Nudging Digital Financial Adoption: Experimental Evidence from Colombia's Cash Transfer Programs*

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Abstract

This study investigates cash-out behaviors among newly banked populations in Colombia who received pandemic relief. Using survey and FinTech administrative microdata, we apply observational and experimental methods to analyze financial patterns. Observational results confirm that beneficiaries rely heavily on immediate cash withdrawals, though physical debit cards and prolonged platform exposure mitigate this trend. In the experimental component, by leveraging randomized survey incentives as micro-income shocks, we find that unexpected digital liquidity disproportionately stimulates digital spending and P2P transfers rather than withdrawals, particularly among vulnerable cohorts. Ultimately, while mandatory digital disbursement scales initial access, achieving welfare-enhancing financial inclusion requires combining structural bridging tools with targeted behavioral nudges.

Keywords: mobile money; financial inclusion; G2P payments; household finance.
JEL Classification: G2, G41, G5, O16

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Impulso para la adopción de servicios financieros digitales: evidencia experimental de los programas de transferencia de efectivo en Colombia

Resumen

Este estudio investiga los comportamientos de retiro de dinero entre las poblaciones recién bancarizadas en Colombia que recibieron ayuda por la pandemia. Mediante encuestas y microdatos administrativos de FinTech, aplicamos métodos observacionales y experimentales para analizar los patrones financieros. Los resultados observacionales confirman que los beneficiarios dependen en gran medida de los retiros inmediatos de efectivo, aunque las tarjetas de débito físicas y la exposición prolongada a la plataforma mitigan esta tendencia. En el componente experimental, al utilizar incentivos aleatorios de encuestas como choques de microingresos, encontramos que la liquidez digital inesperada estimula de manera desproporcionada el gasto digital y las transferencias P2P en lugar de los retiros, particularmente entre los grupos vulnerables. En definitiva, si bien el desembolso digital obligatorio amplía el acceso inicial, lograr una inclusión financiera que mejore el bienestar requiere combinar herramientas estructurales de apoyo con incentivos conductuales específicos.

Palabras clave: dinero móvil; inclusión financiera; pagos de gobierno a persona (G2P); finanzas familiares.
Clasificación JEL: G2, G41, G5, O16

Nudging para a adoção de serviços financeiros digitais: evidências experimentais dos programas colombianos de transferência de renda

Resumo

Este estudo investiga os comportamentos de saque entre pessoas recentemente bancarizadas na Colômbia que receberam auxílio emergencial durante a pandemia. Por meio de dados de pesquisas e microdados administrativos de fintechs, aplicamos métodos observacionais e experimentais para analisar os padrões financeiros. Os resultados observacionais confirmam que os beneficiários recorrem predominantemente a saques imediatos em espécie, embora o uso de cartões de débito físicos e a exposição prolongada à plataforma atenuem essa tendência. No componente experimental, ao utilizar incentivos de pesquisa atribuídos aleatoriamente como microchoques de renda, verificamos que a liquidez digital inesperada estimula desproporcionalmente os gastos digitais e as transferências entre pessoas (P2P), em detrimento dos saques, especialmente entre os grupos mais vulneráveis. Por fim, embora a obrigatoriedade do recebimento digital amplie o alcance inicial, a promoção de uma inclusão financeira capaz de aumentar o bem-estar exige a combinação de mecanismos estruturais de transição com estímulos comportamentais direcionados.

Palavras-chave: dinheiro móvel; inclusão financeira; pagamentos governo-pessoa (G2P); finanças das famílias.
Classificação JEL: G2, G41, G5, O16

Introduction

The unprecedented global health crisis precipitated by the COVID-19 pandemic served as a powerful exogenous shock to the global financial system, accelerating the adoption of digital financial services (FinTech) and fundamentally restructuring household finance in developing economies (CCAF et al., 2020). Driven by stringent social distancing mandates and an urgent, systemic need for remote economic operations, millions of previously unbanked individuals transitioned from traditional, cash-based informal economies into purely digital financial ecosystems (Fu & Mishra, 2022).

A primary catalyst for this shift was the rapid deployment of pandemic-related emergency relief policies, under which national governments used digital accounts and mobile money platforms to disburse unconditional government-to-person (G2P) cash transfers. Consequently, developing nations saw a dramatic increase in active electronic deposit accounts (World Bank, 2025).

However, an enduring puzzle persists in the development economics literature. While G2P transfers successfully overcome the initial access barrier to financial inclusion, it often fails to sustain the productive use of digital financial services. A wealth of administrative and survey-based evidence reveals a pervasive "cash-out trap," defined as the systematic failure of digital transfers to remain in the formal financial system because of compounding frictions from transaction costs and limited merchant acceptance. As a result, beneficiaries of social assistance programs immediately withdraw their entire cash transfer. Research in Colombia and other low and middle-income countries indicates that this occurs largely because beneficiaries are unfamiliar with using mobile money as a currency or because local merchants do not accept it. Consequently, many fail to use the digital wallet as a store of value, a medium for peer-to-peer (P2P) exchange, or an instrument for intertemporal consumption smoothing (IPA, 2024).

Because the long-term welfare gains of financial inclusion, such as enhanced risk-sharing, improved food security, consumption smoothing, and resilience to exogenous macroeconomic shocks, stem from the active and consistent use of financial accounts rather than mere nominal ownership, understanding the determinants of digital usage is of paramount importance to both policymakers and economists (Aker & Mbiti, 2010; Aker et al., 2016; Jack & Suri, 2014; Suri, 2017; Riley, 2018; Suri et al., 2021).

This study extends the empirical analysis of mobile money usage by providing causal evidence on how exogenous micro-income shocks affect the allocation of digital funds. Using a novel, high-frequency dataset that

combines cross-sectional survey data with exact administrative microdata from MOVii, one of the leading non-bank FinTech platforms contracted by the Colombian government to disburse the *Ingreso Solidario* (Solidarity Income) pandemic-relief G2P program, this research examines the behavioral mechanisms of digital financial usage.

This paper's empirical strategy comprises two components: observational and experimental, with the latter as the core focus. First, the observational analysis identifies the structural and idiosyncratic determinants of digital usage versus cash-out behavior by comparing regular, voluntary digital wallet users with the newly banked G2P recipient population. Second, an experimental design estimates the causal impact of unexpected liquidity shocks on digital financial behavior. These windfalls—i.e., small, unexpected digital liquidity shocks credited directly to users' digital wallets—serve as one-time, unconditional cash transfers. These shocks enable a precise causal analysis of how individuals allocate unexpected digital liquidity across spending, saving, transfer, and withdrawal channels.

The observational findings reveal a stark divergence in the financial trajectories of newly included G2P populations compared with voluntary FinTech adopters. Administrative data confirm that G2P beneficiaries are far more likely to cash out their subsidies immediately and far less likely to make digital merchant payments or P2P transfers. However, the analysis identifies two critical mitigants against this cash-out trap: the provision of a physical debit card, which bridges the digital-physical divide and significantly boosts digital spending, and the duration of account ownership, which is positively correlated with transactional volume, indicating a vital learning curve in financial technology adoption.

Importantly, the randomized experiment provides novel causal evidence that unexpected micro-income shocks deposited directly into a digital wallet disproportionately stimulate digital spending and cash-in behavior rather than cash-outs. This behavioral response is amplified among G2P recipients, whose average treatment effect (ATE) on digital spending is three times that of non-recipients. Furthermore, experimental variation in windfall magnitude significantly alters users' preferences for alternative investments and causally reduces their expected reliance on informal debt networks as a risk-coping mechanism.

This paper makes two relevant contributions to the literature. First, and most significantly, it provides novel causal evidence on how exogenous micro-income shocks affect the allocation of digital funds among newly banked, structurally vulnerable populations. By establishing this causal link, our study distinguishes itself from classic empirical and experimental

evaluations (such as Aker et al., 2016, in Niger and Jack & Suri, 2014, in Kenya), which mainly focus on low-income, low-infrastructure settings where mobile money primarily helps overcome severe geographic frictions. In contrast, we articulate the distinct behavioral dynamics of a G2P-FinTech architecture in Colombia: a middle-income economy undergoing a rapid digital transition. This context is uniquely instructive because of its institutional evolution. Unlike the telecom-led environments in early mobile money literature, Colombia's pandemic-era infrastructure was established by specialized, digitally oriented financial institutions and regulated electronic deposit entities (SEDPEs; *Sociedad Especializada en Depósitos y Pagos Electrónicos*). This early institution-led ecosystem operated in a fragmented private market, laying the groundwork for Colombia's current digital public infrastructure (DPI) called Bre-B: a central bank-backed, fully interoperable instant payment system (Banco de la República, 2026). Evaluating mandatory G2P digitization before this national interoperability was established provides vital causal evidence on the behavioral "cash-out trap" generated by fragmented private networks.

