the tax-benefit system shapes effective incentives at the household level can help inform reforms that advance formalization alongside equity and fiscal sustainability.

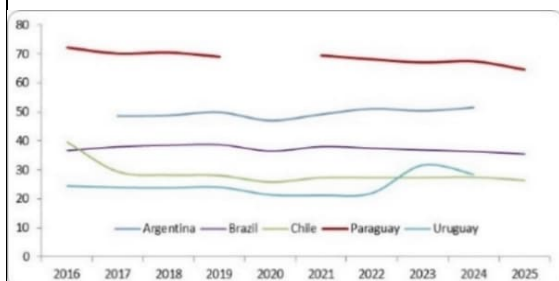
¹ Prepared by Lisa Kolovich (SPR), Duncan MacDonald (FAD), and Vivian Malta (SPR).

² Presidential Decree No. 4416 established the Integrated Strategy for the Formalization of Employment 2025 - 2028, which aims to increase the number of social security contributors by 6 percent over 2025 to 2028.

Figure 1. Paraguay: Informality Stylized Facts

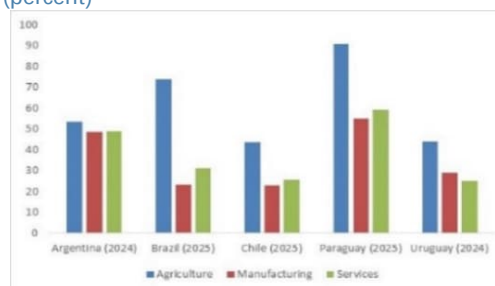
Labor informality in Paraguay remains higher than in peers, with a limited declines over the past decade

(A) Informal Employment, 2016 – 2025 (percent)



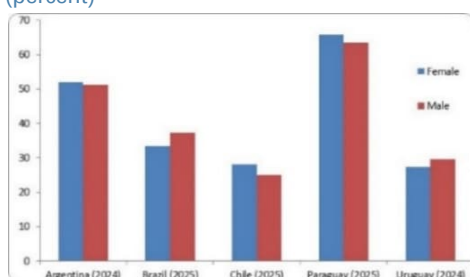
Informality is concentrated in agriculture but remains elevated across services and manufacturing.

(B) Informal Employment by Sector, Latest Year Available (percent)



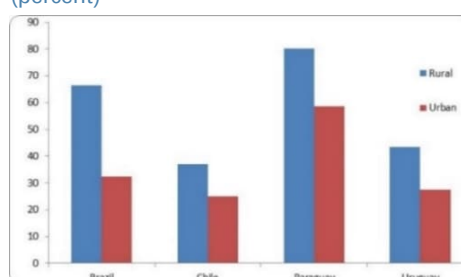
Informality rates are high for both men and women.

(C) Informality by Gender, Latest Year Available (percent)



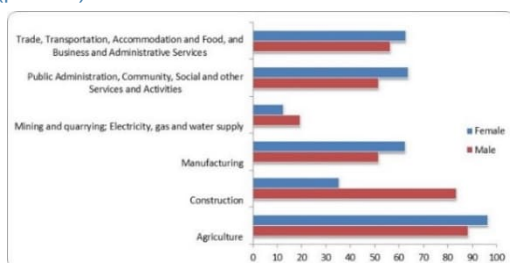
Rural informality substantially exceeds urban levels.

(D) Informality by Urban/Rural, Latest Year Available (percent)



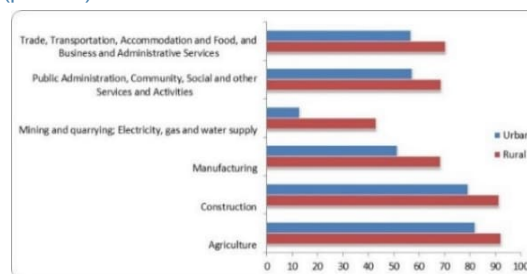
Across most sectors, women are more likely to be in informal employment...

(E) Paraguay Informality by Sector and Gender, 2025 (percent)



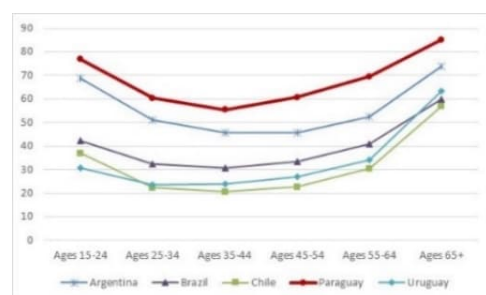
...and workers in rural regions have higher rates of informal employment compared to urban counterparts.

(F) Paraguay Informality by Sector and Location, 2025 (percent)



Informality follows a life-cycle pattern. Rates are particularly high among youth and older workers.

(G) Informality by Age Groups, Latest Year Available (percent)



Sources: World Bank; ILO; and IMF staff estimates.

5. The persistence and broad-based nature of informality also have important implications for the functioning of the fiscal system. Paraguay's fiscal system is characterized by relatively low tax revenues compared to regional peers, with a heavy reliance on indirect taxes and limited progressivity in direct taxation. Social security contributions apply primarily to formal employment, leaving a large share of workers outside contributory systems. On the benefit side, social assistance programs provide important income support but may interact with labor supply and formalization incentives, particularly for low-income households. These features raise questions about how taxes, contributions, and benefits jointly affect work incentives, formalization decisions, and income distribution—issues that are not fully captured by statutory rates or aggregate fiscal indicators.

6. To assess how different policy levers can support formalization, this paper presents two complementary strands of analysis: a structural overlapping generations (OLG) model with detailed tax and benefit microsimulations. The OLG model provides both macroeconomic and distributional insights into how increasing formalization affects the economy. In contrast, the tax and benefit microsimulation analysis focuses on granular tax and pensions policies at the household level, identifying the specific features that shape incentives to enter and remain in formal employment.

A. Using a Structural OLG Model to Analyze Aggregate and Distributional Effects of Formalization

7. The structural OLG model is designed to reflect Paraguay's economy. The model features heterogeneous households differentiated by cohort, skills, education levels, gender, and marital/family status. Agents in this model optimize lifetime utility through decisions regarding consumption of formal and informal goods and services, savings, and labor supply. The framework also captures the implicit costs associated with unpaid care work which disproportionately impacts female labor force. The model is specifically tailored to the demographic and fiscal realities of Paraguay using and replicating several statistics extracted from the 2024 *Encuesta Permanente de Hogares Continua*. The framework also reflects Paraguay's effective income tax of households in different income levels, value-added and corporate taxes, social security contributions, and pension benefits (including *Adultos Mayores* program).

8. The model analyzes the aggregate and distributional effects of increasing formalization in Paraguay. When deciding to supply formal labor, workers in this framework weigh life-cycle costs (such as paying social security contributions) against benefits (including pension entitlements), while also facing constraints related to their own education or skill levels, informality traps, and care responsibilities. In this context, the model is applied to two distinct formalization policy pathways to increase the number of social security contributors by 6 percent (Decree No. 4416). First, a demand-side shock, shifting consumer preferences away from informal goods, which represents enforcement measures such as the mandatory adoption of electronic invoicing or stricter municipal compliance for informal vendors. Then, a supply-side shock, incentivizing the growth of the formal sector, represented by TFP shock (reflecting policies that make formal firms inherently more efficient, such as reduced regulatory costs and infrastructure investment). While

both strategies can achieve the 6 percent formalization target, the results highlight different macroeconomic and distributional outcomes (Table 1 and Figure 2).

