Debt and Liquid Wealth: Evidence from Pension Fund Withdrawals

Enzo A. Cerletti, Tomás Cortés, Borja Larrain, and Patricio Toro*

April 30, 2026

Abstract

We examine the response of individual borrowing to changes in liquid wealth exploiting a quasi-natural experiment. During the COVID-19 pandemic, the Chilean government allowed partial withdrawals from otherwise illiquid pension accounts. The policy's nonlinear rule generates several kinks, which we use to estimate the elasticity of borrowing to liquid wealth through a regression kink design. We find substantial debt repayment among the population that is predominantly low-income, young, and female, particularly for individuals with higher debt and debt-to-income ratios within that population. We interpret these findings through a model in which the marginal cost of debt increases with borrowing.

Keywords: household borrowing; household liquidity; illiquid savings; pension withdrawals; co-holding puzzle; COVID-19.
JEL Codes: D14, E21, G51

*We thank comments and suggestions from Jorge Sabat, and seminar participants at the Central Bank of Chile. This study was conducted within the scope of the research agenda of the Central Bank of Chile. Through various collaboration agreements, the Central Bank of Chile has access to anonymized information from private and public entities, such as the Comision para el Mercado Financiero and the Superintendencia de Pensiones. Only officials from the Central Bank of Chile processed the data and carried out the statistical analysis for this study. The views expressed are those of the authors and do not necessarily represent the views of the Central Bank of Chile or its board members. All errors are our own. Cerletti: Central Bank of Chile; ecerletti@bcentral.cl. Cortés: Central Bank of Chile; tcortes@bcentral.cl. Larrain: Escuela de Administración, Pontificia Universidad Católica de Chile; borja.larrain@uc.cl. Toro: Central Bank of Chile; ptoro@bcentral.cl.

1 Introduction

Defined-contribution (DC) pension plans are increasingly important when saving for retirement. Recent studies focus on various features of these plans, such as auto-enrollment, the auto-escalation of retirement savings, and default investment options. A key characteristic of DC pension plans is the illiquidity of savings, which often involves strict obstacles or even prohibitions on withdrawals prior to reaching retirement age (Beshears et al., 2015). The debate around the optimal level of illiquidity—how much liquidity should be permitted—is ongoing (see Beshears et al. 2025, and Maxted 2025). Illiquidity acts as a commitment device to restrain premature spending, potentially helping individuals with self-control problems. On the other hand, the illiquidity of pension savings might lead to unintended consequences, such as excessive borrowing. Optimal illiquidity involves balancing the benefits of a commitment device against the potential pitfalls of restricting early access to funds. In this paper, we study some of the consequences of removing those restrictions in order to inform the ongoing debate about the design of DC plans.

The COVID-19 pandemic provides a unique quasi-natural experiment to explore the impact of the illiquidity inherent in many pension plans. During this period, Chilean pension funds, for the first time since their inception in 1980, temporarily allowed individuals to withdraw a portion of their savings. We examine debt repayment following these withdrawals to gain insights into the consequences of illiquid pension plans. More broadly, our setup allows to estimate a well-identified elasticity of borrowing to liquid wealth, which is relevant for macroeconomic models and the evaluation of fiscal stimuli.

A significant empirical challenge arises from the endogeneity of liquidity; that is, pension withdrawals are not randomly distributed across the population. The ideal experiment for the econometrician is one where some individuals are randomly granted access to their illiquid pension wealth while others are denied access, but such an approach is unrealistic. In the Chilean case, everyone with a pension account was allowed to withdraw, and millions of individuals participated in the withdrawal program. The amount withdrawn may correlate with other factors that determine credit supply and demand besides liquidity. To identify a true elasticity of borrowing to liquidity, it is crucial to isolate exogenous variation in liquid wealth, i.e., changes in withdrawals driven by "luck" or circumstances unrelated to individual characteristics.

Our empirical strategy hinges on the particular design of the policy. The Chilean policy did not allow everyone to withdraw a lump-sum amount or a constant fraction of their pension balances but instead included several "kinks"—threshold points in a piecewise-linear policy rule. Using a regression kink design (RKD) we can identify causal effects of liquidity on borrowing by studying the change in the slope of debt repayment relative to the withdrawal around these kinks (Card et al., 2015). The thresholds for withdrawals were not associated with other policy thresholds or administrative cutoffs but appeared to be motivated solely by political intuition. The policy rule incorporated three kinks over the distribution of pension balances, and the same rule was applied in three different withdrawals in July of 2020, December of 2020, and May of 2021. This results in nine different "experiments" (3 kinks $\times$ 3 withdrawals). The repeated nature of the experiment and the heterogeneity in populations across kinks enhances the applicability of our findings to other settings.

The validity of the RKD methodology rests on the key assumption that the joint density of the running variable (the pension balance in our case) and all other variables, observable or not, is smooth (Card et al., 2015). Intuitively, smoothness means that the distributions of variables besides the regressor of interest (withdrawal) show no kinks. Thus, a valid RKD has two testable implications. First, the distribution of predetermined observable characteristics—such as age, income, and gender—must be smooth around the kinks, which we verify empirically. Second, there must be no manipulation or strategic reporting of pension balances to influence eligibility—a concern we assess by examining the smoothness of the distribution of pension balances around the thresholds. We find no evidence of manipulation in the distributions around the kinks (Calonico, Cattaneo, and Farrell, 2018). Manipulation is unlikely because pension assets are managed by independent private firms, and our data comes from administrative records rather than self-reported surveys. These conditions support the causal interpretation of our estimates.

The policy rule works as a fuzzy RKD since it allowed a maximum withdrawal amount, but each individual could decide whether to withdraw or not, and how much to withdraw (i.e., partial withdrawals were allowed). Our estimation proceeds via a two-stage least squares (2SLS) approach. In the first stage, we regress observed withdrawals on the variation induced by the policy rule. Given that almost everyone withdrew the maximum, the first stage is extremely strong. In the second stage, we assess the impact of the predicted withdrawal, i.e., the arguably exogenous change in liquid wealth, on borrowing.

Our key findings show that, for the first withdrawal in July 2020 and in the vicinity of the first kink where individuals are low-income, mostly young, and predominantly women, a 1% increase in the amount withdrawn results in a 0.39% decrease in total borrowing. The repayment elasticity with respect to a one-percentage-point increase in wealth withdrawn is 0.45%. Within this population, individuals with higher debt and higher debt-to-income ratios show stronger repayment in response to the withdrawal. Larger withdrawals are also associated with a lower likelihood of getting new loans. We find that the estimated elasticities in the first kink diminish for subsequent withdrawals. The elasticities that we estimate in higher kinks of the policy rule —where individuals are relatively wealthier, older, and more likely to be men—tend to be small and statistically insignificant.

The propensity to repay debt is consistent with the permanent income hypothesis under a constant price of debt. An increase in liquid savings leads to a portfolio reallocation, but the consumption path remains unaltered since total wealth is unaltered. It is harder to explain the heterogeneity of debt repayment across different populations under this hypothesis, since the marginal propensity to repay should be constant along the cross-section of individuals. In models with hard borrowing constraints, the constrained individuals have lower propensity to repay debt since they face a higher marginal utility of consumption. Instead, we find that debt repayment is stronger among low-income individuals, which can be rationalized through a model with varying cost of debt. In these models, the marginal propensity to consume decreases as the cost of debt increases (see Koşar et al. 2025, and Maxted 2025). For individuals who face a high cost of debt, such as those in the first kink, it is relatively more attractive to repay expensive debt than to increase consumption.

Debt does not significantly change with the liquidity shock in segments of the population that are relatively wealthier, older, and more likely to be men. These individuals have access to cheaper debt, and have a higher marginal propensity to consume out of liquidity. This result is akin to the findings of Beshears et al. (2022), who in some sense present the reverse of our experiment: enrollment in illiquid pension accounts does not significantly affect debt balances. It is also likely that wealthier individuals have other liquid savings and therefore that the withdrawal increases these other savings instead of affecting borrowing and consumption. In fact, we confirm that wealthier individuals in the Chilean sample show positive and significant elasticities of voluntary pension savings to withdrawals from the mandatory accounts.

A first contribution of our study is to evaluate the consequences of the illiquidity of pension savings (see Agarwal, Pan, and Qian 2020, Beshears et al. 2025, and Maxted 2025). For a subset of the population, our results suggest that illiquidity pushes individuals to take on expensive debt, at least in the midst of harsh macroeconomic conditions like COVID-19. Even with high marginal utility of consumption, these individuals prefer to repay debt. Our results are in line with Maxted (2025), in the sense that, instead of a hard borrowing constraint, individuals have access to borrowing at increasingly high prices. Once the illiquidity constraint is relaxed, they pay some of the expensive debt.

Although this points out a potential cost of mandatory illiquid savings, a precise policy prescription as to how much liquidity to allow is beyond the scope of our study. Other forces suggest that at least some illiquidity is optimal (Beshears et al., 2025). Illiquidity can be more effective to increase savings than subsidies or behavioral nudges with only transitory impact (see Chetty et al. 2014, and Choukhmane 2025). The long-term investment horizon provided by illiquid pension funds can also have positive externalities for the development of local financial markets, so any change to their structure should be carefully assessed (see Scharfstein 2018, and Stein 2005).

Our research also provides insights into the co-holding puzzle, or the seemingly contradictory fact that individuals hold expensive debt alongside low-yielding liquid assets (Gross and Souleles, 2002). A leading explanation for this phenomenon is mental accounting, whereby individuals separate debt and liquid assets into silos that are not directly compared in a cost-benefit analysis (see Gathergood and Olafsson 2024, and Medina and Pagel 2025). The findings in this paper partly challenge this explanation since many individuals who receive liquidity tend to repay debt rather than simply consume all or accumulate more cash. Our results also suggest that precautionary motives for holding cash instead of paying debt (as in Telyukova 2013) may not be too strong given that the withdrawals occurred in the midst of high macroeconomic uncertainty. Similar to us, Olafsson and Pagel (2018) also find that the possibility of future liquidity constraints does not affect spending behavior and cash holdings.

Finally, by assessing the effects of policy measures that alter household liquidity our study contributes to the vast literature on the consumption effects of fiscal stimuli (Kaplan and Violante, 2022). We focus on debt repayment, which although related to consumption, is less common in the literature due to data limitations (some exceptions are Agarwal, Liu, and Souleles 2007, and Koşar et al. 2025; or Cookson, Gilje, and Heimer 2022 for cash windfalls). The number of studies has also multiplied since COVID-19 (see Chetty, Friedman, and Stepner 2024, among others). While much of the policy analysis around this period is centered on government spending, our findings highlight a different dimension of stabilization policies: changes in the rules of access to private pension savings. Hamilton et al. (2024) and Meriküll (2025) also study the impact of pension withdrawals related to COVID-19 in other countries. The main advantage of our setup is that it allows for an arguably cleaner identification strategy through a regression kink design.

2 Hypotheses Development

In this section we present a simple model of consumption and borrowing decisions to illustrate the predictions of different models regarding debt repayment. We build on the illustrative model of Koşar et al. (2025).

Households live two periods: working life and retirement. They discount the utility of future consumption according to a factor β. The utility function is CRRA. In period 1, they are endowed with labor income y_1 and illiquid pension wealth h. Agents can borrow d_2 subject to the price schedule $q(d_2)$. In the second period, agents receive the capitalized pension wealth $(1+r)h$, and pay back debt d_2. Households can withdraw an amount w from their pension wealth h in period 1. Since we assume a return of $1+r$ for both h and savings ($d_2 < 0$), we can assume all households withdraw w without loss of generality. Therefore, the maximization problem takes the form:

$$\begin{aligned} & \max_{d_2} u(c_1) + \beta u(c_2) \qquad (1) \\ s.t. \quad & c_1 = y_1 + w + d_2 q(d_2) \\ & c_2 = (1+r)(h-w) - d_2 \end{aligned}$$

With a constant price of debt and no wedge with respect to the return on wealth, i.e., $q = \frac{1}{1+r}$, the response of debt to a pension withdrawal shock is straightforward. All proofs are provided in the appendix.

Proposition 1: *When the price of debt is constant, agents reduce debt in response to a withdrawal shock ($\frac{\partial d_2}{\partial w} < 0$).*

For constant price, households do not adjust their consumption level in either period since there is no change in their intertemporal budget set. An early liquidation of pension wealth is undone by a decrease in d_2. For each unit of withdrawal, households reduce debt (increase saving) by $1+r$ units to compensate for the reduction in their pension fund balances and the forgone return r.