Compared to recent evaluations in similar Latin American middle-income contexts (such as Higgins, 2024, in Mexico, or Andia et al., 2024, in Peru), our study distinctively combines mandatory G2P digitization with an experimental micro-shock. In this context, the core policy challenge is not merely providing access or overcoming distance, but rather disrupting the deeply ingrained "cash-out trap," in which users mechanically liquidate digital transfers to service informal liabilities in the physical world.

Second, the paper advances the empirical literature by moving beyond the limitations of self-reported survey data. By integrating a randomized controlled trial (RCT) with high-frequency, granular administrative transaction logs from a leading FinTech platform, this research measures actual, rather than perceived, financial behavior, eliminating the recall and social desirability biases that typically constrain household finance evaluations in developing economies.

The remainder of the paper is organized as follows. Section 2 outlines the institutional context of the *Ingreso Solidario* program and establishes the theoretical framework for transaction costs and mental accounting. Section 3 details the data linkage process and the experimental design. Section 4 presents the empirical strategy. Section 5 discusses the observational results regarding the determinants of usage. Section 6 presents the core experimental results, detailing the causal effects of the micro-income shocks. Section 7 discusses the mechanisms and policy implications, and Section 8 concludes.

Institutional Context and Theoretical Framework

The COVID-19 Shock and the *Ingreso Solidario* Program

Following the outbreak of the SARS-CoV-2 pandemic, the Colombian government, like many Latin American countries and emerging market economies, faced the urgent necessity to protect highly vulnerable populations from the severe economic contraction caused by strict lockdown and quarantine measures (Azevedo et al., 2025). Prior to the pandemic, Colombia's social protection infrastructure primarily consisted of cash transfer programs such as *Familias en Acción* (Families in Action), *Jóvenes en Acción* (Youth in Action), and *Colombia Mayor* (Elder Colombia), which collectively reached several million households living in poverty (World Bank, 2020).

However, the economic crisis disproportionately threatened a vast segment of the population entirely excluded from these pre-existing registries: informal workers and lower-middle-income households who, though not classified as living in extreme poverty, hovered dangerously close to the poverty line and lacked formal income security or financial buffers. To address this massive gap in the social safety net, the government designed and implemented *Ingreso Solidario*, a novel, unconditional cash transfer program explicitly targeting three million previously unassisted households. The program provided a monthly subsidy of COP 160.000 (approximately USD 40 at the time of the pandemic) directly to targeted beneficiaries (Prieto, 2021).

Ingreso Solidario's critical innovation lay in its disbursement architecture. Faced with the epidemiological impossibility of distributing physical cash through traditional banking infrastructure without triggering contagious agglomerations, the government pivoted to a digital-first strategy. The state bypassed traditional brick-and-mortar financial institutions and instead used digitally oriented, mobile money platforms to disburse emergency cash assistance.

MOVii, operating under an SEDPE license, was selected as the primary non-bank FinTech institution to execute this digital disbursement. This FinTech operates entirely without physical branches; users access its financial services exclusively through a smartphone app. The platform enables users to pay utility bills, shop online, and make P2P transfers at zero marginal cost. Cash-in and cash-out (CICO) operations are facilitated through a nationwide network of third-party points of sale (PoS), including retail supermarkets, local drugstores, and betting booths. Users can also request a physical debit card linked to their digital wallet, enabling in-person purchases and traditional ATM withdrawals.

This public-private partnership catalyzed a leapfrogging event in national financial inclusion. In a remarkably compressed timeframe, the need to receive the *Ingreso Solidario* subsidy forced millions of unbanked citizens to adopt digital wallets. Between December 2019 and December 2020, the number of active electronic deposit accounts in Colombia surged from 2.1 million to an unprecedented 7.6 million (Banca de las Oportunidades, 2021). During fieldwork for this study, MOVii alone reported that two million mobile wallets had been opened, with over 650.000 conducting regular transactions, including 240.000 G2P recipients nationwide.

Transaction Cost Theory and the Mobile Money Landscape

To understand the behavioral dynamics of this newly banked population, it is necessary to ground the analysis in transaction cost theory and the economics of asymmetric information. In developing economies characterized by spatial frictions, inadequate physical infrastructure, and weak institutional frameworks, mobile money fundamentally alters the cost structure of financial exchange. By drastically reducing the marginal transaction costs of transferring value over long distances, mobile money facilitates the formation of robust, geographically dispersed informal risk-sharing networks, allowing households to smooth consumption amid idiosyncratic shocks (Jack & Suri, 2014).

However, a digital wallet's utility as a medium of daily exchange is inherently constrained by network externalities and the composition of the local microeconomy. In localized, informal economies where merchants, landlords, and supply chains operate exclusively in physical fiat currency, the relative cost of holding funds digitally exceeds the cost of immediate withdrawal. If a low-income household cannot purchase essential goods (e.g., food, housing, informal transportation) using mobile money, the digital wallet ceases to function as a holistic financial tool and becomes merely a conduit for withdrawals (Higgins, 2024).

Previous research (World Bank, 2025) shows that the transition from basic account access to meaningful financial inclusion depends heavily on the availability of acceptance infrastructure. Unless beneficiaries have physical debit cards or other interoperable tools that allow them to cash out digital funds seamlessly at conventional PoS terminals, the lack of digital merchant acceptance effectively forces users to cash out their full subsidy immediately upon receipt. Consequently, while G2P programs successfully mandate entry into the formal financial sector, this transaction-cost friction prevents sustained digital usage. This failure to maintain digital

liquidity undermines broader macroeconomic externalities, specifically the generation of granular transaction data trails, which are indispensable for developing alternative credit-scoring models and deepening formal financial markets.

Behavioral Economics of Windfalls: Mental Accounting and Liquidity Frictions

While neoclassical macroeconomic models of intertemporal choice posit that money is perfectly fungible, i.e., a rational economic agent should allocate a marginal dollar identically regardless of its source (Samuelson, 1937), this study is grounded in the behavioral economic theory of mental accounting (Thaler, 1999). Mental accounting theory argues that individuals violate the economic principle of fungibility by using a cognitive system of specialized bookkeeping. Under this framework, people do not treat money as a single, uniform aggregate; instead, they code, categorize, and evaluate it. This process involves creating implicit accounts in which funds are partitioned by source (e.g., windfall versus earned income) and by intended use (e.g., necessities versus luxuries), with each category governed by its own distinct set of implicit budgetary rules and transaction utility.

Furthermore, as Duan (2025) notes, the transition to digital finance has blurred the traditional boundaries of these psychological accounts. The "dematerialization" of currency in digital payments eliminates the visual and tactile feedback of physical cash, often reducing the perceived pain of payment and the sense of loss associated with spending. This lack of visual feedback can make it difficult for consumers to link digital expenditures to specific mental accounts, potentially undermining traditional budgeting and increasing impulsive financial behavior.

Therefore, when low-income individuals receive a predictable, recurring, and highly anticipated G2P subsidy like *Ingreso Solidario*, they typically earmark these funds well in advance for essential, physical-world liabilities (e.g., rent, staple groceries, debt repayment). This strict mental earmarking inevitably drives the immediate cash-out behavior observed in the administrative data. Furthermore, longitudinal evidence from large-scale unconditional cash transfers in Indonesia suggests that although these programs are vital for mitigating economic shocks, they often fail to fundamentally alter recipients' underlying behavioral traits, such as risk aversion or time preferences, after payments end (Al Izzati et al., 2023). This indicates that cash-out behaviors may be a deeply rooted response to structural poverty rather than a temporary shift.

Conversely, an unexpected, randomized monetary windfall deposited directly into a digital wallet represents a fundamentally different type of exogenous liquidity shock. Behavioral evidence suggests that small windfalls are not treated as fungible with regular income; instead, people often categorize them as "play money," leading to a significantly higher marginal propensity to consume than with anticipated, recurring income (Milkman & Beshears, 2009). While G2P subsidies are often mentally pre-committed to essential bills, these digital micro-shocks are more likely to be viewed as "found money" that can be spent more freely.