Table 1. Paraguay: Simulation Results from the OLG Model: Demand Versus Supply Shocks (percent)

Variable	Demand	Supply
Formalization Growth (FTE, percent)	6.0	6.0
Total GDP (Real Growth)	0.3	3.4
Formal GDP (Real Growth)	1.8	6.9
Average Formal Wage (Real Growth)	-1.6	1.9
Average Informal Wage (Real Growth)	-2.7	0.7
Average Male Wage (Real Growth)	0.3	3.8
Average Female Wage (Real Growth)	0.9	4.5
Average Pension (Real Growth)	2.4	6.0
Poverty Rate (levels, in percent)	26.4	25.0

Source: IMF staff calculations.

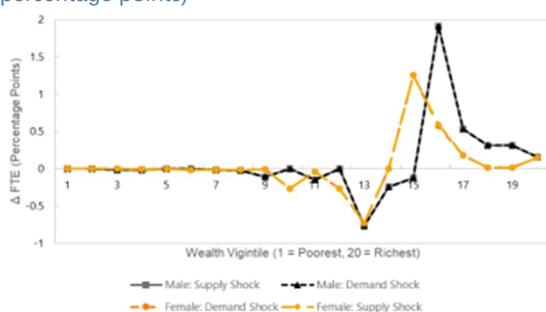
9. The supply-side intervention yields broad-based macroeconomic benefits. Real GDP expands by 3.4 percent, driven by a 6.9 percent surge in formal sector output (Figure 2, top right). As formal firms become more productive, they draw workers out of the informal sector by offering higher real wages. Average formal wages grow by 1.9 percent, and importantly, informal wages also increase by 0.7 percent as the supply of informal labor shrinks, indirectly benefiting those remaining in the sector (usually lower earners). Wage growth is particularly strong for women (+4.5 percent) under this scenario, while the national average for pensions benefits sees a substantial real increase of 6.0 percent in the new steady state. Furthermore, overall tax revenues expand significantly due to the larger economic pie (Figure 2, bottom left).

10. The demand-side intervention, however, shows smaller and less inclusive gains. While formal GDP grows by 1.8 percent, total real GDP is relatively stagnant (+0.3 percent), meaning the policy merely reallocates output without expanding the economy. Furthermore, because consumers substitute away from informal goods, the prices of informal goods decline. This adversely affects the real wages of poorer and informal workers, which fall by 2.7 percent, while average formal wages also see a slight contraction of 1.6 percent.

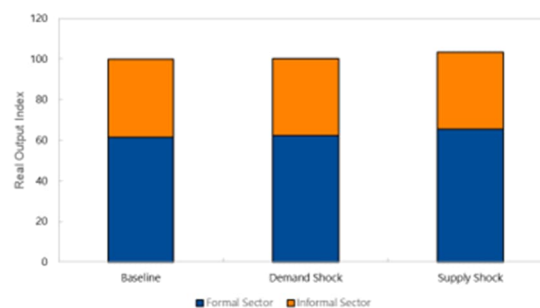
11. Results from the OLG simulations highlight an important distinction for policy design. Reforms that raise productivity and improve the functioning of the formal sector—such as infrastructure investment, digitalization, and better governance—generate broad-based and inclusive gains in output and real wages while supporting formalization. By contrast, policies that rely primarily on enforcement or shifts in demand toward formal goods may achieve formalization targets but risk adverse effects for informal and vulnerable workers.

Figure 2. Paraguay: Simulation Results from the OLG Model: Demand Versus Supply Shocks

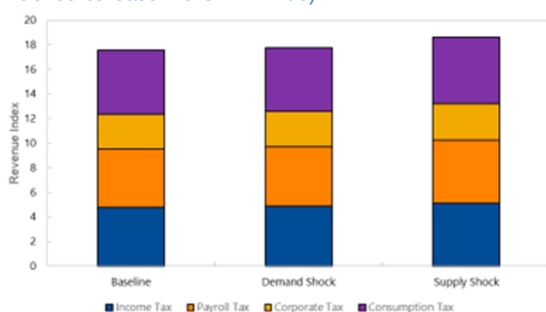
Change in Total Labor Supply (FTE) by Wealth
Vigintile
(percentage points)



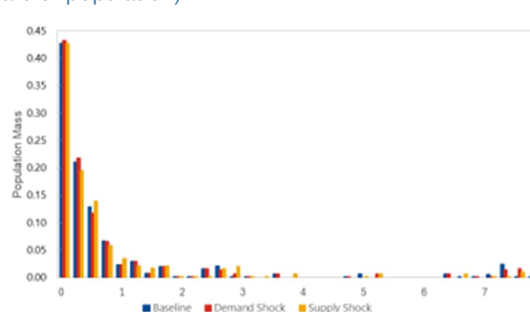
Real GDP Composition
(indexed to baseline = 100)



Tax Revenues
(indexed to baseline GDP = 100)



Real Income Distribution Shift
(share of population)



Source: IMF staff calculations.

B. Measuring and Understanding the Incentives to Formalize: Micro-Level Evidence for Policy Design

12. At the same time, the model abstracts from the detailed structure of the tax and benefit system, which plays a central role in shaping the incentives faced by workers and firms at the margin. In particular, it does not capture how specific features—such as contribution rates, eligibility thresholds, and the design of pension accrual—translate into effective tax burdens and returns to formality across households. To examine these channels more closely, the analysis now turns to micro-level evidence using the IMF's TaxFit model. This framework quantifies the effective incentives embedded in Paraguay's tax-benefit system and evaluates targeted reform options—including personal income tax design, contribution structures, and pension incentives—that can complement the broader supply-side and institutional reforms underway.³

13. Given Paraguay's high informality and the structure of its tax-benefit system, aggregate indicators however provide an incomplete picture of policy incentives. Effective tax rates and eligibility thresholds—and the way taxes, contributions, and transfers interact—vary

³ See [IMF Staff Report](#) (2026) for the final reviews of the arrangements under the Policy Coordination Instrument (PCI) and Resilience and Sustainability Facility (RSF) for a stock-taking of structural reforms under implementation.

markedly across households and between formal and informal work, shaping labor supply and formalization decisions. As a result, even when aggregate data suggest strong growth and improving labor market conditions, they can obscure substantial heterogeneity in incentives across income groups and household types. Micro level analysis of the full tax–benefit package is essential for designing policies that support formalization, labor supply, and inclusive growth (Fietz et al., 2025).

14. These features imply that formal workers bear most of the tax burden through social security contributions, while limited PIT progressivity reduces redistribution at low incomes. At the same time, means-tested benefits can interact with contributions to create localized disincentives for formal work. To address these questions, microsimulations using the IMF TaxFit tool quantify household level effective and marginal incentives under current policies and selected reforms. TaxFit is a static tax–benefit microsimulation model that computes household disposable income by applying the full set of relevant tax and benefit rules to individual and household circumstances. It incorporates personal income taxes, social security contributions, and cash benefits, making it possible to trace how both effective burdens and marginal incentives evolve across the earnings distribution. For Paraguay, the model reflects the main features of the personal tax and benefit system as described in the 2024 Article IV staff report and authorities' documentation. Results should be interpreted as short-term, partial equilibrium incentive effects, rather than full general equilibrium outcomes.⁴

15. TaxFit translates Paraguay's statutory tax and benefit rules into effective incentives faced by households through three key diagnostics: (i) average effective tax rates (AETRs), which indicate whether households are net payers or recipients once taxes, contributions, and benefits are combined; (ii) marginal effective tax rates (METRs), which capture whether earning an additional guaraní—or entering work—is financially worthwhile; and (iii) the cost of formalization, defined as the net-income difference between formal and informal work at the same earnings. Together, these metrics identify where policy design creates large wedges and where reforms can most effectively improve incentives.