The inaction in consumption under a constant price of debt is broken by a hard borrowing constraint of the type $d_2 \leq \bar{b}$. Households consume at least some, and potentially all, of the withdrawal in period 1 when $\bar{b}$ is binding. In any case, constrained households reduce debt by less than unconstrained households. The combination of constant pricing and a hard borrowing constraint is omnipresent in the consumption literature (Zeldes, 1989).

Proposition 2: *When the price of debt is constant and a hard borrowing constraint is binding, $d_2 = \bar{b}$, agents do not necessarily reduce debt in response to a withdrawal shock. Constrained households always reduce debt by less than unconstrained households.*

As in Koşar et al. (2025), we also consider the following pricing function $q(d_2)$:

$$q = \begin{cases} q = \frac{1}{1+r} \ \text{ if } d_2 \leq 0 \\ q = \frac{1}{1+r} - \phi_1 (d_2)^{\phi_2} \ \text{ if } d_2 > 0, \quad \phi_1 > 0, \ 0 < \phi_2 \leq 1 \end{cases} \tag{2}$$

where $\frac{\partial q}{\partial d_2} < 0$ for $d_2 > 0$, or the cost of borrowing is increasing in the the amount of debt.

In this setting, a withdrawal shock can trigger a simultaneous increase in consumption and debt repayment. The key to this result is that, when the price of debt depends on the level of borrowing, the withdrawal is a superior technology for reallocating resources to the present for indebted households. This is true for all borrowers. Moreover, debt repayment is stronger, and instantaneous marginal propensity to consume is weaker, for households facing steeper regions of the pricing schedule. For instance, low income (y_1) workers repay debt more strongly.

Proposition 3: *When the price of debt varies according to (2), agents reduce debt in response to a withdrawal shock ($\frac{\partial d_2}{\partial w} < 0$), and more strongly so when income is lower ($\frac{\partial^2 d_2}{\partial w \partial y_1} > 0$).*

In summary, models differ in at least two dimensions. First, not all models generate a propensity to repay debt out of a withdrawal. In particular, individuals facing a hard borrowing constraint typically do not repay debt. Second, the models have different cross-sectional predictions as to what agents have higher propensity to repay debt. There is no cross-sectional heterogeneity in a standard model; constrained agents have a lower propensity to repay in models with hard borrowing constraints; and more indebted agents have a higher propensity to repay in models with a varying price of debt.

3 Data

3.1 The Chilean pension system

The Chilean pension system was privatized in 1980 through the creation of a DC system that replaced the public pay-as-you-go system (Berstein, 2010). All workers must contribute 10% of their monthly income (with a cap) to individual retirement accounts. The savings rate of 10% is constant across individuals and ages. Individuals can choose between different pension fund administrators and risk profiles, and transfer funds between them over time. More than 80% of the population between 20 and 65 years contributes to individual retirement accounts. The pension system features a government-guaranteed minimum pension for individuals who fail to accumulate enough savings by the end of their working life. The system also considers a subsidy for individuals who can self-finance a pension that is above the minimum pension but below a certain threshold. As seen in Figure 1, at the end of 2019, assets under management in the system were approximately US$200 billion, or 80% of Chilean GDP (Madeira, 2022).

Insert Figure 1 here

3.2 The withdrawals during COVID

An important feature of the initial design of the system was the complete illiquidity of pension savings until retirement. Withdrawals were not allowed under any circumstance. This is frequent in pension systems around the world (Beshears et al., 2015).

During the COVID-19 pandemic, three consecutive constitutional amendments allowed individuals to withdraw part or all of their pension savings. The stated purpose of the withdrawals was to smooth the financial consequences of the crisis. The withdrawals were discussed sequentially, and each voted independently by congress, instead of being treated as a single reform package from the beginning. The withdrawals were announced on July 30^{th} 2020, December 10^{th} 2020, and May 3^{rd} 2021.[1] Individuals could apply for the withdrawal up to one year after each announcement. For the vast majority, the cost of applying for a withdrawal was very low. The application was filled out on-line and there were no fees. The funds were transferred from the individual's pension account to a bank account in less than a week.[2]

Insert Figure 2 here

As depicted in Figure 2, the maximum allowed withdrawal followed a piecewise linear rule that varied according to the individual pension account balance. The cutoff points in the policy rule were expressed in the Chilean UF, an inflation-adjusted unit of account used for most financial contracts in the country (e.g., mortgage payments, school tuition, etc.). Individuals with total savings below UF35 could withdraw 100% of their savings.[3] Between UF35 and UF350, individuals could withdraw a fixed amount (UF35). Then, between UF350 and UF1500, individuals could withdraw 10% of their balance. For savings above UF1500, the withdrawal was capped at UF150. In practice, most individuals applied for the maximum amount allowed, and thus, the withdrawals were massive. Approximately 12 million individuals made at least one of the three withdrawals. Overall, withdrawals amounted to close to US$50 billion or 25% of the assets under management of the pension system.[4]

[1]Several other withdrawal projects were discussed in congress after May of 2021, but they were ultimately rejected.

[2]Individuals without a bank account –which are not part of our sample– could open a free, hassle-free account with *Banco Estado*, the state-owned commercial bank in Chile.

[3]In 2020, UF35 corresponded approximately to US$1,300. For comparison purposes, the monthly minimum wage was close to UF11.

[4]For more details on the withdrawals and their macroeconomic impact we refer interested readers to Inzunza and Madeira (2023), Cerletti et al. (2026), and Chapter 5 of the Financial Stability Report of the Central Bank of Chile.

Participation in the withdrawal programs was nearly universal: 88.8% of account holders participated in the first withdrawal, while 78.3% and 60.1% participated in the second and third withdrawal respectively (Fuentes et al., 2021). Consumption needs were high due to the poor macroeconomic situation. The withdrawals also gave the free option to adjust one's own portfolio. Funds could be reinvested in a more flexible investment account, or debt could be repaid, even if consumption remained the same. The first and third withdrawals also had tax advantages. The historical returns of Chilean pension funds were strong, so poor performance was not a likely motivation for the withdrawals. An often-mentioned explanation for participating in withdrawals was the legitimate doubt of many investors about the future sustainability of the system. Expropriation of pension assets was a remote possibility, but not unheard of in Latin America.

For most individuals, the withdrawals were a pure liquidity shock, i.e., the transformation of illiquid savings into liquid savings while keeping total wealth—comprising liquid assets and pension wealth—constant. For very poor individuals, the withdrawal could also constitute a wealth shock if the individual expected to qualify for a subsidized pension in the future. In this case, the fall in illiquid wealth produced by the withdrawal would be compensated by future government handouts. This calculation about the nature of the shock requires a high level of sophistication from individuals. Still, compared to other government policies, withdrawals had a large privately-funded component, and therefore were closer to a liquidity shock than a wealth shock. The nature of the shock –wealth or liquidity– is potentially relevant for its impact (see Ganong and Noel 2020, and Cookson, Gilje, and Heimer 2022).

3.3 Data sources

This paper uses data from four different sources: (1) administrative records of pension withdrawals and balances from the pension regulator (Superintendencia de Pensiones), (2) the credit registry from the banking regulator (Comision para el Mercado Financiero), and (3) employer-employee records from he unemployment insurance, and (4) income data from the internal revenue service (Servicio de Impuestos Internos).[5] We are able to merge these different datasets through a unique individual identifier.[6] In the main text we only provide an overview of the datasets. More details on the merging procedure and the content of the datasets are provided in the appendix.[7]

The administrative records of the pension withdrawals contain the number of the withdrawal (first, second, or third), the dates of the request and subsequent payment, the amount withdrawn, and the total balance in the individual pension account at the time of withdrawal. We restrict our sample to those individuals who request the withdrawal the first day that it is available, and who receive payment within the following month. The purpose of the first-day filter is to eliminate potential manipulation of the pension balance, for instance, if an individual decides to wait to accumulate a larger balance and, thus, make a larger withdrawal.

An auxiliary dataset from the pension regulator provides information at the monthly frequency on individual pension balances in "Cuenta 2" (Second Account), a voluntary savings account offered by the same pension fund administrators. Balances in Cuenta 2 can be invested under the same conditions as mandatory pension savings, except that voluntary savings offer no tax incentives. Crucially, funds in Cuenta 2 may be withdrawn at any time without incurring penalties. Unfortunately, this auxiliary dataset uses a different individual identifier, which prevents us from merging it with other data.

The credit registry provides stock and flow variables for the universe of bank loans in Chile. Stock variables for each individual at the monthly frequency include the total amount of debt, the amount of debt overdue (i.e., debt payments that are late for 90 days or more),

[5]The information contained in the databases of the Chilean internal revenue service is self-reported by taxpayers; therefore, the veracity of the data is not the responsibility of the service.

[6]This identifier is an anonymous version of the Rol Unico Tributario (RUT), which is assigned to every individual and firm in Chile for tax purposes.

[7]To secure the privacy of workers and firms, the Central Bank of Chile mandates that the development, extraction, and publication of the results should not allow the identification, directly or indirectly, of any natural or legal person. Officials of the Central Bank of Chile processed the disaggregated data. All the analysis was implemented by the authors and did not involve nor compromise the Superintendencia de Pensiones, the Comision para el Mercado Financiero or the Servicio de Impuestos Internos.

and revolving credit. Loans can be divided into mortgages, consumer loans, and other loans (e.g., student loans). The disposable credit limit corresponds to the maximum amount that an individual can draw from credit lines and credit cards less the effective use of credit lines and credit cards. Flow variables refer to the origination of new loans, which can be mortgage loans or consumer (installment) loans. Aggregating the loan origination data for each individual over time we can compute the individual stock of non-revolving debt. We compute the stock of revolving debt as the difference between total debt (minus the overdue portion) and non-revolving debt. We focus on individuals with positive debt three months before withdrawals.

Finally, the unemployment insurance database reports at the monthly frequency demographic information for each individual such as age and sex and wages. Because unemployment insurance in Chile applies only to private-sector employees, we complement income information using tax records from Forms DJ1879—covering self-employed workers and firm directors—and DJ1887, which reports dependent labor income, both collected by the tax authority. Using both datasets we construct a more comprehensive measures of income and an improved indicator variable for unemployment.

3.4 Sample

We build samples around the three kinks of the policy rule in Figure 2. The bandwidth around each kink is selected in a way that we have significant sample sizes. For instance, our sample around the first kink (UF35) considers individuals with pension savings in a range of ±25 UFs from that threshold, while in the second kink (UF350) we consider individuals in a range of ±50 UFs. Both samples have more than 500,000 observations. Our results are robust to variations in bandwidth, for instance, following the optimal bandwidth selection procedure of Calonico et al. (2017).

Insert Table 1 here

In Table 1 we report means of different variables for each one of the 9 samples (=3 kinks × 3 withdrawals). All variables are measured three months before each withdrawal. Average total debt and income increase as we move from individuals in the lower kink (UF35) to the higher kinks (UF350 and UF1500). Debt over income also increases, but the fraction of debt overdue goes down. The samples in higher kinks are composed of older individuals and more likely to be men. The differences across kinks are economically significant: individuals in the third kink are, on average, close to 15 years older than those in the first kink, and there are approximately 30% more men in the third kink. The income of individuals around the third kink is between 2 and 3 times larger than the income of individuals around the first kink.

We find smaller differences when comparing samples across the three withdrawals for a given kink. There is a slight drift towards higher income, and older men, particularly for the consecutive samples around the first kink. This is the case since lower income, and younger women are more likely to withdraw 100% of their balance and leave the sample. Despite the smaller differences we find across withdrawals for a given kink, all differences in means in Table 1, across withdrawals and across kinks, are statistically significant.

Insert Figure 3

In order to illustrate aggregate effects in the data, we run the following regression with individuals in the neighborhood of the first kink (UF35±25):

$$d_{i,t} = \alpha_i + \sum_{t=Sept.2019}^{May2022} \alpha_t + \nu_{i,t} \tag{3}$$

The dependent variable is the log of total debt for individual i in month t. We account for individual fixed effects (α_i). In Figure 3 we show the estimated calendar-time fixed effects (α_t). Debt increased starting from the end of 2019 and continuing with the pandemic in early 2020. A large drop in debt followed the first withdrawal (August 2020), but we find a smaller or flat responses after the next two withdrawals. Debt increases again towards the end of 2021.

4 Empirical Design

4.1 Regression Kink Design (RKD)

In order to test the relationship between liquid wealth and debt, the ideal experiment for the econometrician would be to randomly distribute liquidity among the population and then measure the effect on their borrowing. This ideal (yet impractical) experiment is not what we study. The withdrawals allowed during COVID were not randomly distributed. However, our empirical design can approximate this ideal experiment as we explain below.