Users who perceive digital balances as "not real money" are significantly more likely to spend these funds within the digital ecosystem and have a higher marginal propensity to consume (MPC), particularly through increased discretionary spending. Rather than subjecting a small, unexpected windfall to the physical friction and agent fees of a withdrawal, users are theorized to be significantly more likely to spend the funds within the frictionless digital ecosystem, such as on mobile airtime, digital utility payments, or P2P transfers. This study's experimental design directly tests this behavioral divergence by examining whether introducing micro-shocks can effectively nudge users out of the cash-out trap and stimulate an experiential learning curve on the mobile money platform.

Data and Experimental Design

This paper's methodological novelty lies in successfully integrating an RCT into a demand-side survey and linking it to high-frequency administrative microdata from a leading FinTech operator. This tri-fold data architecture eliminates the recall and social desirability biases that typically plague empirical evaluations of household finance in developing countries.

Survey Instrument and Administrative Data Linkage

The primary observational data are drawn from a comprehensive survey instrument adapted from the World Bank's Global Findex database. The Global Findex is the recognized gold standard for systematically and comparably quantifying financial inclusion, enabling precise measurement of how adults save, borrow, make payments, and manage idiosyncratic risk (World Bank, 2025). The survey included detailed modules on household demographics, socioeconomic stratification, income brackets, educational attainment, and occupational status.

To assess long-term economic status beyond volatile monthly income, the survey asked respondents to inventory household assets (including appliances, housing status, and motor vehicles). Using principal component analysis (PCA), we aggregated these asset variables into a robust household asset-based wealth index (HAWI), which served as a stable proxy for socioeconomic resilience. We also built a continuous financial health index (FHI) via PCA, capturing multidimensional welfare indicators, including access to emergency funds, informal and formal saving profiles, debt composition, and sophisticated coping mechanisms for financial emergencies. The survey also included specialized modules to assess financial literacy—measuring comprehension of interest compounding, inflation, and risk diversification, following Lusardi and Mitchell (2014)—and technology acceptance (using a 5-point Likert scale to assess the perceived ease of use and usefulness of mobile money platforms).

Wherever feasible, we replaced self-reported questions about account ownership, transaction frequency, savings volumes, and payment behavior with exact, time-stamped administrative data provided directly by FinTech. This administrative dataset captured every transaction by survey respondents since opening their accounts, categorizing deposits (cash-ins), withdrawals (cash-outs), P2P transfers, interactions with other financial institutions, airtime top-ups, and merchant purchases. Linking survey demographics to administrative transaction logs provides a high-resolution view of actual, rather than perceived, financial behavior, unlike most surveys.

The survey included detailed modules covering household demographics, socioeconomic stratification, income brackets, educational attainment, and occupational status (see Appendix 1 for the complete survey questionnaire).

Sample Characteristics

The sampling exercise covered 600.000 active users on the partner FinTech platform. In this context, activity was defined as completing at least one transaction in the month preceding the study. Using a randomized selection process stratified by gender and G2P recipient status, the study invited 50.000 users from the active universe to participate in an online survey. Invitations were delivered via SMS and in-app notifications. This population includes a significant proportion of recently onboarded G2P beneficiaries and first-time account holders who entered the formal financial system during the pandemic. Following the data collection phase, conducted between July and September 2021, the final sample comprises 2523 respondents, yielding a highly representative cross-section of the national digital account-holder population.

Table 1 presents summary statistics for the analytical sample, segmented by G2P recipient status. This segmentation is critical because it highlights demographic and socioeconomic disparities between individuals who voluntarily adopted financial technology and those who were effectively pushed into the digital ecosystem by the pandemic relief mandates.

Table 1. Summary Statistics by User Typology

Characteristic	G2P recipients	Non-G2P (regular users)
Household size	4.02	3.67
Number of children	1.59	0.67
Head of household	69 %	43 %
Female	61 %	31 %
Foreigner (Migrant)	6 %	4 %
Married	45 %	32 %
Rural	7 %	5 %
Financial literacy score	1.03	1.24
College degree or higher	40 %	64 %
Employed (formal and informal)	51 %	57 %
Income < COP 250,000	42 %	31 %
Income < Minimum wage	65 %	46 %
Entrepreneurs/self-employed	24 %	27 %

Source: Own elaboration based on merged survey and administrative records.

The descriptive statistics confirm the algorithm's rigorous targeting efficacy when testing the *Ingreso Solidario* proxy means. G2P beneficiaries are structurally more vulnerable than regular FinTech users across nearly every metric. They are significantly more likely to be female (61 % versus 31 %) and to identify as the primary head of larger households with substantially more dependent children (1.59 versus 0.67). They also have lower educational attainment: only 40 % hold a college degree, compared with 64 % among regular users. Crucially, 65 % of G2P recipients report earning less than the national minimum wage, underscoring their severe baseline vulnerability and heightened exposure to persistent liquidity constraints.

Experimental Design: Survey Incentives as Exogenous Shocks

To causally identify how these populations allocate marginal liquidity, the study embedded an RCT within the survey deployment strategy. The empirical framework draws on recent methodological advances showing that randomized financial incentives for survey participation not only boost recruitment but also serve as valid, exogenous income shocks that perturb a household's financial state. By embedding these randomized payouts in the survey deployment, the design captures recipients' causal behavioral responses to sudden digital liquidity, a stimulus shown to be highly salient for vulnerable populations operating at the margins of economic hardship. Consistent with the "rock bottom" framework proposed by Alfonsi et al. (2026), these individuals exhibit heightened behavioral sensitivity to financial fluctuations; for those facing extreme resource constraints, even minor exogenous liquidity injections can become a primary determinant of decision-making and platform engagement.

Upon selection, the 50.000 individuals were randomly assigned to one of four experimental treatment arms, which determined the monetary incentive they would automatically receive in their digital wallet upon successful survey submission.

1. COP 0 (no incentive/baseline solicitation)
2. COP 5.000 (approximately USD 1.1, at the moment of the experiment)
3. COP 10.000 (approximately USD 2.3)
4. COP 20.000 (approximately USD 4.5)

The magnitude of these unanticipated transfers (we use terms such as "windfall" or "micro-income shock" interchangeably only for expositional clarity) was economically meaningful in the local context. The amounts were equivalent to approximately 39 %, 78 %, and 155 % of the median daily income in Colombia, representing substantial, albeit temporary, liquidity injections for the lowest-income brackets (Cárdenas, 2020).

Monetary incentives were credited directly to users' digital wallets immediately after survey completion. In the SMS invitation, users received a link to complete the survey, along with information about the incentive they would receive upon submission. The survey was administered via Typeform. Because invitations were sent in eight waves over a two-month period, treatment timing was staggered across respondents. For each individual, we observed administrative outcomes before and after the incentive

deposit. Specifically, baseline outcomes aggregate all transactions from account opening through the incentive payment date, while post-treatment outcomes aggregate all transactions from the incentive deposit through the end of the observation period. As a result, the post-treatment exposure window varied across users; on average, respondents were observed for approximately 1.6 months after the incentive payment.

During the survey's pilot phase, the reported response rate for the zero-incentive group was near zero. This zero-response pattern perfectly illustrates the theoretical framework for non-response bias in economics; highly constrained individuals require adequate compensation for their time, and failing to provide it results in severe sample truncation (Dutz et al., 2026). Because survey participation incentives were necessary to elicit responses, the COP 5000 arm serves as a reservation-price control rather than a zero-transfer benchmark. All treatment effects are therefore interpreted relative to this minimal inducement.

The COP 10.000 and COP 20.000 treatment arms represent exogenous micro-income shocks. Because these transfers were deposited seamlessly and immediately into respondents' digital wallets, they effectively mimicked unexpected digital windfalls. Randomized incentive assignments ensure that treatment is strictly orthogonal to users' pre-existing socioeconomic characteristics, baseline financial behavior, and unobserved heterogeneity, satisfying the core assumptions for robust causal inference (Cunningham, 2021).

To verify the integrity of the randomization process, we assessed baseline equivalence between the active experimental arms (pooled COP 10.000/COP 20.000 treatments) and the COP 5000 control. Appendix 3 reports standardized mean differences (SMDs) for key demographic and financial covariates. Across all pairwise comparisons, the standardized differences are well below the conventional threshold of 0.10. Furthermore, an omnibus F-test of joint orthogonality, following J-PAL (2026), confirms that baseline characteristics do not jointly predict treatment assignment (F=1.21, p=0.268). These checks confirm that the treatment arms are strictly balanced and that unobserved heterogeneity is orthogonal to treatment assignment.