16. The results suggest that improving formalization incentives in Paraguay hinges on smoothing discrete policy features—such as thresholds and eligibility rules—that generate sharp changes in marginal incentives. The AETR profile is broadly flat and rises only gradually beyond the PIT payability threshold (80 million guaraní), consistent with a low-rate system (Figure 3A). Redistribution at low incomes is limited, as cash benefits are modest and social security contributions apply only to formal work. For many households, the main policy wedge is therefore the contribution cost associated with formalization, pointing to the importance of addressing specific thresholds rather than reducing headline tax rates.

17. The METR profiles reinforce this pattern. At the extensive margin (Figure 3B), METRs evolve gradually but exhibit discrete jumps, implying that the immediate gain from entering formal

⁴ Please see Cost-Capel and others (2025) as well as Domit and others (2025) for further details on the TaxFit model.

work can be small.⁵ At the intensive margin, two localized peaks indicate earnings ranges where progression incentives weaken despite low statutory rates. These patterns reflect the interaction of contribution liabilities and benefit withdrawal, and highlight that even in a low-tax system, discontinuities can meaningfully discourage participation and earnings growth (Figure 3C). Such non-linearities weaken incentives for additional work and can encourage income shifting into informality. The results underscore the importance of smoothing the schedule so that small increases in earnings do not trigger disproportionate losses in disposable income, directly motivating the reform scenarios considered below.

18. The cost of formalization captures the financial return to becoming a formal worker at a given earnings level. In Paraguay, it is driven primarily by employee social security contributions below the PIT threshold, implying a broadly constant wedge across much of the earnings distribution; above the threshold, PIT liabilities also play a role. The decision to formalize hinges on whether the value of contributory benefits—particularly pensions—and any enforcement or compliance gains offset this wedge, especially near eligibility thresholds where benefit withdrawal can be abrupt. Figure 3D shows the cost of formalization for a representative worker (single, age 40, no children, 20 years of service), measuring the percentage decline in net income when moving from informal to formal work, holding earnings constant. Paraguay exhibits a relatively straightforward profile: below 80 million guaraní, the cost is modest—around 9 percent at low earnings—closely aligned with the statutory employee contribution rate (Figure 4).⁶ This suggests that while distortions beyond the social security wedge are limited, they are still a non-trivial barrier to formalization that increases with income. Compared to peers, this cost is relatively low and largely reflects the contribution rate (Fietz, et al., 2025; Davis, et al., forthcoming), indicating that distortions stem from discrete system features than from high overall tax burdens.

19. Taken together, this analysis suggests that informality in Paraguay is not likely to respond strongly to small changes in statutory rates alone; what matters is whether reforms meaningfully change the net payoff to being formal and/or strengthen compliance and enforcement in a way that shifts behavior. The METR schedule is unusually flat to mid incomes but punctuated by sharp spikes at the 15 million and 80 million guaraní thresholds, which can deter both earnings progression and entry into formal work. The limited progression and the cost-of-formalization at about nine percent at low earnings—roughly equal to the statutory employee social security rate but escalating with higher incomes—suggest that modest reforms could remove these kinks without altering headline rates. These patterns motivate four illustrative reform scenarios, discussed in further detail in the next section. They do not represent the universe of reform options or a comprehensive reform package. Instead, they are selected to illuminate specific margins where

⁵ The extensive margin METR reflects how much of the first guaraní earned goes to paying taxes and contributions and to reductions in any benefits provided to the household when an adult starts working and earning an income. For instance, in Figure 3B, workers earnings 2.5 times the minimum wage have an extensive margin METR of almost 12 percent which implies that, out of each additional 1,000 guaraní of gross earnings when entering work, disposable income rises by about 880 guaraní once higher taxes/contributions and lower benefits are taken into account.

⁶ A positive cost implies that moving from informal to formal work reduces disposable income in the short run due to contributions and benefit withdrawal.

current tax-benefit design may weaken formalization incentives, with a focus on concrete options that can be assessed in a short-term, partial-equilibrium setting.

Figure 3. Paraguay: Tax Stylized Facts

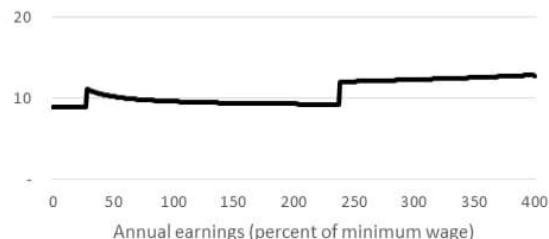
AETRs are broadly flat at low and middle incomes, consistent with the low-rate system and limited redistribution at low earnings.

(A) Average Effective Tax Rates by Income Level (including taxes, contributions, and benefits) (percent)



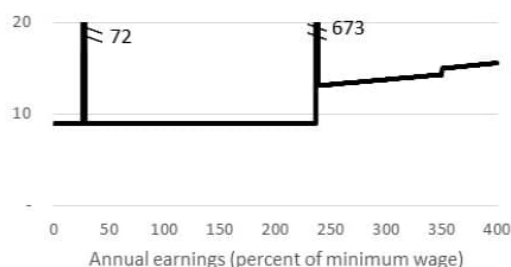
Spikes in extensive METRs reflect discrete features of the system that discourage entry into the formal sector....

(B) Marginal Effective Tax Rates at the Extensive Margin (entering work/formal employment) (percent)



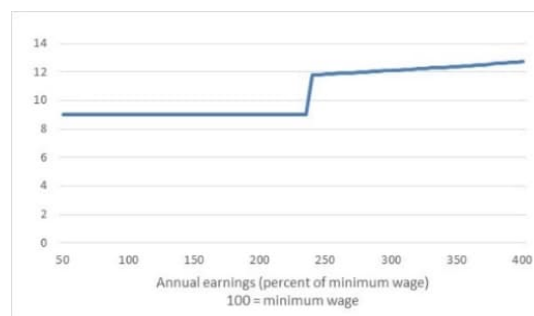
...while the spikes in METRs at the intensive margin highlight weakening incentives for additional earnings in the formal sector.

(C) Marginal Effective Tax Rates at the Intensive Margin (percent)



The short-run cost of formal work is driven mainly by employee social security contributions at low earnings and rises further once PIT liabilities begin to apply.

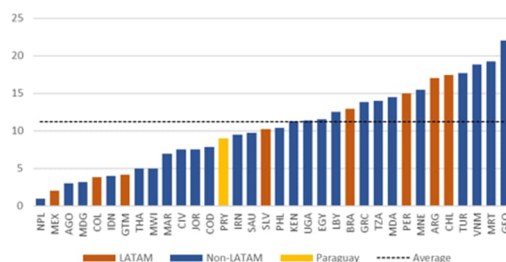
(D) Cost of Formalization (percent)



Sources: Ministry of Economy and Finance; Bloomberg; WEO; and IMF staff estimates.

Notes: Figures A, B, and C present the average and marginal tax rates assuming a household with one working spouse, one non-working spouse, and two young children. Very large values that are beyond the scale of the chart are shown with two horizontal slashes—indicating a break in the chart—along with a number indicating the peak of the indicator value at that point. TaxFit simulations were conducted using 2025 policy rules and regulations.

Figure 4. Paraguay: Loss in Net Income when Formalizing (percentage points)



Sources: IMF staff estimates.