We are interested in estimating the effect of pension withdrawals ($w_{i,t}$) for individual i at time t on future debt changes ($\Delta d_{i,t+1}$).[8] A starting point is the following cross-sectional regression estimated through OLS:

$$\Delta d_{i,t+1} = \alpha + \beta w_{i,t} + \Gamma' X_{i,t-3} + \epsilon_{i,t+1} \tag{4}$$

The vector $X_{i,t-3}$ includes variables, such as age and sex, measured three months before the withdrawal. These variables control for standard determinants of borrowing, e.g., life-cycle borrowing can be proxied with age. These factors also enter from the supply side since they affect credit worthiness. We do not control for income so we do not lose many observations (see Table 1). Later on, we control for the pension balance of each individual, which is related to past and current income levels.

Since we use logs, the interpretation is that, all else equal, debt changes by β% when the amount withdrawn increases by 1%. However, it is unlikely that we can attribute a causal interpretation to the OLS estimate from equation 4. We only observe equilibrium levels of

[8] We use lowercase letters to represent the log of one plus the corresponding amount (in UFs), and Δ to represent log changes with respect to the three previous months. For example, $\Delta d_{i,t+1} = log(1 + D_{i,+1}) - log(1 + D_{i,t-3})$. Month $t + 1$ is the end of the month that follows the withdrawal.

debt and liquid wealth, and, thus, we are not sure if we capture changes in debt due to the withdrawal or some omitted variable that drives both the withdrawal and debt.

The kinks in the policy rule shown in Figure 2 provide a natural way to identify movements in liquid wealth (i.e., withdrawals) that are not related to other determinants of borrowing. In intuitive terms, if we also find a "kink" in debt changes we can attribute it to the kink in liquid wealth produced by the policy rule. We can be more certain that debt changes are due to changes in the availability of liquid wealth, while holding everything else constant.

The regression kink design can be implemented as a 2SLS setup (Card et al., 2015).[9] The sample is restricted to individuals within the bandwidth (e.g., ±25) from the threshold of the policy rule (e.g., UF35). The first stage relates the withdrawal with the distance of the balance in the pension account ($v_{i,t}$) from the threshold ($\overline{v}$):[10]

$$w_{i,t} = \theta + \gamma(v_{i,t} - \overline{v}) + \rho(v_{i,t} - \overline{v})D_i + \Phi' X_{i,t-3} + \zeta_{i,t+1} \tag{5}$$

The dummy D_i is a indicator variable for observations above the threshold, i.e., when $v_{i,t} \geq \overline{v}$. The coefficient ρ captures the change in the slope of the relationship between the withdrawal and the pension balance at the kink. We need a first stage to predict the actual withdrawal because the policy rule is not fully deterministic. Individuals are free to choose the amount that they withdraw. This makes our setup a "fuzzy" RKD in comparison to a sharp RKD where there are no deviations from the assignment rule.

The instrument in the 2SLS setup, in the sense of being the excluded regressor from the second stage, is $(v_{i,t} - \overline{v})D_i$. The second stage uses the predicted value of the withdrawal from the first stage ($\widehat{w_{i,t}}$) as follows:

$$\Delta d_{i,t+1} = \alpha + \beta\widehat{w_{i,t}} + \lambda(v_{i,t} - \overline{v}) + \Gamma' X_{i,t-3} + \xi_{i,t+1} \tag{6}$$

[9] The RKD translates to a 2SLS setup when the kernel is assumed to be uniform.

[10] We present estimations with a polynomial of order one on $v_{i,t} - \overline{v}$, but the setup can be extended to higher orders.

The reduced-form equation relates the outcome of interest ($\Delta d_{i,t+1}$) directly to the instrument ($(v_{i,t} - \overline{v})D_i$). We call the reduced-form coefficient τ. As in any 2SLS setup, the second-stage coefficient β_{rkd} is related to the first stage coefficient and the reduced form coefficient, i.e., $\beta_{rkd} = \tau/\rho$. The interpretation is intuitive: β_{rkd} is the ratio of the changes in slope at the kink for the dependent variable ($\Delta d_{i,t+1}$) and the endogenous regressor ($w_{i,t}$), each with with respect to the running variable ($v_{i,t}$).

The estimate that follows from the second stage, β_{rkd}, has a causal interpretation if the assumptions of the RKD hold. We now examine these assumptions in detail.

4.2 RKD assumptions

Generally speaking, the RKD requires smoothness of the joint density of the running variable (the pension balance in our case) and all other variables, observable or not (Card et al., 2015).[11] Intuitively, smoothness means that the distributions of variables besides the regressor of interest (withdrawal) show no kinks. Under the smoothness assumption, the identification of the effect from the regressor to the outcome variable is clean.

Card et al. (2016) argue that these conditions can be examined with the smoothness of the observed density of the running variable, and the expectation of observable covariates conditional on the running variable. First, the smoothness of the observed density of the running variable requires the absence of manipulation at the kink. Bunching just above or below a kink can indicate manipulation. In our setup this manipulation is unlikely to occur given that pension accounts are managed by independent firms. Manipulating the flow that goes into the pension account, instead of the stock, would need coordination between the employee and the employer (e.g., under-reporting wages), which is also unlikely. Even if such coordination is possible, it would not have a material impact on the stock of savings in the short period of time in which the policy was discussed and implemented.

[11] Smoothness implies that the first and second derivatives of the distributions with respect to the running variable are continuous.

Insert Figure 4 here

As seen in Figure 4, there is no apparent bunching or clustering of observations around the kinks in the first withdrawal. We also show the estimated 95% confidence intervals of the manipulation test developed by Cattaneo, Jansson, and Ma (2018). The distribution of the running variable is estimated from either side of the kink. We find no evidence of manipulation as seen in the high p-values of the manipulation test (all above 40%). We report the manipulation tests for the other two withdrawals in the appendix.

Insert Figure 5 here

Second, smoothness implies that the expectations of observable characteristics conditional on the running variable do not jump at the kinks. In Figure 5 we plot the averages of age, sex, and income conditional on balances of the pension account. There are no noticeable jumps or breaks around the UF35-kink in any of the three withdrawals. This is perhaps not surprising since the kinks of the policy rule were not derived from economic criteria, or pre-existing cutoffs in other government programs, but only from what appeared to be convenient or politically feasible at the time. The distributions around the other policy kinks (UF350 and UF1500) also appear smooth, as seen in the appendix.

5 Results

5.1 First Stage

In Table 2 we show results for the first stage regressions around the three kinks and in the three different withdrawals. For brevity we only report the first stage regressions for the case in which the change in total debt is the dependent variable in the second stage. We show the coefficient for $(v_{i,t} - \overline{v})D_i$, or the change in the slope of the withdrawal with respect to the pension balance at each kink.

Insert Table 6 here

Given the policy rule in Figure 2, we expect to find negative coefficients (i.e., decreasing slope) for the first and third kinks, and a positive coefficient (i.e., increasing slope) in the second kink. Since we work with the log of the amount of the withdrawal and pension balance, all changes in slope in the policy rule are +1 or −1. As seen in Table 2, the estimated coefficients are closely aligned with the policy rule. Hence, although a fuzzy RKD, the lion's share of individuals follows the policy rule. The F-statistics for the first stage are consequently extremely high, which ensures that the setup is not affected by a weak-instruments problem.

Insert Figure 6 here

Figure 6 shows the actual amount withdrawn and the pension balance for individuals around the first kink in the first withdrawal episode. Up to the first kink (UF35), we see a clear 45-degree line, as in the policy rule. After the first kink, we find a flat relationship between the withdrawal and pension balance, again as in the policy rule. Although some people withdraw less than the amount allowed, there is a marked preference for withdrawing the maximum.[12]

5.2 Second Stage

In Table 3 we show results for the second stage regressions. We report the coefficient on the instrumented (log) withdrawal amount across kinks and withdrawal episodes. There are six different dependent variables (all in log-changes): total debt, performing debt, overdue debt, disposable credit limit, revolving debt, and non-revolving debt. For our main results we focus on changes in the first month that follows the withdrawals. We condition our sample on individuals with positive total debt three months before the withdrawal.

[12]Some individuals in Figure 6 appear to withdraw slightly more than the what is allowed by the policy rule. Differences in the UF (the inflation-adjusted unit of account) between the days in which the withdrawal is requested and paid can explain these small differences.

Insert Table 3 here

In Panel A we focus on the results for the first kink (UF35). In the first withdrawal we find strongly significant elasticities across variables. All types of debt present a negative elasticity with respect to the withdrawal. For example, a 1% increase in the withdrawal amount results in a 0.39% decrease in total debt (column 1). The elasticity of disposable credit limit is positive (column 4), meaning that individuals regain debt capacity as they repay debt. For each 1% increase in the withdrawal amount, the disposable credit limit increases by 0.07%.

Although overdue debt is in principle more expensive than performing debt, the elasticity is smaller in magnitude for overdue debt (columns 2 vs. 3). This is likely the case because the intensive margin (how much overdue debt) and the extensive margin (having overdue debt or not) are combined in our regressions. For example, less than a third of the population around the first kink has overdue debt (see Table 1). Thus, there are many individuals with zero change in overdue debt, which dampens the elasticity.

The elasticity for revolving debt (column 5) is also smaller in magnitude than for non-revolving debt (column 6). In this case we condition each sample on having positive amount of each type of debt in the previous three months, so the issue is not the extensive margin. The issue here is that the individuals with access to non-revolving debt are a selected sample. Poorer individuals only have access to revolving debt. It is not always the case that one type of debt is more expensive than the other.[13]

While the signs of the elasticities are preserved across subsequent withdrawals, the magnitudes tend to decrease. The populations are roughly comparable across withdrawal episodes for a given kink, as seen in Table 1. More than changes in population characteristics, the declining elasticities are likely related with the repeated nature of the withdrawal stimulus. We explore the dynamics of the effects in more detail in section 5.5.

[13]Our measure of revolving credit includes different types of cards, some of which are less expensive than non-revolving credit.

In Panels B and C we show the estimated elasticities at higher kinks in the policy rule —where individuals are relatively wealthier, older, and more likely to be men. These elasticities are noisier, and in some cases have different signs when compared to the first kink. The overall picture that emerges from Panels B and C is that there is no robust effect of liquid wealth on debt behavior for individuals in the second and third kinks.

Debt repayment is consistent with the permanent income hypothesis. If mandatory pension savings are above the optimal level of savings, then the individual takes on debt in order to implement the desired consumption path. A liquidity shock allows the individual to repay debt without affecting consumption. If the savings constraint is not binding, then any portfolio reconfiguration (paying debt or increasing other savings) after a liquidity shock is consistent with the classical model. At face value, debt repayment is less consistent with binding hard borrowing constraints. In that case, the marginal propensity to consume is so high for constrained individuals, that repaying debt is unlikely to be optimal. Financially constrained individuals, such as the more vulnerable group —poor, young, and women— in the first kink, should even increase debt if cash-on-hand is needed to access credit.

We find that for individuals in the first kink, an increase in liquidity is strongly associated with debt repayment, while the response for individuals in other kinks is mixed. This heterogeneity is a challenge for the standard model with constant cost of debt because the marginal propensity to consume is constant along the cross-section of individuals. Models with increasing cost of debt can rationalize this behavior, since the marginal propensity to consume decreases as the cost of debt increases (see our Proposition 3 in section 2). For individuals who face a high cost of debt, such as those in the first kink, it is relatively more attractive to repay expensive debt rather than to increase consumption.

5.3 Additional Results and Robustness

In Figure 7 we examine the relationship between debt changes and pension balances around the first kink. We plot the linear relationship between these two variables estimated separately above and below the kink. The change in slope when comparing both estimations is akin to the reduced-form estimation. Since the first-stage coefficients are close to -1 in the first kink, we just need to flip the sign of the second-stage coefficient to predict what the reduced-form relationship should be (i.e., $\tau = \rho \times \beta_{rkd} \approx -\beta_{rkd}$).

Insert Figure 7 here

In the first panel we find a clear increase in slope at the kink, which is what can be expected since $\beta_{rkd} < 0$ for changes in total debt (see Table 3). We find similar increases in slope for overdue debt, revolving and non-revolving debt. For Figure 7 we employ data that is not adjusted for co-variates, and therefore the results are independent of controls. Simply put, the patterns stand out from the raw data.

Insert Table 4 here

In Table 4 we present second-stage results using our data on loan origination. The purpose of this table is to see whether the extensive margin of borrowing behaves like the intensive margin we study in Table 3. We show results for consumer installment loans and mortgage loans separately. For individuals in the first kink (UF35), we find consistently negative effects on the likelihood of getting a new loan, across all withdrawals and for both types of loan. The elasticities are stronger in magnitude for consumer loans, but statistically significant for both consumer and mortgage loans. The effects basically disappear for individuals in the other two kinks (UF350 and UF1500), and sometimes the coefficients become positive. Overall, the effects for loan origination are consistent with the previous evidence for changes in debt holdings. Table 4 suggests that it is not just debt repayment, but that individuals getting a larger withdrawal are also less likely to get new loans.