Empirical Strategy

The empirical analysis is systematically partitioned to address the study's dual objectives: first, to model the observational determinants of the access–usage gap, and second, to estimate the causal effects of exogenous micro-income shocks on subsequent financial behavior.

Observational Modeling: The Determinants of Usage

Following Mugoro and Makhura (2025), we use a Probit estimation to predict the likelihood of specific transaction typologies (the extensive margin). This stage models the binary adoption decision by estimating the probability that an individual engages with the platform, using relevant demographic and socioeconomic predictors. The model is specified by the following equation:

$$P(Y_{ij} = 1 \mid X_{ij}) = \Phi(\beta_0 + \beta_1 X_i + \epsilon_i)$$

Where $Y_{\{ij\}}$ is a dichotomous dependent variable that takes the value of 1 if individual i has performed at least one transaction in a specific administrative category (spending, P2P transfers, cash-ins, or cash-outs) since the inception of their account. The matrix X_{ij} encompasses a highly saturated set of covariates, integrating administrative variables (age, sex, migrant status, G2P recipiency) with self-reported survey data (HAWI wealth index, financial literacy, and technology acceptance factors).

Second, to model the intensive margin of usage (the absolute volume of transactions), we use negative binomial regression, following the methodological precedent for studying digital financial services in emerging markets (Mugoro & Makhura, 2025). Transactional data in G2P cohorts exhibit severe right skewness and overdispersion, with transactional variance substantially exceeding the unconditional mean.

Experimental Modeling: Causal Inference of Liquidity Shocks

While the observational models identify structural barriers to usage, they cannot definitively isolate liquidity's causal effect on behavior. To evaluate the causal effects of unconditional cash transfers, the analysis shifts to an experimental framework that isolates behavioral variations induced solely by randomized survey incentives.

Because the treatment assignment is randomized and independent of baseline characteristics, a multivariate fixed-effects ordinary least squares regression yields unbiased, consistent estimates of the ATE. The primary specification is modeled as follows:

$$Y_{i,t+1} = \alpha + \delta T_i + \rho Y_{i,t} + \theta(T_i \times X_i) + \epsilon_i$$

Where $Y_{\{i,t+1\}}$ represents the administrative outcome variable measured *ex post*, specifically the logarithm of the difference between baseline and

post-treatment transactional volumes (plus 1 because ln(0) is undefined). The variable T_i is the categorical treatment indicator (0 for the COP 5000 control group; 1 for the COP 10.000/COP 20.000 treatment groups).

To maximize statistical power and control for pre-existing behavioral trajectories, a common challenge in digital finance studies, we explicitly include $Y_{\{i,t\}}$ representing the average value of *ex ante* measured usage outcomes. Furthermore, the matrix X_i introduces interaction terms between the treatment indicator and vital markers, such as G2P status and debit card ownership, to quantify heterogeneous treatment effects across distinct subpopulations. For secondary experimental analysis of risk management and investment preferences, the same foundational specification is applied using a Probit model.

Results: The Access–Usage Gap

The initial phase of the analysis unpacks the severe friction between mandated account ownership and active, productive financial use, empirically verifying the theoretical cash-out trap among vulnerable populations.

The Cash-Out Trap Among G2P Recipients

Table 2 presents the marginal effects from Probit estimates of the extensive margin of administrative usage variables. The results unequivocally confirm the pervasive nature of the cash-out trap among the G2P population. Even after rigorously controlling for underlying wealth (HAWI), education, employment status, and geography, G2P recipients remain systematically excluded from the digital velocity of money.

The estimators identify a statistically significant behavioral penalty associated with G2P status. Compared with regular, voluntary FinTech adopters, the previously unbanked G2P population has a 26.4 % lower probability of making digital merchant payments, a 27.7 % lower probability of initiating bank transfers, and a staggering 41.4 % lower probability of depositing funds (cash-ins) into the ecosystem. Conversely, they are 19.6 % more likely to withdraw their funds as physical cash. This empirical reality shows that forced digitization alone does not alter underlying economic behavior; when faced with immediate, physical-world liabilities, highly constrained households will incur the friction of CICO agents to liquidate their digital subsidies.

Table 2. Determinants of Usage: Administrative Data (Probit Marginal Effects)

Variables	(1) Spending	(2) Transfers	(3) Cash-in	(4) Cash-out
G2P recipient	-0.264***	-0.277***	-0.414***	0.196***
Migrant (Foreigner)	0.0645**	0.165***	0.0242	0.0061
Time from account opening	0.00739***	0.00343**	0.00268**	-0.00126
Active debit card	0.239***	0.0430**	0.0865***	-0.0931***
Household asset-based wealth index (HAWI)	0.118**	-0.198***	0.00236	-0.082
Minimum wage earner	0.0253	0.0647***	0.00198	0.0762***
Unemployed	-0.0197	-0.0880***	-0.014	-0.0468**
Entrepreneur/self-employed	0.0346**	0.0475**	0.0342**	0.0171
Rural resident	-0.018	0.0231	-0.105***	0.0811**

Note: Robust standard errors omitted for brevity. Significance: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Observations: 2,532.

Source: Own elaboration.

Geographic constraints further exacerbate this phenomenon. Individuals residing in rural areas are 11 % less likely to make cash-ins and 8.1 % more likely to make cash-outs. This stark geographic disparity highlights a fundamental supply-side constraint: rural ecosystems suffer from a severe deficit in digital public infrastructure, including reliable internet connectivity and ubiquitous merchant PoS networks. In such environments, cash remains the rational, transaction-cost-minimizing medium of exchange, rendering the digital wallet practically obsolete for daily commerce.

Mitigating Factors: Debit Cards and Learning Curves

While the baseline G2P behavior is highly extractive, the analysis identifies two highly significant, actionable variables that effectively counterbalance the cash-out trap.

The first is issuing a physical debit card linked to the digital wallet. As shown in Table 2, cardholders have a 23.9 % higher probability of digital spending and an 8.6 % higher probability of making cash deposits (cash-ins). In this sense, having an active debit card reduces the probability of cash-out behavior by 9.3 %. The debit card serves as an essential technological bridge across the digital-physical divide, enabling users to transact seamlessly at traditional (physical) merchant terminals without the need (or psychological friction) to convert their balance into physical currency.

The second major mitigating factor is technological familiarity. The variable measuring the time elapsed since the account's opening is strongly and positively correlated with all productive usage metrics. Regression coefficients for "Time from account opening" indicate that each additional month of platform exposure increases the probability of app usage. When these monthly marginal effects are multiplied by 12 months, the result is a significant 3.2 % to 8.9 % annualized increase in the likelihood that a user will deposit, transfer, or spend. This finding strongly implies an experiential learning curve: forced initial adoption must be followed by a requisite gestation period. During this phase, users move from mere technical access to developing digital financial competencies, a process in which sustained exposure helps build the trust needed to navigate security risks and overcome behavioral biases, such as the "lower pain of payment," associated with novel digital interfaces (OECD, 2025). For the complete set of regression coefficients across all demographic, financial literacy, and technological variables, see Appendix 2.

The intensive margin analysis in Table 3, using the negative binomial count model (Cameron & Trivedi, 2013) on a zero-truncated subsample, reinforces the findings from the binary probability analysis. Being a G2P recipient severely depresses the expected log of total transactions by 1.378 units. Calculating the predictive margins at the mean of all covariates reveals a substantial disparity in engagement: regular users average 81.5 transactions over their account lifespans, compared with 20.6 for G2P users. However, in this model, the interaction effects highlight the debit card's rescue effect. While card ownership increases transactional velocity across all cohorts, it significantly mitigates the transactional deficit for G2P users by about 0.4 expected log units. Specifically, debit cardholders average 49.2 transactions over their tenure, compared with 33.5 for those restricted entirely to the mobile application.

Table 3. Negative Binomial Model: Total Transaction Volume

Variables	(1) Baseline model	(2) Interaction model
Non-G2P X card		0.364*
G2P X No card		-1.399***
G2P X card		-0.998***
Migrant (Foreigner)	0.485***	0.482***
G2P	-1.378***	
Card	0.384***	

Note: Controls applied. Robust standard errors omitted for brevity. Significance: ***$p < 0.01$, *$p < 0.1$. Observations: 2,532. X denotes interaction terms.

Source: Own elaboration.