C. Distributional Effects and Policy Simulations

20. TaxFit allows to identify groups for whom policy incentives may be particularly weak or distorted, and who could be targeted with tax-benefit reforms.⁷ Four reforms are considered that focus on reducing kinks in incentives profiles and reducing workers' cost of formalization. The stylized facts on informality (Figure 1) and the incentive diagnostics (Figure 3) provide the foundation for these scenarios. It is also important to identify fiscally credible design options that strengthen incentives for formalization by reducing sharp discontinuities in effective tax rates, strengthening compliance incentives, and improving the perceived return to contributing. The reform scenarios below use the 2025 TaxFit model to quantify how design changes along these margins affect METRs and the cost of formalization across earnings levels and worker types because these summarize how reforms change take-home pay when a worker enters formal work (extensive margin) and shifts from informal to formal work at the same earnings (intensive margin). The scenarios focus on (1) smoothing the PIT schedule around the current payability threshold; (2) strengthening invoicing and third-party information; (3) reforming pensions so that accrued rights are less back-loaded; and (4) introducing a targeted in-work benefit. These are not the only possible options, but they are a natural starting point given where the baseline charts identify the largest incentive “kinks” and wedges.⁸ Other approaches—including broader changes to transfers, benefits, or the overall PIT-benefit architecture—could also support formalization but are beyond the scope of the selected simulations here.

21. Reform 1: The current PIT structure in Paraguay features discrete thresholds that create sharp changes in marginal incentives over narrow earnings ranges. In particular, the payability threshold and subsequent brackets generate localized spikes in marginal effective tax rates, weakening incentives for earnings progression and formal reporting. This scenario smoothes these discontinuities by introducing a zero-rated bracket up to 15 million guaraní and removing the 80 million guaraní payability threshold, while keeping other PIT parameters unchanged. The reform is calibrated to be statically revenue neutral. Implementation would require simple filing and withholding arrangements, along with clear rules on deductions, to avoid undue compliance burdens. The objective is to ensure that small increases in earnings translate into predictable changes in disposable income.

22. The TaxFit simulations show that the reform reduces spikes in METRs and creates a more continuous incentive structure across the earnings distribution. Extensive-margin METRs decline at low-income levels, strengthening incentives to enter formal employment, while intensive-margin METRs become more stable, supporting earnings progression. The reform is relatively straightforward to implement, particularly in a low-rate system, but its effectiveness depends on

⁷ While the analysis shown here focuses on stylized reference cases consistent with the assumptions in Figures 3 and 4, the same diagnostics can be extended to alternative household profiles.

⁸ These simulations are illustrative and partial equilibrium in nature. They do not capture full behavioral responses or broader general equilibrium effects, and do not represent a comprehensive reform package.

complementary administrative measures—such as simplified withholding and filing—to ensure that smoother statutory schedules translate into smoother effective incentives.

23. Reform 2: This option examines whether participation in the receipt-based deduction system could strengthen invoicing incentives and formal reporting while keeping net liabilities broadly unchanged at lower income levels. It retains a payability threshold but lowers it to 65 million guaraní (around 1.8 times the minimum wage, as of July 1, 2026⁹) and introduces a low-income allowance of 30 million guaraní, calibrated to keep net liabilities broadly unchanged for taxpayers below 80 million guaraní. The combination of a lower entry point into the tax system and a broad-based allowance expands the set of individuals who file returns while maintaining approximate neutrality in net tax liabilities at lower income levels.

24. A key feature of the reform is that eligibility for deductions remains conditional on documented (formal) transactions. As a result, expanding participation in the system increases the demand for invoices, strengthening third-party reporting and creating positive spillovers for formalization among firms. TaxFit results suggest that this design can increase engagement with the tax system without introducing large new distortions in marginal incentives. While the discontinuity in marginal effective tax rates would remain, the reform could broaden participation in the receipt-based deduction system and strengthen incentives to request invoices, thereby supporting firm-level formalization (Richter, 2019; Bohne & Nimczik, 2025), alongside appropriate enforcement and simplification measures. The reform therefore complements enforcement and digitalization efforts—such as e-invoicing—by aligning individual incentives with broader compliance objectives. Successful implementation would require simplifying filing procedures, improving access to digital tools, and strengthening risk-based enforcement to ensure that increased participation translates into effective compliance.¹⁰

25. Reform 3: This scenario relaxes the “all-or-nothing” structure of pension eligibility by introducing earlier access to pro-rated benefits.¹¹ The high rate of informality in Paraguay suggests that many workers do not accumulate 25 years of formal work contributions to be eligible for a full pension.¹² Under this scenario, workers qualify for a partial pension after 10 years of

⁹ Decree No. 6225/2026, which went into effect on July 1, 2026, increased the monthly minimum wage in Paraguay to 3,044,000 guaraní. The scenarios and analysis presented in this Selected Issues Paper use the minimum wage and rules and regulations that were in effect in 2025.

¹⁰ This scenario is intended to illustrate one possible compliance channel within the current PIT architecture; it should not be interpreted as suggesting that receipt-based deductions are the only—or necessarily preferred—way to improve progressivity, targeting, or redistribution.

¹¹ This reform should be viewed as a medium-term option that strengthens the perceived return to contributions for workers with intermittent careers by reducing the “all-or-nothing” nature of pension eligibility.

¹² The current pension system run by the Instituto de Previsión Social (IPS) in Paraguay allows formal workers to retire at age 60 with a benefit that replaces 100 percent of their earnings, provided they have accumulated 25 years of pension contributions. The system also allows workers to retire at age 55 if they have accumulated 30 years of service, or at 65 years with a partial 60 percent pension and 15 years of service. Workers that fall short of these service requirements receive no pension at all. Some evidence suggests that pension eligibility criteria can influence a worker's decisions to work formally or informally (Attanasio et al., 2011; Canelas & Niño-Zarazúa, 2022; Becerra, 2024).

contributions, with benefits increasing gradually with additional years of service, while preserving the existing full accrual schedule. This design aims to strengthen the perceived return to contributions for workers with intermittent careers by making pension entitlements more continuous over the life cycle.¹³

26. TaxFit simulations show that this reform reduces the cost of formalization for workers with shorter contribution histories by increasing the expected value of pension benefits. Under the current system, pension eligibility is discrete: workers who fall short of minimum service requirements receive no contributory pension, which can reduce the perceived return to social security contributions for groups with a high probability of informal employment. The gains are most pronounced for younger and mid-career workers, for whom earlier eligibility raises the return to formal participation. Figure 5E illustrates how incorporating the expected value of accrued pension rights affects the cost of formalization, by treating the marginal increase in expected pension wealth from an additional year of contributions as part of the return to formality.

27. Under the reform scenario, workers can more quickly acquire pension rights, which helps change the perception of pension contributions from that of a tax to that of an investment. A worker with 10 years of service has already met the minimum contribution requirement and therefore qualifies for at least a partial pension. Each additional year of formal work up to 25 years increases the replacement rate by 4 percentage points, implying a steadier accrual of expected pension wealth across earnings levels. The incentive effects are illustrated further in Figure 5F, which plots the cost of formalization across age for a formal minimum-wage worker. Relative to the current system, the reform shifts incentives toward younger workers with shorter contribution histories by providing earlier access to partial entitlements and reducing the "all-or-nothing" nature of eligibility.

28. More generally, the reform makes pension wealth accumulation less back-loaded and more continuous over a worker's career. In the first 10 years, each additional year of contributions raises the probability of meeting the minimum service requirement; thereafter, each additional year increases the replacement rate mechanically. Compared with the current system, the revised schedule places greater weight on workers with shorter contribution histories—who are more likely to move in and out of formality—while preserving incentives to remain formal after the minimum threshold has been met.