Insert Table 5 here

In Table 5 we show the main results using as explanatory variable the fraction of pension savings withdrawn instead of the (log) amount withdrawn. The fraction withdrawn is multiplied by 100, so the interpretation of the coefficient is that, if the fraction withdrawn increases by one percentage point, then debt increases by $100 \times \beta_{rkd}\%$. For the first kink and withdrawal we find that total debt decreases by 0.45% when the individual withdraws 1% more of her total pension savings. This elasticity is not far from the one estimated in Table 3 for the amount withdrawn (0.39%), which is not surprising given that many individuals in the first-kink sample are withdrawing 100% of their wealth. This alternative way to express the elasticity can be useful depending on the particular model and context. The advantage is that both the liquidity shock and repayment are expressed as percentages of a stock (illiquid wealth and debt, respectively).

Insert Figure 8 here

An important robustness check in the RKD literature has to do with the size of the bandwidth around the kinks. In Figure 8 we show the variation of β_{rkd} and its 95% confidence interval as a function of the bandwidth in the first kink. The coefficient is stable and tightly estimated for samples with bandwidth above UF20 (our main results use a bandwidth of UF25). For smaller bandwidths, the coefficient remains negative and significant, although the standard errors increase. This can be expected from the smaller sample sizes. For example, when the bandwidth is UF10, the sample is less than half the size as our main sample. Overall, our choice of bandwidth (UF25) for the main results provides a good balance between the power (lower variance) of larger samples and the improved consistency (less bias) of tighter bandwidths.

5.4 Heterogeneity "within" kinks

In the previous tables we find heterogeneity of the effect across populations in different kinks of the policy rule. We now explore heterogeneity "within" kinks, i.e., within the sample around each kink. In Table 6 we focus on the first kink and withdrawal, splitting the sample according to the characteristics of individuals before the first withdrawal.

Insert Table 6 here

We show results for changes in total debt. The results for the sample splits according to debt levels (column 1) and the ratio of debt-to-income (column 2) show that strong repayment elasticities are concentrated in high-debt and high-debt-to-income individuals. This is consistent with a higher cost of debt for those that are highly indebted.

Younger individuals have a higher repayment elasticity (column 3), which is again consistent with these individuals facing higher cost of debt. The lower repayment elasticity of older individuals can also be related to family composition, particularly since older individuals in this kink are likely to be recently married or starting families. We find similar repayment elasticities for employed and unemployed individuals (column 4). Finally, we find a high repayment elasticity among those that do not own a home (column 5), who represent the majority of this sample around the first kink. This is relevant for theories of financial constraints that predict, instead, a positive relationship between cash-in-hand and debt since down-payments are necessary to acquire durable goods such as homes, cars, and others.

5.5 Dynamic Effects

In Figure 9 we study long-run effects of the withdrawals. We plot the elasticity estimates for changes in debt up to 36 months after the withdrawal, i.e., the dependent variable is $\Delta d_{i,t+j}$ up to $j = 36$ and with respect to the level observed three months before the withdrawal. We provide the estimate for the first month as a baseline for comparison. Again, we focus on the first kink. The effect of the first withdrawal in total debt changes is persistent: even after 36 months it remains close to -0.20, which is about half of the first-month elasticity. Thus, withdrawal policies can have long-lasting effects on household borrowing. The effect of the second withdrawal is smaller and short lived. The impact effect of the third withdrawal is the smallest of the three episodes, although it is quite persistent.

Insert Figure 9 here

In Figure 10 we split between revolving and non-revolving debt. The long-run elasticities after the first withdrawal are consistently negative for both revolving and non-revolving debt. Revolving debt shows a negative elasticity for the first withdrawal, but close to zero long-run elasticities after the second and third withdrawals. In other words, individuals reduced their revolving debt after the first withdrawal, but did not continue to cut their borrowing after the subsequent withdrawals. This suggests that revolving credit taken during the early months of the pandemic reverted quickly after the first withdrawal.

Insert Figure 10 here

Another important dynamic feature of our setup is the repeated nature of the experiment: the three withdrawals occurred in less than a year, and with 4 or 5 months between them. The recent history, by changing the experience of the population or the initial conditions for each experiment, potentially matter for the results. In order to study this, in Table 7 we split the sample around the first kink in the second and third withdrawals with respect to the cumulative amount withdrawn for each individual in the previous withdrawal(s).

Insert Table 7 here

We find stronger repayment elasticities for the sample with low cumulative withdrawals. For example, in the second withdrawal, the elasticity of total debt changes is -0.169 in the sample with a low first withdrawal, while it is -0.124 for those with a high first withdrawal. Something similar happens in the third withdrawal when we split for the cumulative amount in the first and second withdrawal. In fact, for those with high cumulative withdrawals we find close to zero or positive elasticities instead of negative (expect for the credit limit that is supposed to be positive). Overall, withdrawals have a diminishing effect as initial liquidity increases.

A complementary approach is to control for the initial liquidity conditions instead of looking at the heterogeneity of treatment related to those conditions. We want to control for previous liquidity since the decision to withdraw or not, and how much to withdraw, can capture additional demand channels that affect borrowing. The cumulative withdrawal from previous episodes does not only capture variation around kinks, but all of the variation in the policy rule.

Insert Table 8 here

In Table 8 we show the estimated elasticities in the second and third withdrawals after controlling for the cumulative withdrawal up to each point. The cumulative withdrawal has a mostly negative coefficient across debt types, meaning that initial liquidity is correlated with debt repayment. This is the case across the three kinks. Interestingly for us, the coefficient on the instrumented last withdrawal retains its significance and magnitude when compared to our baseline estimates in Table 3. For instance, the elasticity of total debt changes in the first kink and after the second withdrawal is -0.1429 when we control for the cumulative withdrawal, and -0.1462 when we do not control. These results suggest that the identification strategy based on variation around the kinks of the last withdrawal provides independent variation in borrowing behavior that is not correlated with past liquidity or withdrawal behavior.

5.6 Effects on Voluntary Pension Savings

We can partially study the savings decision, which represents another margin of adjustment of the individual to pension withdrawals. We do not have access to the entire portfolio of savings (e.g. stocks, time deposits, etc.), but we can study voluntary savings ("Cuenta 2") within the same pension system. In Chile, pension fund administrators also offer pension accounts where individuals can voluntarily save. The pension funds where individuals can invest voluntary savings are the same as those available under the mandatory accounts. Thus, the main difference is that voluntary savings can be withdrawn at any time without incurring in penalties. In other words, voluntary savings are totally liquid.

Insert Table 9 here

In Table 9 we explore the effect of the withdrawals on two outcomes related to voluntary pension savings. First, we study the creation of new accounts. Particularly among poorer individuals, voluntary accounts are uncommon. Second, among those with voluntary accounts before the withdrawals, we study changes in the amount of voluntary savings. The setup is otherwise analogous to our previous empirical design for debt changes.

After the first withdrawal, we find that the creation of new voluntary accounts increases by 2.01% among individuals in the second kink (Panel A). This effect persists in the second withdrawal. After the third withdrawal, we find positive and significant impact on the creation of accounts around the first and third kinks. Individuals in the third kink open 0.026% more accounts in response to a 1% larger withdrawal. Once we condition on those with active accounts before the first withdrawal, we find positive elasticities for voluntary savings (Panel B). Among individuals in the third kink, we estimate an elasticity of 0.36 after the first withdrawal, and 0.18 after the third withdrawal. Overall, the results are consistent with the idea that debt repayment is the preferred option among individuals in the first kink, particularly after the first withdrawal, while individuals in higher kinks increase savings.

6 Conclusions

During COVID, and for the first time in their 40-year history, Chilean pension funds allowed partial withdrawals from otherwise illiquid retirement accounts. We use this quasi-natural experiment to study how individual borrowing responds to liquid wealth. The policy rule for withdrawals was a piecewise-linear function of the balance in the individual retirement account. This rule included several "kinks," which we use to estimate the elasticity of borrowing to liquid wealth through a regression kink design.

We find a negative elasticity among predominantly low-income, young, and female individuals. Repayment is stronger for individuals with higher debt-to-income ratios within that population. We interpret these findings through a model in which the marginal cost of debt increases with borrowing.

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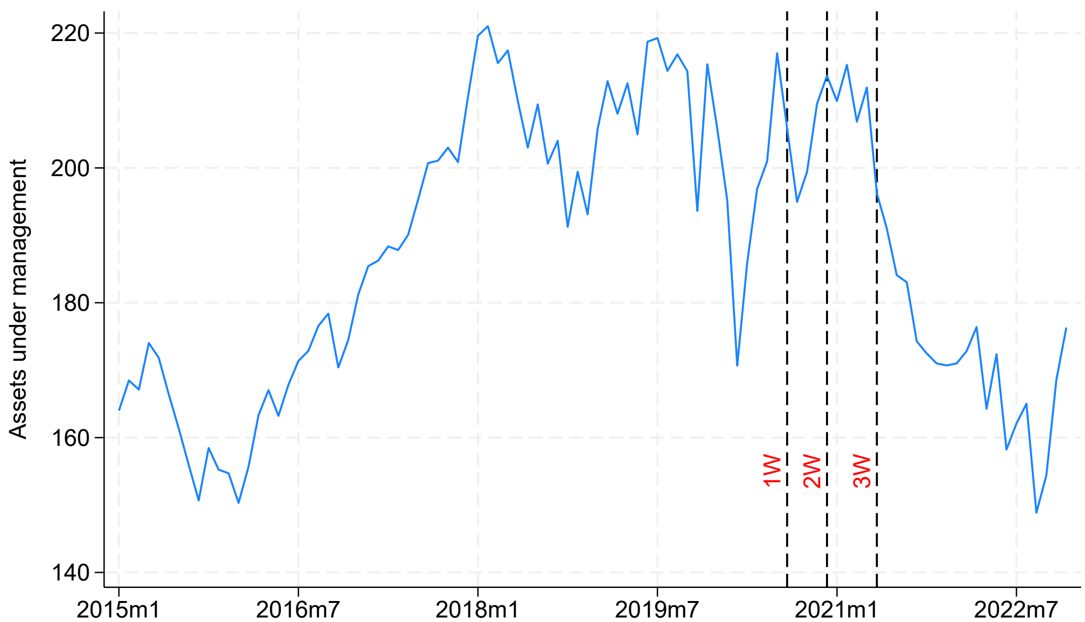
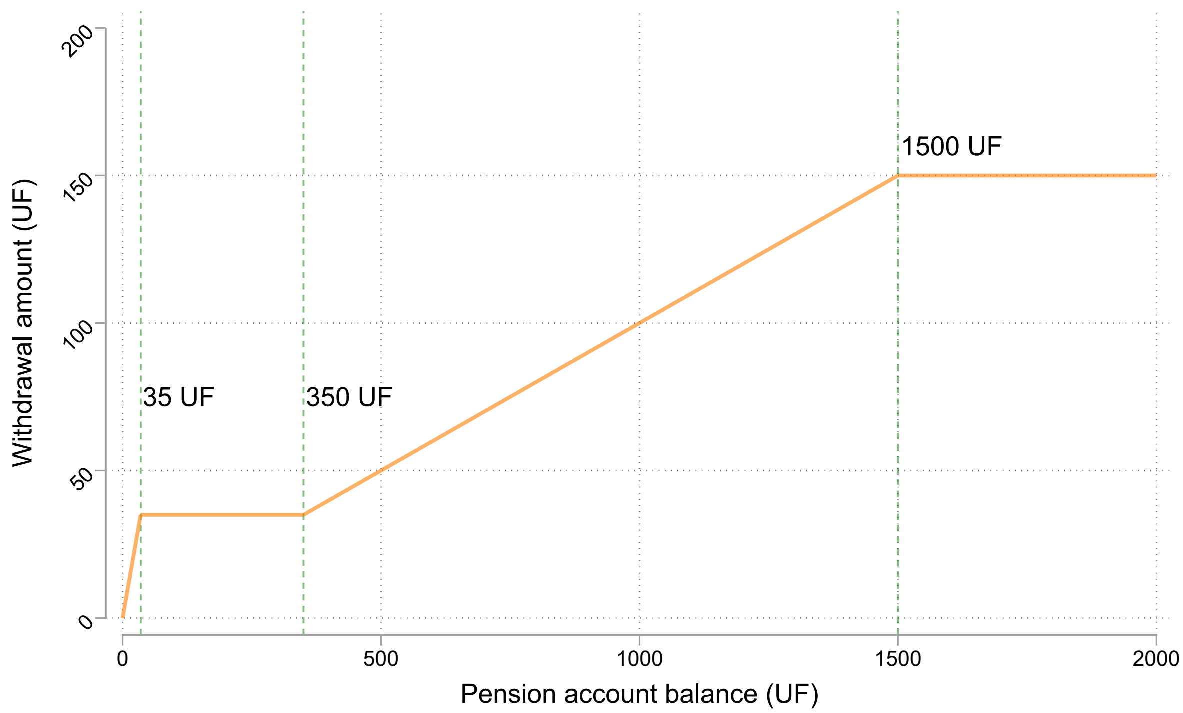
Figure 1: Assets under Management of the Chilean Pension System