Financial Health and Intertemporal Welfare

To assess the broader welfare implications of these digital financial behaviors, we ran an ordinary least squares (OLS) regression to identify the determinants of the continuous financial health index (FHI) (Table 4). The analysis shows that access to intertemporal consumption tools is associated with overall financial well-being. Even after controlling for income brackets and asset wealth, holding formal loans and maintaining consistent savings mechanisms (formal or informal) significantly and positively affect users' resilience to macroeconomic shocks. Conversely, reliance on informal, predatory lending networks and the psychological and financial penalties of formal credit rejection severely degrade the FHI. This evidence underscores the imperative for FinTech platforms and policymakers to move beyond basic payment disbursement; to structurally elevate the welfare of the newly banked, platforms must integrate accessible micro-credit and structured digital saving products (Klapper, 2024).

Table 4. Ordinary Least Squares: Determinants of the Financial Health Index

Variables	FHI estimators
Formal loans	0.0165***
Informal loans	-0.0190***
Formal savings	0.0287***
Informal savings	0.0280***
Loan app rejected	-0.00552***

Note: Controls: Income, gender, card possession, wealth (HAWI). R-squared: 0.466. Significance: ***$p < 0.01$. Observations: 1,829.

Source: Own elaboration.

Experimental Results: The Causal Impact of Micro-Liquidity Shocks

The observational data highlight deep-seated structural inertia that favors physical cash extraction over digital velocity among low-income, forced adoption cohorts. The experimental phase tests a critical behavioral hypothesis: whether an exogenous, randomized digital windfall can disrupt this inertia, alter mental accounting mechanisms, and stimulate productive, long-term wallet use. By comparing individuals who received higher micro-shocks (COP 10.000 and COP 20.000) with the baseline reservation control group (COP 5000), the analysis successfully isolates the causal behavioral response to unexpected liquidity.

Causal Effects on Transactional Velocity

High-frequency administrative data tracking pre- and post-treatment behavior were used to measure proportional changes in specific transaction typologies, based on logarithmic differences between the established baseline and subsequent post-treatment activity (Table 5).

Table 5. Randomized Controlled Trial: Administrative Records on Usage (Ln Differences)

Variables	Cash-out	Cash-in	Spending	Transfers
COP 5000 X G2P	1.057***	-0.28	1.055***	0.692*
COP 10.000-COP 20.000 X Non-G2P	-0.0652	0.239*	0.420***	-0.0767
COP 10.000-COP 20.000 X G2P	1.092***	0.324	1.216***	0.900***

Note: Observations restricted to users with active baseline and post-treatment transactions. Controls applied. Significance: ***$p < 0.01$, * $p < 0.1$. In differences denote log differences of total transaction volumes aggregated over the relevant period, computed as ln(1+Y{post}) − ln(1+Y_{pre}). X denotes interaction terms.

Source: Own elaboration.

The causal estimates reveal a meaningful and somewhat counterintuitive shift relative to the benchmark neoclassical prediction. In standard intertemporal consumption models with binding liquidity constraints, households operating near subsistence are expected to optimally treat unexpected income as current disposable resources, immediately cashing out any transitory windfall to meet pressing physical-world obligations and consuming it much as they do their regularly anticipated G2P subsidy. Such behavior reflects a high marginal propensity to consume driven purely by constrained optimization rather than myopia. However, consistent with recent evidence on unanticipated liquidity shocks (Acconcia et al., 2024), the experimental data show the opposite pattern: even among low-income households, unexpected shocks do not uniformly translate into immediate cash-out consumption. Instead, recipients partially defer or reallocate the windfall, signaling a departure from the textbook hand-to-mouth response and suggesting that the shock is processed differently from routine income flows. This divergence indicates that the marginal dollar of an unexpected transfer may enter a distinct decision framework (shaped not only by liquidity constraints but also by expectations, uncertainty, and emerging financial choice sets) rather than being mechanically absorbed into contemporaneous consumption.

In our exercise, treated non-G2P users saw a substantial increase in digital activity, including a 27 % rise in cash-in operations and more than a 50 %

increase in digital spending relative to the control group, with no statistically significant change in cash-out behavior. The heterogeneity analysis, captured through interactions with G2P recipiency, is particularly illuminating. For the historically inactive, cash-dependent G2P population, the exogenous liquidity shock led to increased digital engagement. The treatment nearly tripled the digital spending response observed among non-recipients and generated a large, statistically significant surge in P2P digital transfers (0.900 log points). Although G2P beneficiaries also increased their absolute volume of cash-outs (1.092 log points), the proportional acceleration of digital spending was even larger (1.216 log points), indicating a decisive shift toward on-platform usage rather than mechanical cash extraction.

This pattern of causal effects aligns best with a behavioral mechanism rooted in mental accounting. When regular, anticipated *Ingreso Solidario* subsidies are disbursed, funds are cognitively earmarked for rigid, essential, cash-based expenditures (such as informal rent payments or servicing local debt) that are strongly resistant to reallocation (Wicker et al., 2025). The mental friction required to deviate from these established consumption categories is substantial, particularly when transfers arrive in familiar, cash-like forms that reinforce existing budgeting norms (Milkman & Beshears, 2009; Gelman & Roussanov, 2024).

However, when an unexpected micro-shock is deposited directly into a digital wallet, the cognitive framing of the funds appears to shift. In this context, the perceived transaction costs of cashing out, such as travel to CICO agents, waiting time, or withdrawal fees, can plausibly exceed the effort required to complete an immediate, frictionless digital transaction, such as airtime top-ups, utility micro-payments, or P2P transfers (Higgins, 2024; Jack & Suri, 2014). As a result, the unexpected windfall serves as a behavioral catalyst, encouraging experimentation with digital payment features and facilitating initial platform use beyond cashing out. This interpretation aligns with evidence that exogenous income shocks can accelerate adoption and intensive use of electronic payment systems and related financial technologies (Crouzet et al., 2023).

Shifting Preferences: Alternative Investments and Risk Aversion

Beyond immediate, high-frequency transaction velocity, the experimental design used the survey instrument to elicit the causal impact of the liquidity shock on self-reported prospective financial behaviors, with an explicit focus on risk aversion and demand for unconventional investment instruments (Table 6).

Table 6. Randomized Controlled Trial: Alternative Investment Preferences

Variables	More savings	Cryptocurrencies	Crowdfunding	P2P lending
Mean	44.70 %	15.50 %	20.80 %	
COP 10.000	0.0084	0.00851	0.0317*	-0.0489***
COP 20.000	0.0442*	-0.0144	0.0265	-0.0576***

Note: Controls applied. Significance: ***$p < 0.01$, *$p < 0.1$. Observations: 2,492.

Source: Own elaboration.

Baseline survey responses reveal pronounced risk aversion typical of highly vulnerable households. When presented with a hypothetical investment choice, nearly half of respondents (44.7 %) select the strictly risk-averse option, preferring to save rather than invest, underscoring a strong baseline preference for capital preservation. Outcomes are measured as binary indicators equal to 1 if the respondent selects a given option, and the estimates reported in Table 7 are marginal effects from Probit regressions. Importantly, all treatment effects are interpreted relative to the control group receiving the COP 5000 participation incentive, which serves as the experimental baseline.

Against this backdrop, the randomized liquidity shocks produce nuanced, decidedly nonlinear shifts in stated preferences. Relative to the COP 5000 baseline, receiving a moderate COP 10.000 transfer increases the probability of selecting crowdfunding (defined in the survey as financing local entrepreneurship and business ventures) by 3.2 percentage points. This effect suggests that small, unexpected windfalls can temporarily relax risk thresholds, fostering interest in higher-return, community-oriented investment opportunities. However, this exploratory response does not scale monotonically with transfer size. When the shock doubles to COP 20.000, the crowdfunding effect becomes statistically insignificant relative to the baseline, while precautionary motives reassert themselves: the likelihood of choosing strict saving rises by 4.4 percentage points.

Most strikingly, preferences for P2P lending show a strong, monotonic negative response to the transfer size, again relative to the COP 5000 group. The probability of selecting P2P lending falls by 4.9 percentage points under the COP 10.000 treatment and by 5.8 percentage points under the COP 20.000 treatment, with both effects significant at the 1 % level. This pattern suggests a complex sociological dynamic: as individuals experience larger positive, idiosyncratic income shocks, their propensity for horizontal, reciprocal financial cooperation diminishes. This effect likely occurs because the sudden influx of exogenous liquidity temporarily reduces the urgency of

relying on intra-community, informal risk-sharing networks, lowering the perceived need to build social capital through lending (Jensen, 2004).

Impacts on Coping Mechanisms and Financial Resilience

The final experimental module evaluates the causal effect of unconditional cash transfers on household risk-management strategies. Respondents were asked about their hypothetical responses to an abrupt financial emergency, and responses were categorized into four broad behavioral strategies: reducing consumption or liquidating savings, increasing informal debt, increasing formal debt, or being completely out of options (Table 7).