29. A similar pattern holds for workers with long and continuous formal careers. Under the current system, the implicit return to an additional year of contributions is concentrated near the point at which eligibility for a full pension is achieved. Under the reform scenario, pension rights

¹³ The scenario reduces the minimum contribution period for pension eligibility to 10 years and introduces a pro-rated accrual schedule: 10 years of contributions provide a pension covering 40 percent of earnings, and each additional year up to 25 adds 4 percentage points to the replacement rate (Figure 5D). This reform option preserves the existing 4 percent accrual rate and allows the existing full- and partial-pension benefits to be acquired as they are currently. The intuition for the 10/40 design is to (i) establish a meaningful minimum entitlement after a plausible formal contribution history in a high-informality setting, while (ii) preserving incentives to remain formal thereafter through a steady accrual schedule, rather than concentrating the implicit return only near the 25-year eligibility point.

accrue earlier and more smoothly, reducing sharp changes in incentives late in the contribution history.¹⁴ As shown in Figure 5D, under the baseline replacement rates remain flat until eligibility is reached, while under the reform they increase gradually from early in the contribution history.

30. Reducing the minimum contribution period should be considered within an integrated reform package, as it changes the distribution of contributory benefits and may increase IPS outlays. By expanding eligibility, the reform reduces the implicit cross-subsidy from non-qualifying contributors to eligible retirees and could entail fiscal costs unless accompanied by offsetting parametric or governance measures (e.g., adjustments to accrual rates, retirement age, contribution rates, or administrative efficiency). At the same time, broader access to partial pensions may reduce reliance on non-contributory old-age support for some households, with potential gains for equity and targeting if coordinated with social assistance reforms. Overall, the reform strengthens the perceived return to contributions-particularly for workers with intermittent careers-but should be assessed within a broader strategy to safeguard pension system sustainability.¹⁵

31. Reform 4: This scenario introduces a targeted in-work benefit aimed at strengthening incentives for young workers to enter and remain in formal employment. Unlike standard earned income tax credits that phase in with earnings, this design incorporates a tenure-based component, reflecting the importance of job stability and contribution histories in Paraguay's high-informality environment. Eligibility is restricted to workers below the age of 30 who are formally employed and earn at least 75 percent of the minimum wage in 2025. To further target the benefit toward lower-income households, eligibility can be conditioned on total household income, with workers becoming ineligible if combined income with a spouse exceeds a defined threshold (e.g., four times the minimum wage). This ensures that the benefit is concentrated on younger, lower-income workers at the margin of formalization.

32. A distinctive feature of the reform is that the benefit is phased in over time rather than immediately upon entry into formal work. While the potential credit is defined as a share of earnings-aligned with the employee social security contribution rate-the effective benefit increases with tenure in formal employment. Specifically, the credit accrues gradually at a rate of one-twelfth per month, reaching its full value only after twelve months of continuous formal employment. This structure strengthens incentives not only to enter the formal sector but also to remain employed, addressing the high turnover and intermittent contribution patterns observed among younger workers. In practice, implementation would need to ensure that workers can retain accrued eligibility when switching jobs within the formal sector.

33. The maximum benefit is capped at the level of social security contributions paid by a minimum-wage worker, consistent with the objective of making formal employment close to "tax-neutral" at the bottom of the earnings distribution. As a result, the policy directly offsets

¹⁴ The calibration is illustrative and anchored to the current minimum contribution period, with parameters chosen to smooth accrual while preserving broadly comparable replacement rates over a full career.

¹⁵ Similar proposed reforms to the minimum contribution threshold for Peru were estimated to have only a small cost of 0.05 percent of GDP (Freudenberg and Toscani, 2019).

the primary financial cost of formalization for low-income workers. The benefit remains constant up to around 1.5 times the minimum wage in 2025, after which it is gradually phased out. The phase-out is designed to account for household income by incorporating a portion of spousal earnings above the threshold into the clawback calculation. This approach improves targeting while mitigating strong disincentives for secondary earners, helping to limit potential "marriage penalty" effects.

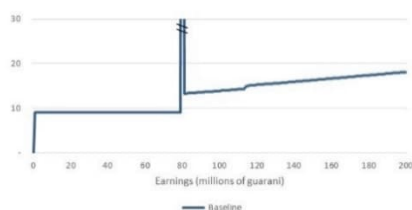
34. Simulation results suggest that the fiscal cost of the program would be modest—estimated at about 0.12 percent of GDP in static terms, with an additional cost of around 0.03 percent of GDP for each percentage point increase in formal employment induced by the policy. At the same time, the reform substantially reduces the cost of formalization at low earnings and strengthens incentives at the extensive margin, particularly for young workers with limited attachment to the formal labor market. Overall, this scenario complements the other reforms by directly increasing the immediate return to formal employment while also encouraging sustained participation, thereby addressing both entry and retention margins in Paraguay's labor market.

35. The four reforms are conceptually complementary. PIT smoothing (Reform 1) and the threshold/allowance redesign (Reform 2) primarily address short-run reporting and entry/earnings incentives around PIT discontinuities, while the pension accrual reform (Reform 3) targets the longer-run return to contributing for workers with intermittent careers. The targeted in-work benefit (Reform 4) complements these measures by directly reducing the short-run contribution wedge at low earnings, where the baseline diagnostics indicate that formalization costs are most salient. In practice, combining PIT reforms with more continuous pension accrual and an in-work credit is informative because it shows whether short-run wedges (taxes/contributions today) are offset by a stronger longer-run return (pension wealth tomorrow) and higher immediate take-home pay. Where the evaluation metric is the cost of formalization, combined reforms would be expected to reduce the cost through both channels—lower contemporaneous discontinuities and higher expected benefit accrual—though the overall desirability depends on distributional effects, implementation feasibility, and fiscal sustainability.

Figure 5. Paraguay: Reform Scenarios

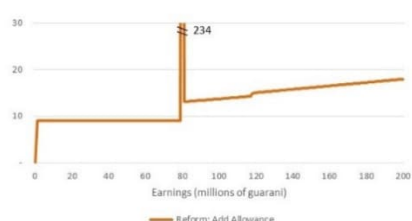
The discontinuity at 80 million guaraníes can be smoothed...

(A) Intensive METR: Baseline for Scenarios 1 and 2 (percent)



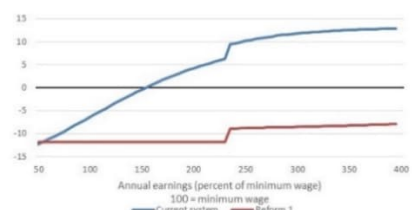
Strengthening compliance incentives shifts behavior by increasing the returns to formal reporting.

(C) Scenario 2: Intensive METR, Post-Reform (percent)



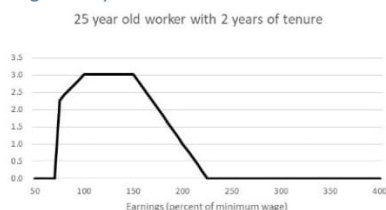
More continuous benefit accrual reduces the cost of formalization across low and higher earners....

(E) Scenario 3: Cost of Formalization with Pension Rights (percent)



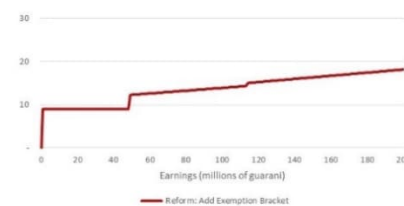
In-work benefits strengthen participation incentives for lower-wage workers, though effects taper off as the benefit phases out....

(G) Scenario 4: In-Work Benefits, Post-Reform (millions of guaraní)



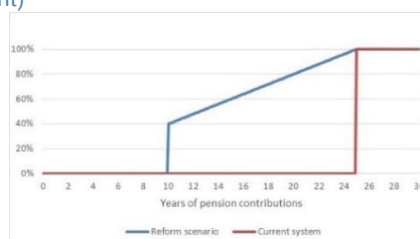
...to strengthen earnings progression incentives and formal reporting, particularly for workers near eligibility cutoffs.