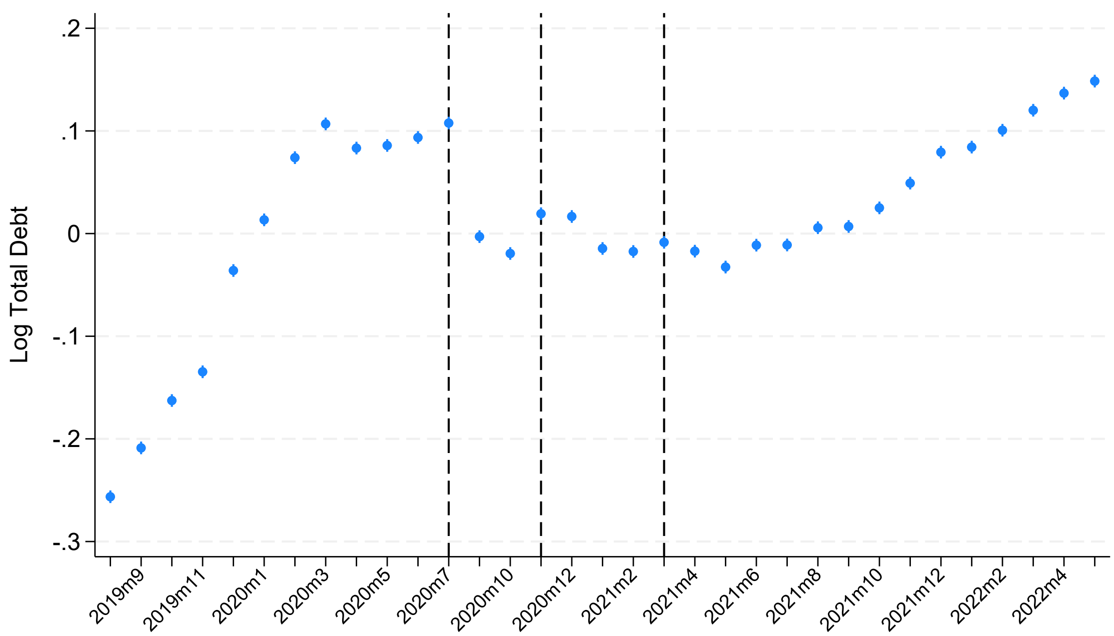
Notes: The figure shows the assets under management of the Chilean pension system in billions of U.S. dollars. The dashed vertical lines mark the dates in which the three withdrawals were announced.

Figure 2: Policy Rule for Pension Withdrawals



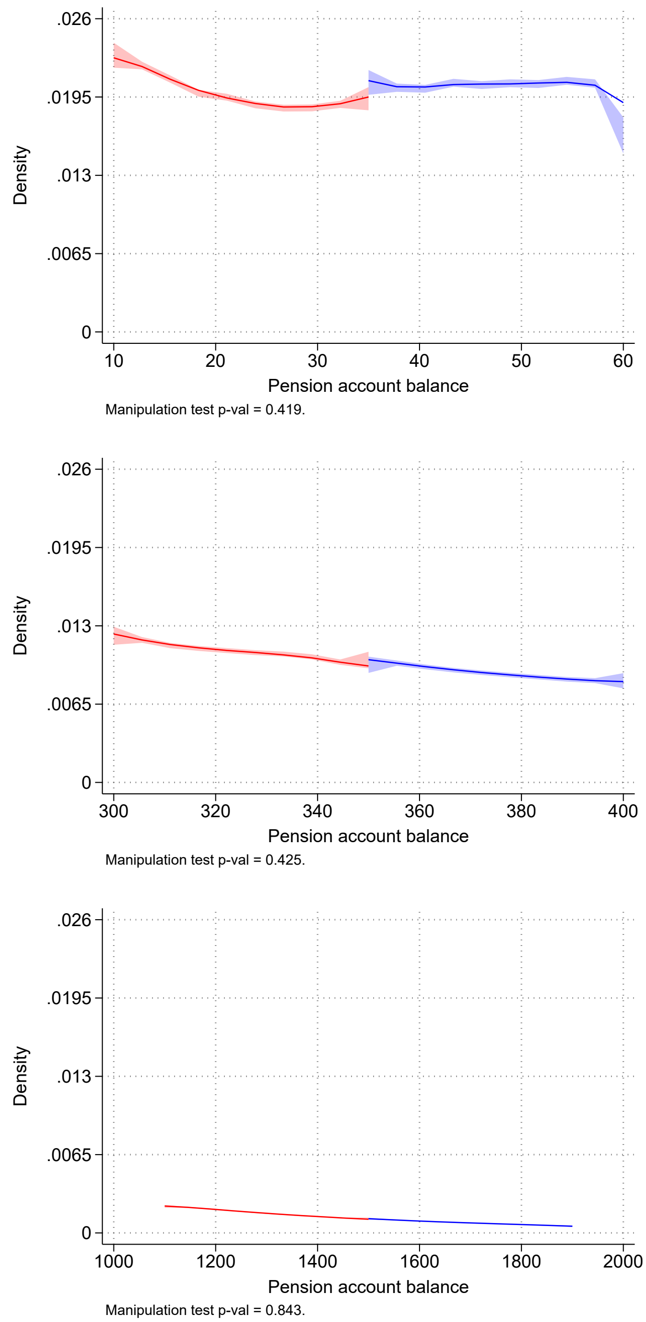
Notes: The figure shows the policy rule for the three withdrawals. The pension account balance and the maximum amount to withdraw are expressed in UFs. The UF is an inflation-adjusted unit of account.

Figure 3: Average Time Effects for Total Debt around the Three Withdrawals



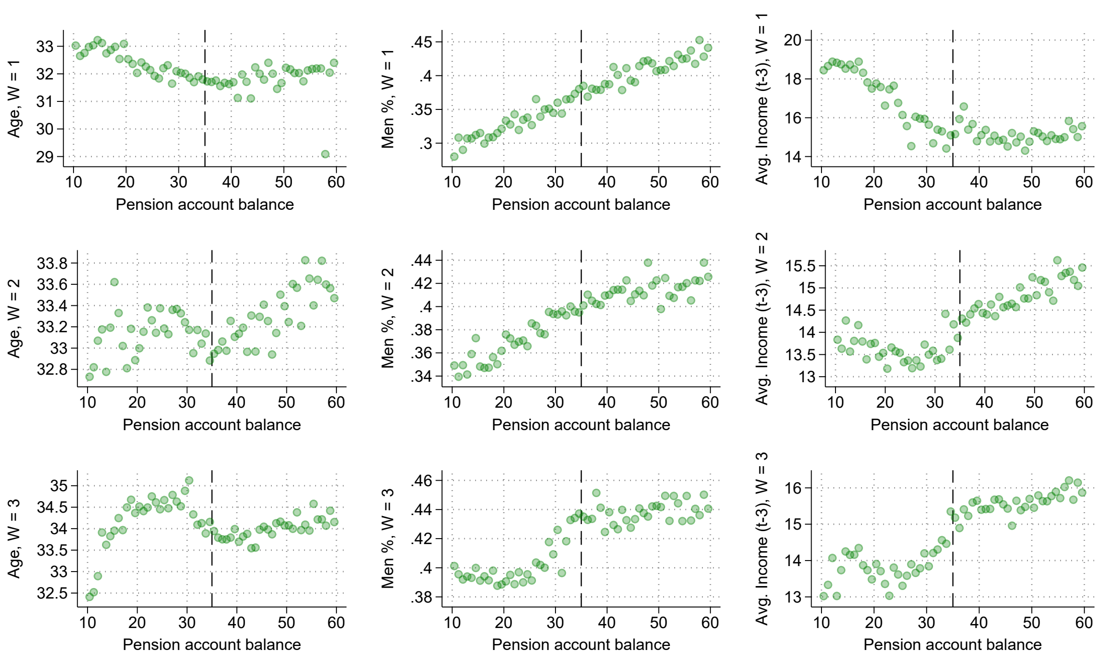
Notes: The figure shows the calendar time effects (α_t) from equation 3 in the main text. The dependent variable is the log of total debt for each individual. The dashed vertical lines mark the dates in which the three withdrawals were announced. The sample is composed of individuals in the neighborhood of the first kink (UF35$\pm$25).

Figure 4: Manipulation test around each kink in the first withdrawal



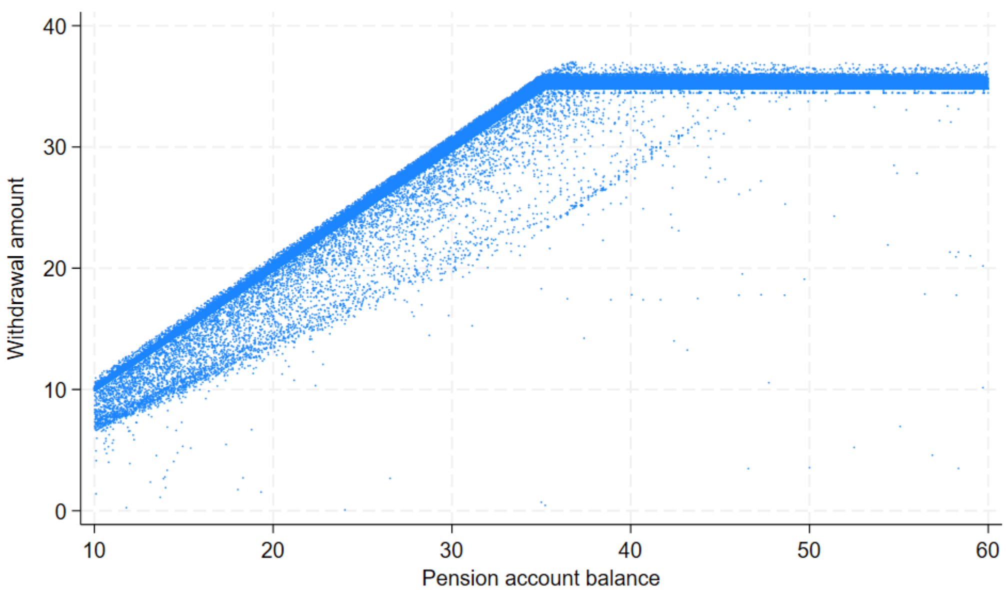
Notes: The figure shows the distribution of individuals around each kink (35, 350, and 1500) in the first withdrawal. The distribution is independently estimated from either side of the kink. The p-value reported below each panel corresponds to the manipulation test of Cattaneo, Jansson, and Ma (2018).

Figure 5: Smoothness of observable variables around the first kink in each withdrawal



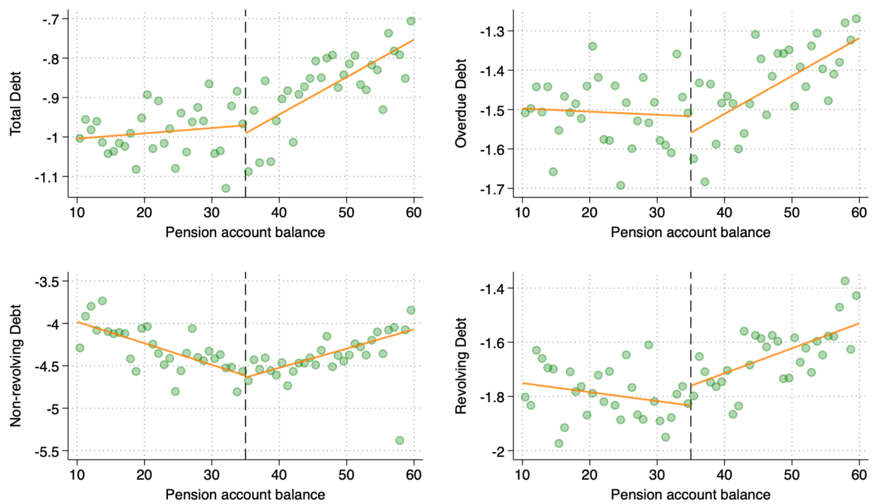
Notes: The figure shows the averages of age, the dummy for men, and monthly income conditional on the pension account balance. The sample corresponds to individuals around the first kink (UF35). Each panel corresponds to a different withdrawal (W=1,2,3).