Table 7. Randomized Controlled Trial: Risk Management Strategies

Variables	Savings/ Consumption	Informal debt	Formal debt	Out of options
Mean	84.40 %	16.30 %	14.40 %	10.80 %
COP 10.000	-0.000885	-0.0300*	-0.0263*	-0.0102
COP 20.000	-0.00406	-0.0237	-0.0346*	0.000506

Note: Controls applied. Significance: ***$p < 0.01$, *$p < 0.1$. Observations: 2,492.

Source: Own elaboration.

The experimental data show that injecting immediate, frictionless liquidity into the household cushions perceived financial vulnerability and reshapes emergency planning. Relative to the COP 5000 baseline incentive, the COP 10.000 treatment yields a statistically significant 3.0 percentage-point reduction in the intent to rely on informal debt networks (such as high-interest moneylenders, friends, or extended family) to weather a shock, and a 2.6 percentage-point reduction in the propensity to seek formal loans. The larger COP 20.000 shock further depresses anticipated reliance on formal debt by 3.4 percentage points. Notably, neither treatment significantly alters reliance on savings-based self-insurance, nor does it increase the probability of reporting being "out of options." This pattern indicates that the liquidity injections operate primarily by substituting away from debt-based coping mechanisms rather than by crowding out precautionary saving or increasing perceived financial fragility.

A large body of literature documents that financially vulnerable households operate with extremely thin buffers, so even small, unexpected injections can substantially reduce psychological stress and improve short-term coping capacity (Lusardi et al., 2011). Consistent with evidence from

randomized evaluations of unconditional cash transfers, these liquidity infusions (when delivered rapidly and without bureaucratic friction) enhance short-term resilience by reducing households' reliance on costly coping mechanisms, including high-interest informal credit (Haushofer & Shapiro, 2016). In this context, digital disbursement amplifies the effectiveness of even small transfers by ensuring immediacy, certainty, and ease of access, thereby shielding vulnerable households from the compounding costs of predatory emergency borrowing documented in low-income settings (Banerjee & Duflo, 2007; Collins et al., 2009).

Discussion and Mechanisms

The synthesis of observational modeling and experimental causal estimates reveals a nuanced paradigm for understanding the mechanics of digital financial inclusion. The rapid, pandemic-driven onboarding of millions of beneficiaries into the *Ingreso Solidario* program was a major logistical and infrastructural achievement for the Colombian state and its private FinTech partners. However, a growing body of evidence warns against conflating mere digital access with meaningful, welfare-enhancing inclusion. As observed in prior electronic G2P rollouts and recent digital wallet expansions in Latin America, account ownership alone rarely translates into sustained or productive use without broader integration into the local payment ecosystem (Andia et al., 2024; Zimmerman et al., 2014).

The default financial behavior of newly banked, structurally vulnerable households is overwhelmingly extractive. Consistent with the literature on early-stage mobile money adoption, G2P beneficiaries operating under tight income constraints and in cash-dependent informal economies initially prioritize rapid cash withdrawals over using digital payment features (Demirgüç-Kunt et al., 2018; Jack & Suri, 2014). Our observational results reinforce this pattern, underscoring that inertia stems not from technological failure but from structural and behavioral frictions.

Empirical evidence identifies two mechanisms that can weaken this inertia: structural bridging and behavioral nudging. From a structural perspective, access to a physical debit card is particularly effective at reducing systemic cash dependency. By enabling digital balances to be spent directly at conventional merchant terminals, debit cards circumvent the travel costs, time delays, and agent fees associated with cash-in/cash-out networks, thereby increasing the functional value of digital liquidity. This finding aligns with broader evidence on the central role of merchant acceptance and interoperability in sustaining digital payment usage.

From a behavioral perspective, the randomized intervention highlights the power of small, exogenous digital windfalls to reshape transaction choices. The finding that micro-income shocks stimulate digital spending, P2P transfers, and deposits (rather than mechanically accelerating cash out) provides causal evidence that the cash-out trap is strongly mediated by rigid mental accounting (Gelman & Roussanov, 2024; Wicker et al., 2025). Predictable income streams are allocated to cash-based survival needs, whereas unexpected digital transfers are treated more flexibly, encouraging low-risk experimentation on the platform. As related work shows, such shocks can serve as entry points to broader digital engagement by reducing the perceived costs of adoption.

The experimental design itself further highlights the non-linear nature of this cognitive reframing. During the pilot phase, a near-zero response rate required providing a baseline compensation of COP 5000 to all participants. Because all ATEs are measured against this already substantial baseline, the observed behavioral shifts in the COP 10.000 and COP 20.000 arms are particularly telling. Rather than scaling linearly with increased liquidity, the distinct behavioral responses suggest rigid cognitive boundaries.

In a context of resource constraints, the baseline COP 5000 is likely to be coded by the user as earned compensation, a reservation wage for the time and effort spent on the survey. As such, these initial funds are rapidly absorbed into mental accounts pre-earmarked for essential cash-based survival needs. However, as the transfer size increases to COP 10.000 and COP 20.000, the liquidity exceeds this perceived reservation wage. This excess shifts in its mental classification from "earned" income to an "unexpected windfall" (Milkman & Beshears, 2009). This cognitive reframing, rather than the marginal increase in purchasing power, may reduce the friction of spending and drive increases in digital experimentation, discretionary digital spending, and peer-to-peer transfers. Therefore, the digital wallet serves not only as a conduit for disbursements but also as an ecosystem in which the non-linear effects of mental accounting can manifest physically.

These mechanisms yield clear design implications for the next generation of digital social protection systems. As discussed, access to a physical debit card is highly effective in the short term because it provides a physical, interoperable debit card by default, rather than serving as a technological bridge that circumvents the time delays and agent fees of cash-out networks by enabling direct transactions at conventional PoS terminals. However, relying solely on physical cards is a transitional solution. To ensure sustained digital inclusion, governments and central banks must prioritize developing a comprehensive digital public infrastructure (DPI)

with interoperable fast payment systems. Central banks play a pivotal role as catalysts for implementing these instant payment networks, driving financial inclusion, reducing transaction costs, and improving overall financial health by empowering households to efficiently manage obligations and withstand economic shocks (BIS, 2024).

If local grocery stores, landlords, and informal supply chains operate on disparate, non-communicating digital payment rails, the digital wallet cannot function as a holistic medium of daily exchange. In Colombia, this structural barrier has been directly addressed by Bre-B, a government-mandated, real-time payment rail launched in October 2025. By enforcing strict platform interoperability across all licensed banks, digital wallets, and payment service providers, Bre-B establishes a unified national infrastructure. Policymakers must incentivize or mandate the deployment of universal, low-cost acceptance technologies, leveraging features such as Bre-B's simple payment aliases (*llaves*) or standardized QR codes for 24/7, instant account-to-account transfers, to ensure that digital subsidies can circulate seamlessly within local microeconomies in seconds.

Furthermore, to encourage continued use beyond mere cashing out, platforms must actively mitigate administrative "hassle factors" and build confidence in the digital ecosystem using DPI by setting digital delivery as the default, simplifying onboarding instructions, and leveraging social norms to make digital adoption trusted among marginalized groups (ideas42 & World Bank, 2021; World Bank, 2023).

The causal mechanisms identified in our experimental results provide a clear policy blueprint that translates directly into structural design recommendations for the next generation of digital social protection. First, our experimental results demonstrate that exogenous, unexpected digital pay-outs above the reservation wage disproportionately stimulate on-platform digital spending and P2P transfers rather than mechanical cash withdrawals, highlighting the malleability of mental accounting.