(B) Scenario 1: Intensive METR, Post-Reform (percent)



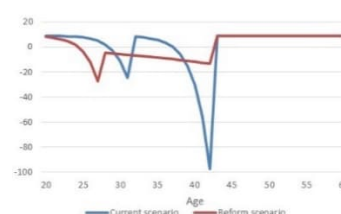
Introducing a more continuous pension accrual scheme increases the expected return to contributing, particularly for workers with intermittent careers.

(D) Scenario 3: Baseline and Reform Replacement Rate (percent)



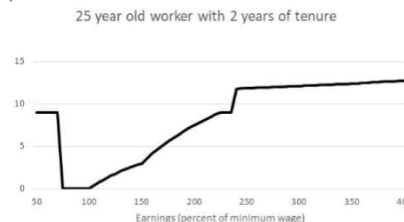
...and strengthens incentives to participate in formal employment over the life cycle.

(F) Scenario 3: Cost of Formalization with Pension Rights, by Age of Formal Worker (percent)



...and reduce the cost of formalization at low earnings.

(H) Scenario 4: Cost of Formalization, Post-Reform (percent)



Sources: IMF staff estimates.

Notes: In the cost-of-formalization charts that incorporate pension rights, a negative "cost" should be interpreted as the worker's accrual of expected pension wealth exceeding the contemporaneous contribution/tax wedge—i.e., formality becomes financially attractive for that worker type under the assumed valuation of future pension benefits. The cost of formalization by age (Figure 5F) considers a 50-year-old worker that earns the minimum wage. Accrual of pension rights for service prior to achieving the minimum contribution threshold are modelled as the change in the likelihood of reaching the minimum contributions by working one extra year. Likelihoods are modeled using a geometric distribution.

D. Conclusions

36. The illustrative reforms highlight how Paraguay's tax-benefit system shapes incentives to work, earn, and formalize, in line with the model's key behavioral margins: labor supply, formalization decisions, and perceived returns to social insurance. Despite a relatively low-tax environment, the analysis identifies important distortions arising from discrete features of the system. Effective tax rates are broadly flat at low and middle incomes but exhibit localized spikes around key thresholds, while the cost of formalization—driven primarily by social security contributions—remains modest but persistent across much of the earnings distribution. Together, these features weaken incentives both to increase earnings and to enter formal employment, particularly for workers near eligibility thresholds.

37. The reform scenarios illustrate that meaningful gains can be achieved through targeted design changes.¹⁶ Smoothing discontinuities in the personal income tax, redesigning thresholds and allowances to support participation and compliance, and strengthening the link between contributions and benefits through more continuous pension accrual can jointly improve incentives to formalize while preserving the overall structure of the system. Moreover, reducing sharp discontinuities in effective tax rates strengthens the perceived return to contributing to social insurance, and safeguards medium-term revenue mobilization and social spending objectives. In the personal income tax, moving from discrete exemptions toward smoother schedules (as in Reform 1) can mitigate high marginal tax wedges that discourage earnings progression and formal reporting; where receipt-based deductions are used (Reform 2), simplifying compliance, improving withholding, and strengthening risk-based enforcement can enhance invoicing incentives while limiting administrative burdens for low-income taxpayers. In the pension system, earlier access to pro-rated entitlements (Reform 3) can raise the attractiveness of formality for workers with intermittent careers but should be implemented alongside parametric and governance measures to preserve IPS financial sustainability. Introducing targeted in-work benefits (Reform 4) is one possible option to further strengthen participation incentives at the bottom of the income distribution by increasing the net return to formal employment, particularly for younger, low-income, and secondary earners, while avoiding the sharp discontinuities associated with threshold-based relief. Careful design would be needed to phase out benefits gradually to limit new marginal tax spikes and contain fiscal costs. Complementary measures to lower non-tax barriers to formality—including simplified registration, digitalization of payments, and targeted labor inspections—would help translate tax-benefit reforms into durable increases in formal employment and a broader revenue base.

¹⁶ These examples should not be read as an exhaustive reform agenda, but rather as concrete illustrations of how selected largely revenue-neutral tax-benefit design changes could improve formalization incentives while preserving the overall structure of the system. They do not preclude broader reforms to tax expenditures, tax rates, transfer design, or PIT progressivity.

38. Informality is less a function of high statutory tax burdens than of how the system translates those rules into effective incentives. Both the microsimulation and the underlying modeling framework point to three key margins shaping behavior: the responsiveness of labor supply at low and middle incomes, the decision to operate formally versus informally, and the perceived return to contributing to social insurance over the life cycle. Reducing kinks in the tax-benefit schedule, strengthening the link between contributions and benefits, and simplifying compliance can expand formal employment and broaden the tax base. Moreover, the OLG model suggests that policies that increase the expected lifetime value of formal participation—through more continuous benefit accrual and improved access to social protection—can reinforce the impact of tax design reforms, especially in the presence of demographic change and intermittent careers. At the same time, reforms should be implemented within a coherent medium-term strategy that safeguards fiscal sustainability and complements tax policy changes with improvements in administration, enforcement, and access to social protection. While the simulations are illustrative and partial equilibrium in nature, they highlight a set of feasible, targeted reforms that can help advance formalization alongside equity and fiscal objectives. They should be seen as complements to, rather than substitutes for, broader discussions of tax expenditure rationalization, transfer design, and medium-term tax-benefit reform.

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Appendix I. Overlapping Generations Model

1. This appendix summarizes the overlapping generations (OLG) model used to analyze aggregate and distributional effects of formalization. In this framework, heterogeneous agents live in a small open economy for $J = 13$ periods and die at the end of period J . One model period corresponds to five years, so that agents enter the economy at age 20 and exit at age 84. Agents are eligible to work for the first $T_l = 8$ periods (ages 20 to 59) and are retired thereafter. The economy has two sectors: a formal sector, which is perfectly competitive and produces a tradable good with capital and labor, and an informal sector, which is an own-account, labor-only activity producing a non-tradable good with decreasing returns to scale. Individuals differ exogenously by generation, gender ($i \in \{m, f\}$), household type (singles versus married households), and an idiosyncratic endowment (ε). The endowment determines both innate productivity and educational attainment, since years of schooling are assigned by the agent's rank in the endowment distribution. Throughout working life, human capital evolves depending on whether the agent worked in the previous period.¹

E. Households' Maximization Problems

2. In households headed by married couples, husband and wife belong to the same generation and are assortatively matched, sharing the same endowment draw and hence the same rank in the education distribution; because schooling profiles are gender-specific, they nonetheless differ in years of schooling. A couple with endowment ε chooses consumption of the formal good (c_t^{fo}) and of the informal good (c_t^{inf}), the labor each spouse supplies to the formal and to the informal sector ($l_t^{m,fo}, l_t^{m,inf}, l_t^{f,fo}, l_t^{f,inf}$), and savings (a_t), so as to maximize lifetime utility:

$$\max_{\{c_t^{fo}, c_t^{inf}, l_t^{m,fo}, l_t^{m,inf}, l_t^{f,fo}, l_t^{f,inf}, a_t\}_{t=1}^J} \sum_{t=1}^J \beta^{t-1} \left[\zeta_{fo} \log c_t^{fo} + \zeta_{inf}^{eff} \log c_t^{inf} - \Psi_m(t) (l_t^m)^\chi - \Psi_f(\varepsilon, t) (l_t^f)^\chi - Q(\varepsilon) \mathbb{I}_{\{l_t^f > 0\}} \right]$$

where β is the discount factor; ζ_{fo} and ζ_{inf}^{eff} are the preference weights on the formal and the informal good, with $\zeta_{fo} = 1$ as a normalization; χ governs the elasticity of labor supply, with an implied Frisch elasticity of $1/(\chi - 1)$; and $l_t^i \equiv l_t^{i,fo} + l_t^{i,inf} \in [0, 1]$ is the total labor supplied by spouse $i \in \{m, f\}$.