Figure 6: Observed withdrawal amount and pension balances in the first withdrawal



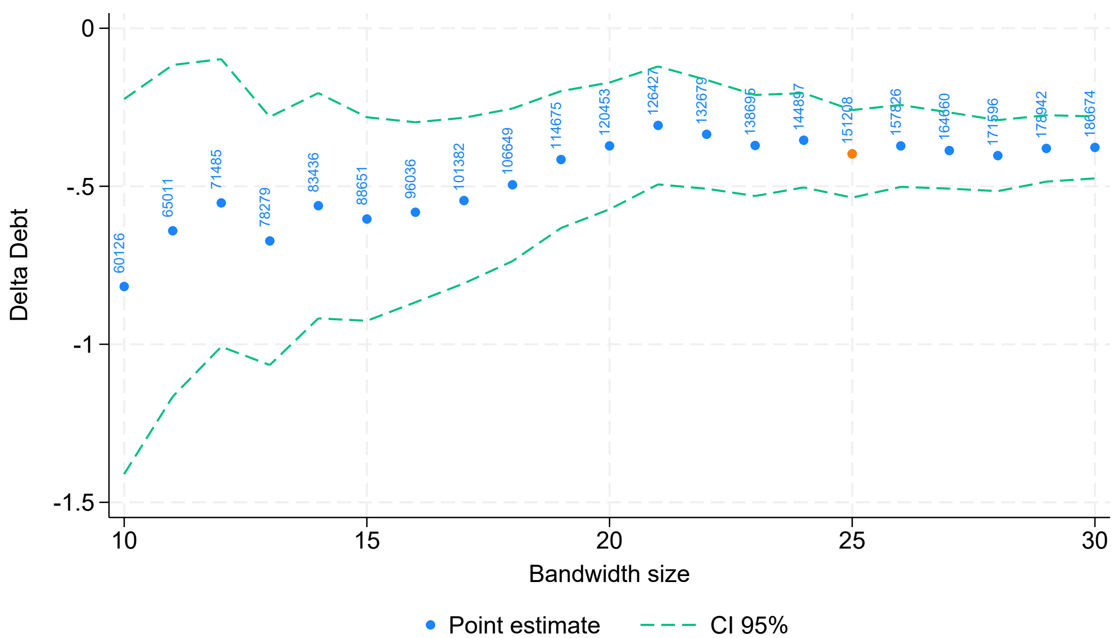
Notes: The figure shows the actual amount withdrawn during August 2020 as a function of the pension account balance around the first kink (UF35).

Figure 7: Observed change in debt and pension balances in the first withdrawal



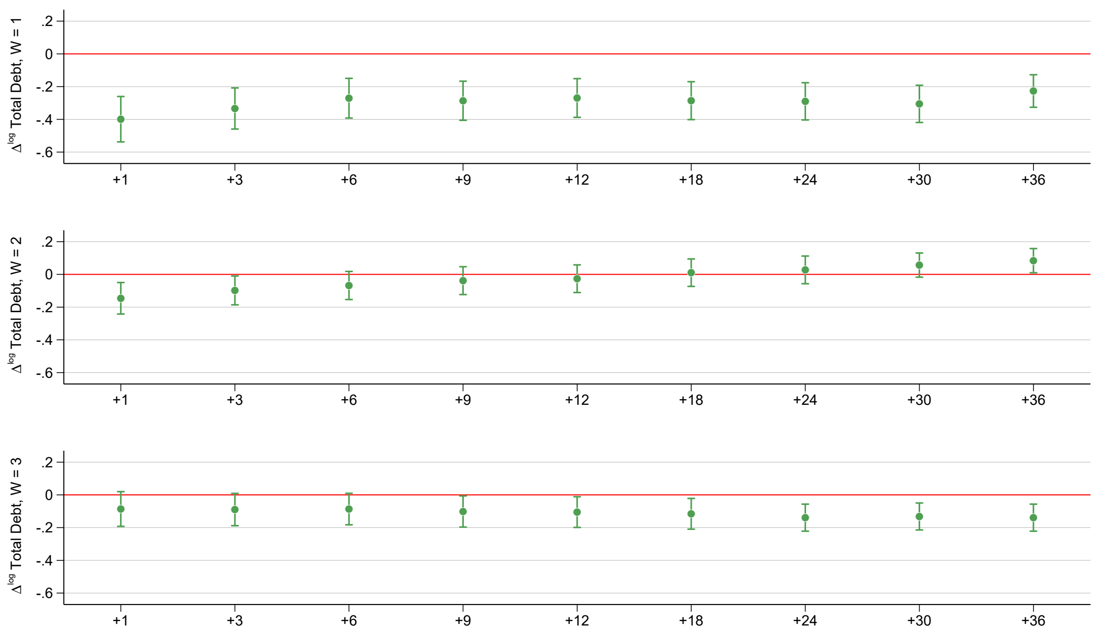
Notes: The figure shows the relationship between debt changes in the first month after the first withdrawal and pension balances around the first kink (UF35). The linear relationship is estimated separately above and below the kink. Each panel shows a different type of debt: total debt, overdue debt, revolving debt, and non-revlving debt.

Figure 8: RKD estimate as a function of the bandwidth



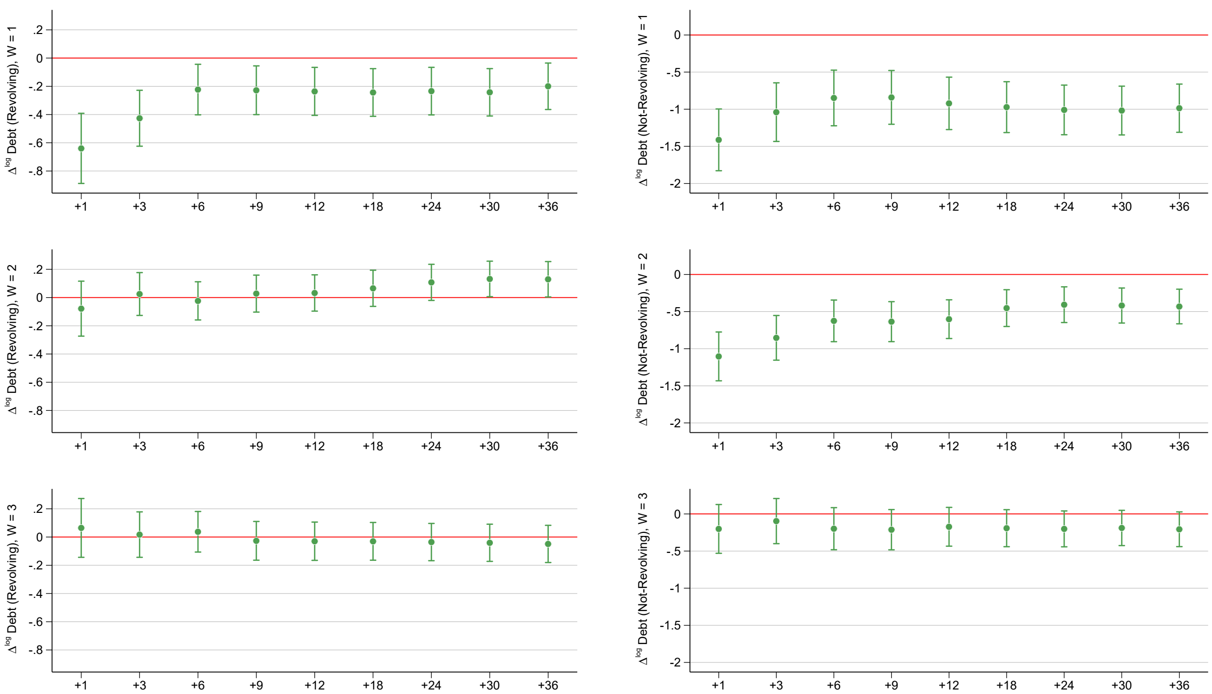
Notes: The figure shows the coefficient from the second stage regressions as function of the bandwidth around the first kink (UF35). Numbers next to point estimates correspond to the total observations in each estimation. We report results for log-changes in total debt as dependent variable, and for the first withdrawal.

Figure 9: Long-run effects of withdrawals



Notes: The figure shows the coefficient estimated for $\widehat{w_{i,t}}$ in equation 6 when we extend the horizon of the change in the dependent variable $\Delta d_{i,t+j}$ up to $j = 36$. The results for $j = 1$ correspond to the baseline results shown in Table 3 for total debt in the first kink (UF35). The results for each withdrawal (W=1,2,3) are shown in separate panels.

Figure 10: Long-run effects of withdrawals: Revolving and Non-Revolving Debt



Notes: The figure shows the coefficient estimated for $\widehat{w_{i,t}}$ in equation 6 when we extend the horizon of the change in the dependent variable $\Delta d_{i,t+j}$ up to $j = 36$. The results for $j = 1$ correspond to the baseline results shown in Table 3 in the first kink (UF35). The results for each withdrawal (W=1,2,3) are shown in separate panels.

Table 1: Summary Statistics around Policy Kinks

This table shows averages of different variables for the samples around the three kinks of the policy rule (35, 350, and 1500) in each one of the the three withdrawal programs. *Total Debt* and *Income* are measured in UFs. *Debt over income* is the ratio of the two previous variables. *Overdue* is the fraction of total debt with late payments. *Age* is measured in years. *Men* is an indicator variable equal to one when the individual is male. *Cumulative withdrawal* is the total amount withdrawn (in UFs) in the previous withdrawal episode(s). In the column labeled as *Total obs.* we report the total number of individuals for each variable across kinks. In the row labeled as *Total obs.* we report the total number of individuals with debt data for each kink across withdrawals. The sample bandwidth around each kink is reported at the bottom of the table. Continuous variables are winsorized at 1%.

	Kink (UF)			
	35	350	1500	Total obs.
Panel A. Withdrawal #1				
Total Debt	47.29	138.05	334.69	284,352
Overdue	0.31	0.30	0.22	283,799
Income	15.80	21.59	41.26	156,624
Debt over income	6.29	10.17	11.81	156,624
Age	32.15	39.12	49.69	265,743
Men	0.37	0.54	0.76	283,921
Panel B. Withdrawal #2				
Total Debt	44.56	126.29	295.70	660,635
Overdue	0.34	0.26	0.18	632,001
Income	14.19	21.79	40.75	450,513
Debt over income	5.80	8.55	9.25	450,513
Age	33.23	40.14	50.38	616,366
Men	0.39	0.52	0.69	659,340
Cumulative withdrawal	34.78	37.30	140.08	660,635
Panel C. Withdrawal #3				
Total Debt	57.06	130.22	341.18	591,768
Overdue	0.34	0.25	0.15	548,095
Income	17.22	25.37	57.29	417,236
Debt over income	6.67	7.79	8.40	417,236
Age	34.07	40.64	50.08	554,611
Men	0.42	0.55	0.70	590,590
Cumulative withdrawal	67.79	77.03	279.64	591,768
Total obs.	654,443	506,529	375,783	
Bandwidth (UF)	25	50	400	

Table 2: The Effect of Policy Kinks on the Amount Withdrawn

This table reports results for equation (5) in the main text. The dependent variable is the log of the amount withdrawn in each withdrawal program. The coefficient for $(v_{i,t} - \overline{v})D_i$ captures the change in slope around each kink (35, 350, or 1500). The F-statistic corresponds to the test for weak instruments. Robust standard errors are reported in square brackets. Significant at: *10%, **5% and ***1%.

	Kink (UF)		
	35	350	1500
Panel A. Withdrawal #1			
$(v_{i,t} - \overline{v})D_i$	-1.0042***	1.0050***	-1.0090***
	[0.0012]	[0.0055]	[0.0031]
Obs.	151,208	63,326	50,264
F-statistic	738,414	33,021	105,009
Panel B. Withdrawal #2			
$(v_{i,t} - \overline{v})D_i$	-0.9995***	1.0001***	-0.9922***
	[0.001]	[0.0023]	[0.0024]
Obs.	230,859	205,754	151,379
F-statistic	1,100,000	197,158	168,731
Panel C. Withdrawal #3			
$(v_{i,t} - \overline{v})D_i$	-0.9956***	1.0002***	-0.9975***
	[0.0011]	[0.0032]	[0.0022]
Obs.	192,015	195,731	124,247
F-statistic	804,989	100,144	211,803

Table 3: The Effect of the Amount Withdrawn on Debt Changes

This table reports results for equation (6) in the main text. Dependent variables are log-changes between the end of the first month after the withdrawal and three months prior to the withdrawal. The 6 dependent variables are: total debt, performing debt, overdue debt, credit limit (net of credit-line and credit-card utilization), revolving debt, and non-revolving debt. The coefficient for $\widehat{w_{i,t}}$ captures the elasticity with respect to the instrumented (log) amount withdrawn each time. Each panel shows regressions around a different kink and in the three withdrawal episodes. Robust standard errors are reported in square brackets. Significant at: *10%, **5% and ***1%.