To translate this into policy, program designers and partnered FinTechs should embed gamified, targeted micro-incentives in the digital wallet interface rather than relying exclusively on predictable, flat-rate monthly G2P disbursements. Because predictable income is immediately absorbed into rigid mental accounts earmarked for cash-based survival, platforms must introduce variability to disrupt this inertia. Implementing behaviorally informed nudges (such as randomized cashbacks, digital lottery-style rewards, or temporary liquidity bonuses conditional on making a first digital merchant payment) can synthetically recreate the "windfall" effect. Because they fall outside pre-established household budgets, these unpredictable rewards bypass strict

mental accounting rules and are instead framed as flexible digital liquidity. As Kearney et al. (2011) show, low-income populations respond strongly to these gamified, prize-linked financial structures, which hold significantly more behavioral appeal than standard flat-rate returns. Furthermore, as Schaner (2018) notes, when temporary financial subsidies explicitly incentivize active account use, they successfully overcome these initial psychological frictions and generate persistent behavioral changes long after the incentive expires. In the G2P context, these targeted micro-injections actively pull users up the digital learning curve and permanently shift behavior from mechanical cash extraction to sustained digital circulation (Higgins, 2020)

Second, we find that moderate liquidity injections temporarily ease risk aversion, increasing interest in community-based crowdfunding, whereas larger shocks reassert precautionary saving motives and universally reduce the propensity for horizontal P2P lending. This shifting risk appetite yields a clear structural recommendation: digital wallets must evolve from static delivery rails into dynamic financial health platforms. Policymakers should encourage FinTech operators to integrate tiered, low-barrier digital savings and micro-investment products directly into the G2P interface. Offering structured features (such as localized crowdfunding pools for moderate liquidity or automated goal-based savings for larger balances) can capture this shifting risk appetite, converting temporary digital windfalls into durable asset-building tools.

Finally, our experimental results show that frictionless liquidity injections immediately reduce households' anticipated reliance on costly informal debt networks and formal credit during abrupt financial emergencies. To institutionalize this financial resilience, DPI and digital social protection frameworks should proactively incorporate data-driven emergency liquidity buffers. Governments and financial operators can use granular transaction data from G2P usage to underwrite and offer pre-approved, low-interest nano-credit or algorithmic overdraft facilities within the wallet. This structural feature would effectively replicate the protective psychological and financial buffer of a micro-shock, shielding vulnerable beneficiaries from the compounding costs of predatory lending even after temporary pandemic-era subsidies expire.

Conclusion

As governments increasingly rely on digital infrastructure to deliver social assistance, respond to crises, and modernize public financial management, understanding the behavioral dynamics of digital financial use is essential.

By integrating high-frequency administrative transaction data with a randomized income-shock experiment, this study demonstrates that although mandatory G2P digitization can rapidly increase nominal account ownership, access alone is insufficient to achieve sustainable, welfare-enhancing financial inclusion.

The observational evidence confirms that newly banked, low-income households initially treat digital wallets as pass-through instruments, extracting funds to service predominantly cash-based informal economies. Crucially, the experimental results show that this behavior is not immutable. Structural interventions, most notably the provision of interoperable debit cards, materially reduce reliance on cash-out by enabling direct participation in the formal merchant economy. At the same time, small, unexpected digital liquidity shocks causally induce disproportionate increases in digital spending, peer-to-peer transfers, and deposits, particularly among the most vulnerable G2P recipients.

Taken together, these findings provide new causal evidence for the financial inclusion literature, showing that temporary digital liquidity and access to physical payment interfaces jointly accelerate progress along the digital learning curve. Importantly, the results also show that such shocks reduce households' immediate reliance on informal and formal debt mechanisms, highlighting a previously under-documented channel through which digital G2P programs can enhance short-term financial resilience. Furthermore, the observed non-linear shifts in risk aversion underscore the need for digital wallets to evolve into dynamic financial platforms that offer tiered micro-investment and savings tools to capture shifting liquidity thresholds.

For policymakers and platform designers, the implications are clear. Achieving the long-run gains of financial inclusion requires moving beyond a narrow focus on enrollment toward deliberate system design that integrates infrastructure expansion with behaviorally informed incentives. Strategic deployment of small, well-timed digital transfers, coupled with broad merchant interoperability, can transform digital wallets from static delivery rails into platforms for sustained economic engagement. More broadly, these results suggest that DPI, when combined with targeted nudges, can play an active role in formalizing economic activity and strengthening household resilience, even in highly cash-dependent environments.

Future research should assess the durability of these behavioral shifts over longer time horizons and examine how repeated or conditional digital incentives interact with income volatility, trust formation, and access to credit. Understanding these dynamics will be critical as digital G2P systems transition from emergency responses to permanent pillars of social protection.

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Authors' Contributions – CrediT

Samir Kiuhan Vásquez: conceptualization, methodology, data curation, formal econometric analysis, and writing – original draft.
Erick Rincón Cárdenas: conceptualization, project supervision, institutional and regulatory framework validation, and writing – review & editing.
Both authors have read and agreed to the published version of the manuscript.

Conflict of Interest

The authors declare no known competing financial interests or personal relationships that could appear to influence the work reported in this paper.

Ethical Considerations

This study was reviewed and approved by the Institutional Review Board / Research Ethics Committee of Università Bocconi under Protocol Code SA000298. All research procedures strictly adhered to the institution's research ethics guidelines and standards for research involving human subjects.

Data Availability

Due to non-disclosure agreements with the partner financial technology institution (MOVii) and to compliance with applicable data protection regulations (including GDPR principles), the microdata and individual transaction records used in this study cannot be made publicly available.

Use of Generative AI

During the preparation of this work, the authors used generative AI tools exclusively for language editing, grammar checking, and improving the text's clarity and coherence. After using these tools, the authors reviewed, revised, and verified the content, and they take full responsibility for the integrity and accuracy of the final publication.

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Appendix

Appendix 1. Survey Questions

1. First things first. What's your name?
2. Your cellphone number is?
3. How do you identify yourself?

    a. Woman
    b. Man
    c. Other

4. What type of ID document do you have?

    - Citizenship card
    - Identity card
    - Special residence permit
    - Foreign ID
    - Other

5. Write down your document number here (This field is required)
6. What city/municipality do you live in?
7. In which department is it located? (This field is required)
8. What is your marital status?

    a. Separated/Divorced
    b. Unmarried cohabitation
    c. Single
    d. Married
    e. Widowed

9. What socioeconomic strata do you belong to?

    a. 1
    b. 2
    c. 3
    d. 4
    e. 5
    f. 6

10. What is the highest educational level you achieved?

    a. Primary school
    b. High school
    c. Technical trainee
    d. Technical degree
    e. Bachelor's degree
    f. Postgraduate degree

11. How do you spend your time?

    a. Working as an employee
    b. Self-employment
    c. Looking for a job
    d. Studying
    e. Doing household work
    f. Other activity

12. How much income do you receive in a month in COP?

    a. Up to 250.000
    b. Between 250.000 and 500.000
    c. Between 500.000 and 1 million
    d. Between 1 million and 2 million
    e. Between 2 million and 3 million
    f. Between 3 million and 5 million
    g. More than 5 million

13. How many people live in your household?
14. Are you the head of your household?

    a. Yes
    b. No

15. How many children do you have?

    a. 0
    b. 1
    c. 2
    d. 3

e. 4
f. 5
g. 6
h. 7
i. 8
j. 9
k. 10
l. More than 10

16. What type of debt do you have?

a. I owe it to friends or family
b. Shark loans
c. Bank loans
d. Mortgage
e. Student loans
f. Credit card
g. Microloans
h. I have no debts

17. In the last 2 years, how many times have you applied for a loan?

a. 0
b. 1
c. 2
d. 3
e. 4
f. More than 4

18. Have you had a credit application rejected in the last two years?

a. Yes
b. No

19. Do you know why your application was rejected?

a. Employment situation
b. Lack of guarantees
c. Lack of debt capacity
d. Not enough income

e. Didn't have enough credit history
f. Being reported in credit bureaus
g. Never got an explanation
h. Other

20. Are you currently a homeowner?

a. Yes
b. No

21. From the following list, what assets do you have in your house?

a. Computer
b. TV
c. Fridge
d. Washing machine
e. Microwave
f. Dryer
g. Electric/gas stove
h. Cellphone
i. Motorcycle
j. Car
k. Stereo
l. Air conditioning

22. How do you save?

a. I don't earn enough money to save
b. I buy assets (gold, animals, etc.)
c. Cash (under the mattress)
d. Financial investment products
e. In term certificate of deposit and savings accounts in banks
f. In digital wallets as MOVii, Nequi, or Daviplata
g. Buy Crypto currencies (Bitcoin, Etherium, etc.)