3. The disutility of work is gender-specific and age-specific, and for women it also depends on the endowment. The male disutility $\Psi_m(t)$ varies only with age, while the female disutility $\Psi_f(\varepsilon, t)$ varies with age and changes with the endowment. In addition, married women face a fixed utility cost of participating, $Q(\varepsilon) = \max\{q_0 + q_1\varepsilon, 0\}$, incurred in any period in which they supply positive labor. This term is a reduced-form representation of the implicit cost of unpaid care and domestic work, which falls disproportionately on women.

4. Note that the preference weight on the informal good is non-homothetic, reflecting Engel's Law. Because the informal good is non-tradable and is produced with decreasing returns to scale, a constant

¹ The framework builds on the OLG model of [Malta and Pinat \(2024\)](#), extended with an informal sector that produces a non-tradable good.

expenditure share would generate a self-reinforcing increase in its relative price whenever formal incomes rise. Instead, the effective weight on the informal good declines with the formal wage:

$$\zeta_{\text{inf}}^{\text{eff}} = \zeta_{\text{inf}} \left(\frac{\bar{w}_{fo}}{w_{fo}} \right)^{\eta_{\text{engel}}}$$

where ζ_{inf} is the informal preference scalar, $\bar{w}_{fo}$ is the formal wage in the calibrated baseline, and η_{engel} governs the strength of the effect. As formal wages rise, households devote a smaller share of their budget to the informal good, which is the necessity in this economy.

5. Couples are subject to the period budget constraint:

$$\begin{aligned} & (1 + \tau_c) c_t^{fo} + p_{\text{inf}} c_t^{\text{inf}} \\ & \leq \sum_{i \in \{m, f\}} \left[\underbrace{y_{t,i}^{fo} (1 - \tau_{ss} - T(y_{t,i}^{fo}))}_{\text{net formal income}} + \underbrace{p_{\text{inf}} y_{t,i}^{\text{inf}}}_{\text{informal income}} + \underbrace{Pen_{t,i}}_{\text{pension}} \right] + \underbrace{Tr(\varepsilon)}_{\text{transfer}} \\ & + \underbrace{[a_{t-1}(1 + r^*(1 - \tau_a)) - a_t]}_{\text{net savings income}} \end{aligned}$$

where τ_c is the consumption tax, levied on the formal good only; p_{inf} is the endogenous price of the informal good; τ_{ss} is the social security contribution paid by the employee; $T(\cdot)$ is the average income tax rate on formal labor earnings; $Tr(\varepsilon)$ is a means-tested cash transfer (Paraguay's *Tekoporã*); $Pen_{t,i}$ is the pension benefit, defined below; r^* is the international real interest rate; τ_a is the tax on savings remuneration; and $a_0 = a_j = 0$. Labor is supplied only over the working life, so $l_t^{i,fo} = l_t^{i,inf} = 0$ for $t > T_l$, and the pension is received only in retirement, so $Pen_{t,i} = 0$ for $t \leq T_l$ and $Pen_{t,i} = Pen_i$ for $t > T_l$.

6. Gross formal earnings and informal output of spouse i are

$$y_{t,i}^{fo} = w_{fo} \phi_{fo}^i h_{t,i} l_t^{i,fo}, \quad y_{t,i}^{\text{inf}} = \phi_{\text{inf}}^i z_{\text{inf}} (l_t^{i,inf} h_{t,i})^{\alpha_{\text{inf}}}$$

where w_{fo} is the formal wage per efficiency unit of labor; $h_{t,i}$ is agent i 's human capital; z_{inf} is total factor productivity in the informal sector; and $\alpha_{\text{inf}} < 1$ governs the decreasing returns to scale of informal production. The parameters ϕ_{fo}^i and ϕ_{inf}^i lie between 0 and 1 and capture the residual discrimination against females that reduces their labor efficiency and wages in the formal and in the informal sector, respectively. They are normalized to one for males, $\phi_{fo}^m = \phi_{\text{inf}}^m = 1$, so that $\phi_{fo}^f = \phi_{fo}$ and $\phi_{\text{inf}}^f = \phi_{\text{inf}}$ measure the female efficiency penalty in each sector.

7. Human capital is a function of the endowment, education, and work experience. In period 1, an agent's human capital is $h_{1,i} = \varepsilon e_i(\varepsilon)^{\alpha_e}$, where $e_i(\varepsilon)$ is years of schooling — an increasing, gender-specific function of the agent's position in the endowment distribution — and α_e its elasticity. In the following periods and until retirement, male human capital grows at the exogenous age-specific rate $g_m(t)$. Female human capital grows at the exogenous rate $g_f(t)$ only if the woman participated in the previous period, and is stagnant otherwise, which captures the wage-scarring effect of career interruptions and is one source of gender gaps in the labor market. Therefore, for $t \in \{2, \dots, T_l\}$:

$$h_{t,m} = (1 + g_m(t-1))h_{t-1,m}, \quad h_{t,f} = (1 + g_f(t-1) \mathbb{I}_{\{l_{t-1}^f > 0\}})h_{t-1,f}$$

8. Pension entitlements are a key life-cycle benefit of formal work. Let n_i denote the number of periods in which agent i contributed to the formal system. Following Paraguay's vesting rules, an agent who contributed for at least 5 periods (25 years) receives a full pension based on the final formal wage; an agent who contributed for at least 3 periods (15 years) receives a partial pension equal to 50 percent of that amount; and an agent who fails to meet the 15-year threshold falls back on the non-contributory *Adultos Mayores* floor, modeled as a universal basic income $\underline{p}$. The pension is therefore

$$Pen_i = \max\{\underline{p}, \lambda(n_i) w_{fo} \phi_{fo}^i h_{T_i,i} (1 - T(\cdot))\}, \quad \lambda(n_i) = \begin{cases} 1 & \text{if } n_i \geq 5 \\ 0.5 & \text{if } 3 \leq n_i < 5 \\ 0 & \text{if } n_i < 3 \end{cases}$$

and is paid from period $T_i + 1$ until death at J . Its present discounted value at the beginning of life is

$$\Gamma_i = \sum_{t=T_i+1}^J \frac{Pen_i}{R^{t-1}} = Pen_i \Lambda_i, \quad \Lambda_i \equiv \sum_{t=T_i+1}^J \frac{1}{R^{t-1}}$$

where $R = 1 + r^*(1 - \tau_a)$ is the gross net-of-tax return on savings and Λ_i is the annuity factor that capitalizes a unit of retirement income. Because Pen_i depends on the agent's own formal-work history, Γ_i is endogenous: the household's problem is a discrete choice over contribution histories, each of which delivers a different lifetime budget set. Since the vesting schedule $\lambda(n_i)$ is a step function of that history, agents do not weigh the pension only through Γ_i . When choosing how much labor to supply to the formal sector, they also take into account the pension rights accrued on an extra unit of formal earnings, $\rho y_{t,i}^{fo} \Lambda_i (1 - T(y_{t,i}^{fo}))$, where ρ is the accrual rate. This term enters the first-order condition for formal labor supply — it is the value agents attach to contributing at the margin, rather than an additional source of lifetime resources — and it is the channel through which the pension system shapes the incentive to formalize.