	(1) Tot. Debt	(2) Perf. Debt	(3) Overdue Debt	(4) Credit Limit	(5) Revol. Debt	(6) Non-Revol. Debt
			Panel A. UF35			
			Withdrawal #1			
$\widehat{w_{i,t}}$	-.3974***	-.6194***	-.4223***	.0764***	-.6398***	-1.413***
	[.0707]	[.092]	[.0978]	[.029]	[.1267]	[.2121]
Obs.	151,208	116,923	151,208	82,618	89,019	52,130
			Withdrawal #2			
$\widehat{w_{i,t}}$	-.1462***	-.2613***	-.0832	.0341*	-.0785	-1.104***
	[.0492]	[.0636]	[.0703]	[.0206]	[.0993]	[.1677]
Obs.	230,859	165,866	230,859	125,363	129,023	73,223
			Withdrawal #3			
$\widehat{w_{i,t}}$	-.0892*	-.1037	-.1232	.0383*	.0646	-.2013
	[.0542]	[.0664]	[.0771]	[.0208]	[.1063]	[.1677]
Obs.	192,015	137,182	192,015	106,236	105,761	65,585
			Panel B. UF350			
			Withdrawal #1			
$\widehat{w_{i,t}}$	.8963*	.2781	-.296	.274	-1.509	.7783
	[.4954]	[.6137]	[.8521]	[.189]	[1.037]	[1.193]
Obs.	63,326	50,465	63,326	35,589	34,087	32,563
			Withdrawal #2			
$\widehat{w_{i,t}}$	.0963	.2172	.375	-.1193	-.0533	.8315
	[.2574]	[.288]	[.4201]	[.0861]	[.5022]	[.6195]
Obs.	205,754	165,575	205,754	124,518	115,814	100,834
			Withdrawal #3			
$\widehat{w_{i,t}}$	.1825	.5233*	-.0669	.141*	.7898	-.0704
	[.2791]	[.2985]	[.4298]	[.0833]	[.5119]	[.6381]
Obs.	195,731	158,823	195,731	123,517	113,240	94,907
			Panel C. UF1500			
			Withdrawal #1			
$\widehat{w_{i,t}}$	-.7705**	-.154	-.5521	.1554*	-.8768	.1761
	[.3072]	[.3415]	[.5941]	[.0906]	[.6516]	[.5849]
Obs.	50,264	43,659	50,264	33,596	29,096	30,924
			Withdrawal #2			
$\widehat{w_{i,t}}$	-.1945	.1471	-.34	-.0068	-.3057	.3802
	[.1586]	[.1661]	[.2954]	[.0388]	[.3165]	[.3185]
Obs.	151,379	132,999	151,379	108,200	90,393	89,658
			Withdrawal #3			
$\widehat{w_{i,t}}$	.0754	.0609	-.0649	-.0462	.0288	.7019**
	[.1742]	[.1734]	[.3099]	[.0383]	[.3486]	[.3403]
Obs.	124,247	111,010	124,247	94,061	76,850	73,570

Table 4: The Effect of the Amount Withdrawn on New Loans

This table reports results for equation (6) in the main text. The dependent variable is an indicator variable for new loans. Panel A shows results for consumer loans and Panel B shows results for mortgages. The coefficient for $\widehat{w_{i,t}}$ captures the elasticity with respect to the instrumented (log) amount withdrawn each time. Robust standard errors are reported in square brackets. Significant at: *10%, **5% and ***1%.

	Kink (UF)		
	35	350	1500
	Panel A. New Consumer Loans		
	Withdrawal #1		
$\widehat{w_{i,t}}$	-.0523***	.035	-.0015
	[.0057]	[.0535]	[.0369]
Obs.	151,787	64,501	51,569
	Withdrawal #2		
$\widehat{w_{i,t}}$	-.0134***	.031	-.0189
	[.0048]	[.0298]	[.0222]
Obs.	244,779	217,414	160,326
	Withdrawal #3		
$\widehat{w_{i,t}}$	-.0152***	.0471	-.0246
	[.0055]	[.0325]	[.0269]
Obs.	211,842	213,806	134,195
	Panel B. New Mortgages		
	Withdrawal #1		
$\widehat{w_{i,t}}$	-.0037**	.0321	.0061
	[.0015]	[.0196]	[.0132]
Obs.	151,787	64,501	51,569
	Withdrawal #2		
$\widehat{w_{i,t}}$	-.0053***	.0052	.0044
	[.0013]	[.0109]	[.0077]
Obs.	244,779	217,414	160,326
	Withdrawal #3		
$\widehat{w_{i,t}}$	-.0055***	.0196**	-.0115
	[.0015]	[.0099]	[.0084]
Obs.	211,842	213,806	134,195

Table 5: The Effect of the Fraction of Pension Savings Withdrawn on Debt Changes

This table reports results for equation (6) in the main text using the fraction of pension savings withdrawn in percentage points. Dependent variables are log-changes between the end of the first month after the withdrawal and three months prior to the withdrawal. The 6 dependent variables are: total debt, performing debt, overdue debt, credit limit (net of credit-line and credit-card utilization), revolving debt, and non-revolving debt. The coefficient for $\widehat{w_{i,t}^F}$ captures the elasticity with respect to the instrumented fraction of savings withdrawn each time. Each panel shows regressions around a different kink and in the three withdrawal episodes. Robust standard errors are reported in square brackets. Significant at: *10%, **5% and ***1%.

	(1) Tot. Debt	(2) Perf. Debt	(3) Overdue Debt	(4) Credit Limit	(5) Revol. Debt	(6) Non-Revol. Debt
			Panel A. UF35			
			Withdrawal #1			
$\widehat{w_{i,t}^F}$	-.0045***	-.0079***	-.0064***	.0018***	-.0084***	-.0257***
	[.0013]	[.0017]	[.0018]	[.0005]	[.0023]	[.0039]
Obs.	151,208	116,923	151,208	82,618	89,019	52,130
			Withdrawal #2			
$\widehat{w_{i,t}^F}$	-.0022**	-.0024**	-.002	.0012***	.0039**	-.0123***
	[.0009]	[.0012]	[.0013]	[.0004]	[.0019]	[.0032]
Obs.	230,859	165,866	230,859	125,363	129,023	73,223
			Withdrawal #3			
$\widehat{w_{i,t}^F}$	-.0008	.0001	-.0021	.0014***	.0052**	.0034
	[.001]	[.0013]	[.0015]	[.0004]	[.002]	[.0032]
Obs.	192,015	137,182	192,015	106,236	105,761	65,585
			Panel B. UF350			
			Withdrawal #1			
$\widehat{w_{i,t}^F}$	.0749*	.0203	-.024	.0244	-.1263	.056
	[.0423]	[.0525]	[.0728]	[.0161]	[.0881]	[.1021]
Obs.	63,326	50,465	63,326	35,589	34,087	32,563
			Withdrawal #2			
$\widehat{w_{i,t}^F}$	.0064	.0156	.0325	-.0105	-.0073	.0622
	[.0221]	[.0247]	[.0361]	[.0074]	[.0431]	[.0532]
Obs.	205,754	165,575	205,754	124,518	115,814	100,834
			Withdrawal #3			
$\widehat{w_{i,t}^F}$	.014	.0419	-.007	.0119*	.0651	-.0182
	[.024]	[.0257]	[.037]	[.0072]	[.0441]	[.055]
Obs.	195,731	158,823	195,731	123,517	113,240	94,907
			Panel C. UF1500			
			Withdrawal #1			
$\widehat{w_{i,t}^F}$	-.0853**	-.0104	-.0749	.0178	-.0991	.0466
	[.0376]	[.0421]	[.0728]	[.0111]	[.0801]	[.0719]
Obs.	50,264	43,659	50,264	33,596	29,096	30,924
			Withdrawal #2			
$\widehat{w_{i,t}^F}$	-.0164	.0311	-.0487	-.0016	-.0312	.0751*
	[.0197]	[.0206]	[.0367]	[.0048]	[.0394]	[.0396]
Obs.	151,379	132,999	151,379	108,200	90,393	89,658
			Withdrawal #3			
$\widehat{w_{i,t}^F}$	.0194	.0199	-.0064	-.0052	.004	.1115***
	[.0217]	[.0216]	[.0386]	[.0048]	[.0435]	[.0425]
Obs.	124,247	111,010	124,247	94,061	76,850	73,570

Table 6: Heterogeneity Analysis within the First Kink

This table reports results for equation (6) in sub-samples. Sorting variables are measure three months before each withdrawal: total debt, the debt-to-income ratio, age, and indicator variables for being unemployed or a homeowner. For continuous variables we use the median to split the sample in high and low sub-samples. The dependent variable is the log-change in total debt. The coefficient for $\widehat{w_{i,t}}$ captures the elasticity with respect to the instrumented (log) amount withdrawn. We show regressions around the first kink (UF35) and in the first withdrawal episode. Robust standard errors are reported in square brackets. Significant at: *10%, **5% and ***1%.

	(1)	(2)	(3)	(4)	(5)
	Sorting variable at t-3				
	Total Debt	Debt/Income	Age	Employed?	Homeowner?
Dep. Variable: Total Debt					
			Low/No sample		
$\widehat{w_{i,t}}$	-.2181*	-.2401	-.5835***	-.3659***	-.4125***
	[.1186]	[.1646]	[.1016]	[.0903]	[.0717]
Obs.	78,628	34,388	74,645	101,142	148,064
			High/Yes sample		
$\widehat{w_{i,t}}$	-.3509***	-.4759***	-.2366**	-.4001***	.6028
	[.0738]	[.1049]	[.0991]	[.1107]	[.3804]
Obs.	72,580	32,671	76,563	50,066	3,144

Table 7: Heterogeneity by Cumulative Withdrawal

This table reports results for equation (6) in sub-samples. We split the sample of individuals according to the median of the cumulative withdrawal in the previous withdrawal episode(s). Dependent variables are log-changes between the end of the first month after the withdrawal and three months prior to the withdrawal. The 6 dependent variables are: total debt, performing debt, overdue debt, credit limit (net of credit-line and credit-card utilization), revolving debt, and non-revolving debt. The coefficient for $\widehat{w_{i,t}}$ captures the elasticity with respect to the instrumented (log) amount withdrawn each time. We show regressions around the first kink (UF35). Robust standard errors are reported in square brackets. Significant at: *10%, **5% and ***1%.

	(1) Tot. Debt	(2) Perf. Debt	(3) Overdue Debt	(4) Credit Limit	(5) Revol. Debt	(6) Non-Revol. Debt
Panel A. Withdrawal #2						
			Low cumulative withdrawal			
$\widehat{w_{i,t}}$	-.169**	-.2968***	-.0669	.065**	-.0517	-1.472***
	[.0673]	[.0893]	[.0977]	[.0294]	[.1408]	[.2384]
Obs.	118,234	82,976	118,234	64,382	64,427	36,692
			High cumulative withdrawal			
$\widehat{w_{i,t}}$	-.1245*	-.2312**	-.1065	.0006	-.1108	-.7612***
	[.0718]	[.0905]	[.1014]	[.0287]	[.1399]	[.2359]
Obs.	112,625	82,890	112,625	60,981	64,596	36,531
Panel B. Withdrawal #3						
			Low cumulative withdrawal			
$\widehat{w_{i,t}}$	-.1353*	-.1535*	-.3085***	.0546*	.0137	-.4891**
	[.0745]	[.0916]	[.1079]	[.0295]	[.1483]	[.2342]
Obs.	96,252	69,390	96,252	53,799	53,714	33,447
			High cumulative withdrawal			
$\widehat{w_{i,t}}$	.0067	.0249	.1462	.0274	.1594	.1076
	[.0798]	[.0985]	[.1118]	[.0295]	[.1552]	[.245]
Obs.	95,763	67,792	95,763	52,437	52,047	32,138

Table 8: Controlling by Cumulative Withdrawal

This table reports results for equation (6) in the main text. Dependent variables are log-changes between the end of the first month after the withdrawal and three months prior to the withdrawal, and the log-cumulative withdrawal from the previous episode(s) ($w^{cum}_{i,t-1}$). The 6 dependent variables are: total debt, performing debt, overdue debt, credit limit (net of credit-line and credit-card utilization), revolving debt, and non-revolving debt. The coefficient for $\widehat{w_{i,t}}$ captures the elasticity with respect to the instrumented (log) amount withdrawn each time. Each panel shows regressions around a different kink and in the second and third withdrawal episodes. Robust standard errors are reported in square brackets. Significant at: *10%, **5% and ***1%.