23. What are you saving for?

a. To buy a house
b. For retirement
c. To start/improve my business or entrepreneurship

d. To buy a car/motorcycle or appliances
e. For vacations
f. In case of calamity
g. For self-education or family members
h. Other

24. If you had an emergency in your family, how would you get the money to solve the situation?

a. Savings
b. Help from family or friends
c. Working more time
d. Reduce spending
e. Credit card
f. Bank loans
g. Shark loans
h. Sell or pawn valuable objects
i. Out of options

25. In the last month your expenses have been

a. Bigger than your earnings
b. Smaller than your earnings
c. You are not sure

26. Do you have credit cards?

a. Yes
b. No

27. Do you have any accounts in a financial institution other than MOVii?

a. Yes
b. No

28. If you had the opportunity to invest your savings in the following options, receiving higher interest than those offered by a bank, but with the risk of losing, which one would you be interested in?

    a. Lending to people like you, who need funding for emergencies and other needs
    b. Lending to companies with entrepreneurship, and businesses that want to grow
    c. Investing in risky assets such as stocks or bitcoin (cryptocurrencies)
    d. It seems very risky to me, and I prefer an account that cannot lose my savings

29. Suppose you have COP 100.000 in a savings account, which pays 1 % interest per year. You also know that the inflation rate is 2 % per year. After 1 year, how much could you buy with the money in this account?

    a. More than today
    b. Exactly the same
    c. Less than today
    d. I don't know

30. Do you think the following statement is true or false: "It is safer to bet COP 100.000 on one soccer team to win than to bet COP 25.000 on 4 different teams to win."

    a. True
    b. False
    c. I don't know

31. Suppose you have COP 100.000 in a savings account with an annual interest rate of 2 %. After 5 years without touching that account, how much money do you think you would have?

    a. More than COP 102.000
    b. COP 102.000
    c. Less than COP 102.000
    d. I don't know

32. Why don't you have accounts in other financial institutions?

    a. They are far away
    b. They charge a lot
    c. They are not willing to open an account for me
    d. I'm not interested
    e. Other

33. Why did you decide to sign up for and use MOVii?

    a. Recommendation from a friend
    b. I receive a government subsidy (*Ingreso solidario*, B*ogotá Solidaria en Casa*,other G2P)
    c. Easy to open/use
    d. Because I can use the card for online purchases

34. For the following statements, please choose on a scale from 1 to 5, 1 being "Completely disagree" and 5 being "Strongly agree":

    a. MOVii helps me make transactions faster.
    b. Using MOVii is beneficial for me.
    c. I think it is easy to learn how to use the MOVii application.
    d. I think the MOVii app is easy to use.
    e. I use MOVii because I have constant internet access.
    f. I use MOVii because I have my own cell phone.
    g. I feel safe using a cell phone to access content.

35. For the following statements, please choose on a scale from 1 to 5, 1 being "Completely disagree" and 5 being "Strongly agree":

    a. People whose opinions I value prefer me to use the MOVii app.
    b. Among my acquaintances, I am usually the first one to try new technologies.
    c. My colleagues greatly value my opinion about new technologies.
    d. I believe that the regulation that applies to MOVii protects me as a consumer.
    e. I use MOVii because I have constant internet access.
    f. I believe that MOVii acts honestly when capturing, processing and managing my personal data.
    g. I trust MOVii to protect my savings.

36. Do you have a MOVii card?

    a. Yes
    b. No

Appendix 2. Determinants of Usage – Admin Data – Complete Regression

	(SPD)	(TRS)	(CSN)	(CST)
Variables	**Spending**	**Transfers**	**Cash-in**	**Cash-out**
Age	0.000532	-0.0158***	-0.00327	-0.000917
	(0.00345)	(0.00501)	(0.00302)	(0.00400)
Age^2	-2.64e-05	0.000196***	2.02e-05	-2.30e-05
	(4.09e-05)	(6.18e-05)	(3.58e-05)	(4.96e-05)
Female	-0.0205	0.0203	-0.00393	-0.0192
	(0.0153)	(0.0206)	(0.0132)	(0.0176)
G2P	-0.264***	-0.277***	-0.414***	0.196***
	(0.0131)	(0.0196)	(0.00838)	(0.0181)
Migrant	0.0645**	0.165***	0.0242	0.00610
	(0.0307)	(0.0428)	(0.0277)	(0.0355)
Time from account opening	0.00739***	0.00343**	0.00268**	-0.00126
	(0.00118)	(0.00159)	(0.00110)	(0.00138)
Active debit card	0.239***	0.0430**	0.0865***	-0.0931***
	(0.0132)	(0.0218)	(0.0131)	(0.0182)
Head of household	0.0154	-0.0167	-0.0152	0.0165
	(0.0173)	(0.0232)	(0.0150)	(0.0196)
Marital status	0.00328	0.0707***	0.0439***	0.0197
	(0.0155)	(0.0212)	(0.0135)	(0.0184)
Professional degree	0.0197	-0.0259	0.0272**	-0.0325*
	(0.0157)	(0.0209)	(0.0133)	(0.0176)
Number of children	-0.0103	0.00998	-0.00439	0.0224**
	(0.00673)	(0.00938)	(0.00590)	(0.00946)
HAWI	0.118**	-0.198***	0.00236	-0.0820
	(0.0594)	(0.0763)	(0.0539)	(0.0617)

	(SPD)	(TRS)	(CSN)	(CST)
Variables	**Spending**	**Transfers**	**Cash-in**	**Cash-out**
Minimum wage	0.0253	0.0647***	0.00198	0.0762***
	(0.0176)	(0.0233)	(0.0149)	(0.0199)
Unemployed	-0.0197	-0.0880***	-0.0140	-0.0468**
	(0.0190)	(0.0270)	(0.0180)	(0.0228)
Financial literacy	-0.0434	-0.0101	-0.0273	0.00687
	(0.0282)	(0.0374)	(0.0248)	(0.0310)
Entrepreneur	0.0346**	0.0475**	0.0342**	0.0171
	(0.0167)	(0.0220)	(0.0142)	(0.0186)
Rural	-0.0180	0.0231	-0.105***	0.0811**
	(0.0298)	(0.0385)	(0.0267)	(0.0364)
Formal loan	-0.0384	0.0464	0.00233	0.0463
	(0.0235)	(0.0330)	(0.0193)	(0.0284)
Informal loans	-0.0630***	0.0208	0.00737	0.0313
	(0.0243)	(0.0333)	(0.0200)	(0.0281)
Formal savings	-0.0289	0.0531	-0.00848	0.0378
	(0.0291)	(0.0397)	(0.0252)	(0.0333)
No debt	0.0203	0.0430**	-5.30e-05	0.0495***
	(0.0151)	(0.0202)	(0.0133)	(0.0169)
Informal savings	0.0375	0.0754**	0.0387*	0.0394
	(0.0241)	(0.0296)	(0.0208)	(0.0250)
Loan app rejected	0.0322	0.0428	0.0171	0.0183
	(0.0235)	(0.0289)	(0.0206)	(0.0240)
No savings	0.0384	-0.00439	0.0150	0.0340
	(0.0274)	(0.0349)	(0.0240)	(0.0297)
TAM-usefulness	0.00840	0.0111	0.00435	0.0171**
	(0.00668)	(0.00925)	(0.00595)	(0.00807)
TAM-trends	0.0195***	-0.00168	-0.000861	0.00285
	(0.00717)	(0.00993)	(0.00626)	(0.00843)
Observations	2,532	2,532	2,532	2,532

Note: Standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0$.

Source: Own elaboration.

Appendix 3. Baseline Balance Verification (Standardized Mean Differences)

Variable	Treatment mean (n=1,554)	Control mean (n=938)	p-value	Standardized mean difference (SMD)
Demographics and socioeconomics				
Age (age)	31.59	30.86	0.11	0.066
Female (sex)	0.46	0.45	0.58	0.023
Migrant (foreign)	0.06	0.05	0.26	0.046
Unemployed (unemp)	0.14	0.17	0.09	0.07
Income bracket (income_2)	2.39	2.4	0.84	0.009
Financial inclusion status				
G2P recipient (subs)	0.51	0.48	0.18	0.055
Active debit card (card)	0.52	0.51	0.74	0.014
Baseline transactional behavior (millions COP)				
Total spending (total_ spending)	1.89	1.65	0.23	0.049
Cash extraction/OTC (cashext_)	1.19	1.08	0.53	0.026
Cash-in (cashin_)	1.01	0.85	0.28	0.045
Cash-out (cashout_)	0.82	0.72	0.34	0.04
Digital spending (spending_)	0.7	0.57	0.09	0.07
P2P transfers (transfers)	0.31	0.27	0.63	0.02

Note: SMD measure the effect size of the difference in means between the treatment and control groups. An SMD<0.10 indicates that the covariate is well-balanced across the experimental arms. The p-values report the results of two-sided t-tests for equality of means. An omnibus F-test of joint orthogonality further confirms overall balance: $F(12, 2479) = 1.21$, $p = 0.268$.

Source: Own elaboration.