Single households solve the same constrained maximization problem above but without the spouse's terms. Moreover, single women face no care penalty, so the term in $Q(\varepsilon)$ is absent from their problem.

F. Production

9. The formal good is produced by a representative competitive firm using effective labor and capital in a Cobb-Douglas production function. The firm pays a levy τ_v on revenue and employer-side social security contributions τ_{ss2} on its wage bill, rents capital at the internationally given rate r^* and maximizes:

$$\max_{K, L_m^{fo}, L_f^{fo}} (1 - \tau_v) A K^{\alpha_k} (L_m^{fo} + \phi_{fo} L_f^{fo})^{1-\alpha_k} - (1 + \tau_{ss2}) w_{fo} (L_m^{fo} + \phi_{fo} L_f^{fo}) - (r^* + \delta_k) K$$

where A is total factor productivity, α_k the capital share, δ_k the depreciation rate of capital, and L_m^{fo} and L_f^{fo} are effective labor supplied by males and females, respectively.

The informal good is produced by individuals on own account, with output equal to $\phi_{inf}^i z_{inf} (l_t^{i,inf} h_{t,i})^{\alpha_{inf}}$.

G. Equilibrium and Government

10. In equilibrium, households maximize utility subject to their budget constraints; the formal firm maximizes profits; the formal wage and the capital stock are determined by the firm's first-order conditions; and the price of the non-tradable informal good, p_{inf} , adjusts to clear the informal goods market. The formal good is tradable, its price is the numeraire, and any excess demand is absorbed through the external account. In this framework, the government collects the personal income tax, employee and employer social security contributions, the corporate levy, and the consumption tax, and finances pension benefits, the *Adultos Mayores* floor, and *Tekoporã* transfers.

H. Calibration

11. The model is calibrated using both exogenous and endogenous parameters, replicating statistics drawn from the 2024 *Encuesta Permanente de Hogares Continua* (EPHC) and from Paraguay's fiscal accounts. Parameters calibrated exogenously include the following:

Age structure and household composition: Paraguay's age distribution determines the weight of each generation $j \in \{1, \dots, J\}$. The EPHC gives the shares of couples (85 percent), single males (7 percent), and single females (8 percent).

Education (e_i): Years of schooling by gender, taken from the EPHC and assigned to the endowment vigintiles in ascending order, so that education and innate productivity are closely rank-correlated. Schooling ranges from 7.0 to 14.0 years for men and from 6.7 to 15.1 years for women.

Returns from experience (g_m, g_f): Male and female returns from experience are estimated using Mincer regressions on the EPHC and decline with age.

Gender efficiency gaps ($\phi_{fo}, \phi_{\text{inf}}$): The residual gender gap is estimated through an Oaxaca-Blinder decomposition of wages. In the baseline, the formal-sector gap is zero ($\phi_{fo} = 1$) and the informal-sector gap is 17.5 percent ($\phi_{\text{inf}} = 0.825$). The gender wage gap generated by the model therefore arises from differences in returns to experience, in participation, and in sectoral allocation.

Tax and pensions benefit parameters: some effective rather than statutory tax rates are used, since deductions, evasion, and imperfect enforcement can create a significant wedge between the tax code and actual revenue collection. Pension rules replicate the contributory vesting thresholds of the *Instituto de Previsión Social* and the non-contributory *Adultos Mayores* floor. See details in Table 1.

Table 1. Paraguay: List of Exogenous Parameters

Parameter	Description	Value
J	Number of periods	13 (five years each; adults from 20 to 84)
T_l	Length of working life	8 periods (retirement at age 60)
μ_1, μ_2, μ_3	Share of couples, single males, single females	0.85, 0.07, 0.08
$e_m(\varepsilon), e_f(\varepsilon)$	Education (years of schooling)	Profiles over the 20 endowment vigintiles (20 vigintiles of income distribution in EPHC data)
α_e	Elasticity of human capital to schooling	0.30
g_m	Male returns from experience	0.050 to 0.005, declining with age
g_f	Female returns from experience	0.040 to 0.005, declining with age
β	Discount factor	0.94 per year (0.94 ⁵ per period)
r^*	Real interest rate	4.03 percent
α_k	Capital share	0.50
δ_k	Depreciation rate of capital	5 percent per year (1.05 ⁵ – 1 per period)
A	Total factor productivity, formal sector	1.00 (normalization)
z_{inf}	Total factor productivity, informal sector	0.40
ϕ_{fo}	Gender efficiency gap, formal sector	1.000
ϕ_{inf}	Gender efficiency gap, informal sector	0.825
ζ_{fo}	Formal preference scalar	1.00 (normalization)
η_{engel}	Engel elasticity	1.00
τ_c	Consumption tax (VAT)	0.080 (statutory 0.100)
τ_v	Corporate levy on formal revenue	0.046 (statutory 0.100 tax on net profits)
τ_{ss}	Social security contribution, employee	0.040 (statutory 0.090)
τ_{ss2}	Social security contribution, employer	0.060 (statutory 0.165)
τ_a	Tax on savings' returns	0.080
AI	Reference income	Full-time formal earnings of a male worker with the lowest endowment and education level (PYG 160,822,380 per year in the data)
$T(x)$	Income tax rate function	$\min\{\max(0.001x^2 + 0.002x - 0.006, 0), 0.10\}$, where x is gross formal earnings divided by the reference income AI
ρ	Pension accrual rate	2 percent per year (0.10 per period)
λ	Pension vesting schedule	100 percent with at least 25 years of contributions; 50 percent with at least 15 years; zero otherwise
$\underline{p}$	Non-contributory floor (<i>Adultos Mayores</i>)	25 percent of the reference income AI
Tr	<i>Tekoporã</i> transfer	10 percent of the reference income AI , paid to married households in the bottom four endowment vigintiles
S_c	Equivalence scale, married households	4.63 (average size of a married household)

Sources: 2024 Encuesta Permanente de Hogares Continua; and IMF Staff Calculations.

Note: The endogenous parameters include the disutility of labor, the care penalty, the dispersion of endowments, and the informal-sector parameters. They are calibrated jointly and that the simulated baseline reproduces eight empirical targets: the formal shares of employment and of GDP; male and female labor force participation; female hours relative to men; and female participation in the poorest, middle, and richest quintiles of the endowment distribution. Table 2 reports the calibrated values of these parameters, and Table 3 the fit of the simulated baseline against the eight targets.

Table 2. Paraguay: List of Endogenous Parameters. Source: IMF staff calculations

Parameter	Description	Calibrated value
Ψ_m	Disutility of labor (males)	0.27
Ψ_f	Disutility of labor (females), level	0.50
$\Psi_{f,slope}$	Disutility of labor (females), endowment gradient	-0.20
q_0	Care penalty, level	0.10
q_1	Care penalty, endowment gradient	-0.30
σ	Standard deviation of log endowments	2.00
χ	Labor supply elasticity parameter	2.50
ζ_{inf}	Informal preference scalar	0.40
α_{inf}	Returns to scale, informal sector	0.50

Sources: IMF Staff Calculations.

Table 3. Paraguay: Model Fit — Empirical Targets versus Simulated Baseline (in percent)

Target statistic	Data	Model
Formal labor share (headcount, %)	25.5	27.7
Formal GDP share (%)	64.9	61.3
Male labor force participation (FTE, %)	80.8	78.3
Female labor force participation (headcount, %)	64.1	70.8
Female relative hours (%)	86.2	92.9
Female LFP, poorest quintile (Q1, %)	46.1	55.1
Female LFP, middle quintile (Q3, %)	64.6	73.1
Female LFP, richest quintile (Q5, %)	77.4	81.6

Sources: 2024 Encuesta Permanente de Hogares Continua; and IMF Staff Calculations.