	(1) Tot. Debt	(2) Perf. Debt	(3) Overdue Debt	(4) Credit Limit	(5) Revol. Debt	(6) Non-Revol. Debt
Panel A. UF35						
Withdrawal #2						
$\widehat{w_{i,t}}$	-0.1429***	-0.2453***	-0.0789	0.0385*	-0.0554	-1.1130***
	[0.0493]	[0.0638]	[0.0705]	[0.0207]	[0.0997]	[0.1682]
$w^{cum}_{i,t}$	-0.0653	-0.2634***	-0.0834	-0.0654***	-0.3460***	0.1855
	[0.0542]	[0.0558]	[0.0703]	[0.0210]	[0.0948]	[0.2339]
Obs.	230,859	165,866	230,859	125,363	129,023	73,223
Withdrawal #3						
$\widehat{w_{i,t}}$	-0.0711	-0.0482	-0.1145	0.0454**	0.1372	-0.1599
	[0.0547]	[0.0671]	[0.0779]	[0.0209]	[0.1072]	[0.1690]
$w^{cum}_{i,t}$	-0.1127***	-0.3058***	-0.0546	-0.0391***	-0.3847***	-0.2366**
	[0.0388]	[0.0444]	[0.0558]	[0.0151]	[0.0663]	[0.1120]
Obs.	192,015	137,182	192,015	106,236	105,761	65,585
Panel B. UF350						
Withdrawal #2						
$\widehat{w_{i,t}}$	0.3453	0.7266**	0.1942	-0.0476	0.1560	1.4800**
	[0.2706]	[0.3033]	[0.4398]	[0.0902]	[0.5393]	[0.6583]
$w^{cum}_{i,t}$	-0.3471***	-0.7016***	0.2521	-0.0987***	-0.2872	-0.8795***
	[0.0933]	[0.1026]	[0.1568]	[0.0298]	[0.2370]	[0.2522]
Obs.	205,754	165,575	205,754	124,518	115,814	100,834
Withdrawal #3						
$\widehat{w_{i,t}}$	0.3294	0.7789**	0.0458	0.1614*	0.9177*	0.5673
	[0.2835]	[0.3057]	[0.4348]	[0.0842]	[0.5173]	[0.6509]
$w^{cum}_{i,t}$	-0.3654***	-0.6219***	-0.2802***	-0.0476**	-0.3095**	-1.4800***
	[0.0891]	[0.1386]	[0.1008]	[0.0206]	[0.1218]	[0.2055]
Obs.	195,731	158,823	195,731	123,517	113,240	94,907
Panel C. UF1500						
Withdrawal #2						
$\widehat{w_{i,t}}$	-0.1159	0.3085	-0.3137	0.0165	-0.1672	0.5790
	[0.1807]	[0.1956]	[0.3426]	[0.0472]	[0.3636]	[0.3994]
$w^{cum}_{i,t}$	-0.0801	-0.1647*	-0.0268	-0.0238	-0.1405	-0.2038
	[0.0798]	[0.0907]	[0.1539]	[0.0247]	[0.1553]	[0.2264]
Obs.	151,379	132,999	151,379	108,200	90,393	89,658
Withdrawal #3						
$\widehat{w_{i,t}}$	0.1696	0.1383	0.2394	-0.0534	0.2173	0.7070**
	[0.1782]	[0.1776]	[0.3254]	[0.0389]	[0.3554]	[0.3557]
$w^{cum}_{i,t}$	-0.1345***	-0.1105**	-0.4348***	0.0103	-0.2735***	-0.0070
	[0.0457]	[0.0445]	[0.1340]	[0.0076]	[0.0831]	[0.1213]
Obs.	124,247	111,010	124,247	94,061	76,850	73,570

Table 9: The Effect of the Amount Withdrawn on Voluntary Pension Savings

This table reports results for equation (6) in the main text. In Panel A the dependent variable is an indicator variable for new voluntary pension accounts. In Panel B the dependent variable is the log-change in the amount of voluntary pension savings between the end of the first month after the withdrawal and three months prior to the withdrawal, conditional on having positive voluntary savings three months prior. The coefficient for $\widehat{w_{i,t}}$ captures the elasticity with respect to the instrumented (log) amount withdrawn each time. Robust standard errors are reported in square brackets. Significant at: *10%, **5% and ***1%.

	Kink (UF)		
	35	350	1500
	Panel A. New Account		
	Withdrawal #1		
$\widehat{w_{i,t}}$	-0.0005	0.0201**	0.0126
	[0.0008]	[0.0094]	[0.0109]
Obs.	1,026,047	513,908	367,862
	Withdrawal #2		
$\widehat{w_{i,t}}$	0.0002	0.0127*	0.0028
	[0.0007]	[0.0072]	[0.0091]
Obs.	630,126	468,772	265,891
	Withdrawal #3		
$\widehat{w_{i,t}}$	0.0018**	-0.0011	0.0263***
	[0.0008]	[0.0057]	[0.0096]
Obs.	549,288	465,230	214,706
	Panel B. Amount Voluntary Savings		
	Withdrawal #1		
$\widehat{w_{i,t}}$	0.0544	0.0839	0.3644***
	[0.0573]	[0.1360]	[0.0932]
Obs.	5,464	42,779	136,272
	Withdrawal #2		
$\widehat{w_{i,t}}$	0.0115	0.3294	0.0351
	[0.0739]	[0.2119]	[0.0784]
Obs.	12,489	51,226	121,611
	Withdrawal #3		
$\widehat{w_{i,t}}$	0.0158	-0.0494	0.1893*
	[0.0749]	[0.1532]	[0.0979]
Obs.	18,007	63,382	112,862

Appendix

A Proofs

Proof of proposition 1: the first order condition of (1) with respect to d_2 implies

$$u_c(c_1) = \beta \frac{u_c(c_2)}{q(d_2) + \frac{\partial q(d_2)}{\partial d_2} d_2} \tag{7}$$

For a constant price $q = \frac{1}{1+r}$, (7) would become $u_c(c_1) = \beta(1+r)u_c(c_2)$. Assuming $u_c(.)$ is an invertible multiplicative function[14] we obtain:

$$\begin{aligned} & \frac{u_c(c_1)}{u_c(c_2)} = \beta(1+r) \\ \Rightarrow \quad & \frac{c_2}{c_1} = u_c^{-1}\left([\beta(1+r)]^{-1}\right) = \gamma^c \end{aligned}$$

Substituting the budget constraints yields

$$\begin{aligned} & (1+r)(h-w) - d_2 = \gamma^c \left(y_1 + w + \frac{d_2}{1+r} \right) \\ \Rightarrow \quad & d_2 = \frac{(1+r)[(1+r)(h-w) - \gamma^c(y_1+w)]}{1+r+\gamma^c} \end{aligned} \tag{8}$$

Differentiating (8) with respect to w:

$$\frac{\partial d_2}{\partial w} = \frac{1+r}{1+r+\gamma^c}\left[-(1+r) - \gamma^c\right] = -(1+r) < 0 \tag{9}$$

Proof of proposition 2: adding a hard borrowing limit $d_2 \leq \bar{b}$ to (1) under a constant debt price, it becomes

$$\max_{d_2} u(c_1) + \beta u(c_2) + \lambda\left[\bar{b} - d_2\right] \tag{10}$$

$$\begin{aligned} s.t. \quad & c_1 = y_1 + w + d_2 q(d_2) \\ & c_2 = (1+r)(h-w) - d_2 \end{aligned}$$

$$\lambda\left[\bar{b} - d_2\right] = 0 \tag{11}$$

[14] This assumption is met by utility functions typically used in the literature, such as the CRRA function $u(c) = \frac{1-c^{1-\sigma}}{1-\sigma}$, which yields $\gamma^c = [\beta(1+r)]^{\frac{1}{\sigma}}$.

The first order condition becomes

$$u_c(c_1) = \beta(1+r)u_c(c_2) + (1+r)\lambda \tag{12}$$

For unconstrained individuals, $\lambda = 0$ and the result in (8) holds. Therefore, $\frac{\partial d_2}{\partial w} = -(1+r)$. For constrained households, $\lambda > 0$ and $d_2 = barb$, so $\frac{\partial d_2}{\partial w} = 0$, since at the margin the individual remains constrained.

Given the size of the withdrawals, we also consider discrete changes in w, denoted by Δw. Due to the linearity of (8), the response of an unconstrained household would be $\Delta d_2 = -(1+r)\Delta w$. For a large enough Δw, a constrained household could obtain enough present resources so that she no longer wants to borrow beyond $\bar{b}$. In particular, let $\psi \in (0,1)$ be the fraction of Δw that would bring desired borrowing below the limit, $d_2^* < \bar{b}$. The debt response of someone switching from constrained to unconstrained would thus be:

$$\Delta d_2 = 0 - (1+r)(1-\psi)\Delta w > -(1+r)\Delta w \tag{13}$$

which implies lower debt repayment for constrained individuals.

Proof of proposition 3: we further assume a specific CRRA utility function, $u(c) = \frac{1-c^{1-\sigma}}{1-\sigma}$ and define $\gamma^u \equiv \frac{u(c_2)}{u(c_1)} = \left(\frac{c_1}{c_2}\right)^{\sigma} = (\gamma^c)^{-\sigma}$. We can express (7) as

$$\beta\gamma^u = q(d_2) + \frac{\partial q}{\partial d_2} d_2 \tag{14}$$

Differentiating (14) with respect to w:

$$\beta\sigma\left(\frac{c_1}{c_2}\right)^{\sigma-1}\left[\frac{c_2\left(1+\frac{\partial q}{\partial d_2}\frac{\partial d_2}{\partial w}d_2 + \frac{\partial d_2}{\partial w}q(d_2)\right) - c_1\left(-(1+r) - \frac{\partial d_2}{\partial w}\right)}{c_2^2}\right] =$$
$$\frac{\partial d_2}{\partial w}\left(2\frac{\partial q}{\partial d_2} + \frac{\partial^2 q}{\partial d_2^2}d_2\right)$$
$$\beta\sigma\gamma^u\left(\frac{c_2}{c_1}\right)\left[\frac{\left(1+\frac{\partial d_2}{\partial w}\beta\gamma^u\right) - \frac{c_1}{c_2}\left(-(1+r) - \frac{\partial d_2}{\partial w}\right)}{c_2}\right] =$$
$$\frac{\partial d_2}{\partial w}\left(2\frac{\partial q}{\partial d_2} + \frac{\partial^2 q}{\partial d_2^2}d_2\right)$$
$$\beta\sigma\gamma^u\left[\frac{1+\frac{\partial d_2}{\partial w}\beta\gamma^u}{c_1} - \frac{-(1+r) - \frac{\partial d_2}{\partial w}}{c_2}\right] = \frac{\partial d_2}{\partial w}\varphi$$

where we define $\varphi \equiv 2\frac{\partial q}{\partial d_2} + \frac{\partial^2 q}{\partial d_2^2}d_2$. Therefore,

$$\frac{\partial d_2}{\partial w}\left[\varphi - (\beta\gamma^u)^2\frac{\sigma}{c_1} - \beta\gamma^u\frac{\sigma}{c_2}\right] = \beta\gamma^u\sigma\left[\frac{1}{c_1} + \frac{1+r}{c_2}\right] \tag{15}$$

The right-hand side of (15) is always positive. However, the sign of the term in brackets in the left-hand side depends on the shape of the price schedule $q(d_2)$ and the slope of the desired consumption path. Moreover, $\frac{\partial d_2}{\partial w}$ is not constant, as it depends on the level of debt through $q(d_2)$, and is not independent of income and pension balances as it was in the constant-price case. For $\frac{\partial d_2}{\partial w}$ to be negative, it suffices that φ is negative or positive but not too large, since $-(\beta\gamma^u)^2\frac{\sigma}{c_1}$ and $-\beta\gamma^u\frac{\sigma}{c_2}$ are both negative. Assuming the specific shape of $q(d_2)$ in (2), and focusing on borrowers ($d_2 > 0$),

$$\begin{aligned}
\varphi &= 2\left(-\phi_1\phi_2 d_2^{\phi_2-1}\right) + \left(-\phi_1\phi_2(\phi_2-1)d_2^{\phi_2-2}\right)d_2 \\
&= -2\phi_1\phi_2 d_2^{\phi_2-1} + (1-\phi_2)\phi_1\phi_2 d_2^{\phi_2-1} \\
&= d_2^{\phi_2-1}(\phi_1\phi_2^2 - \phi_1\phi_2)
\end{aligned} \tag{16}$$

Under the parametric restrictions in (2), $\phi_1 > 0$ and $\phi_2 > 0$, implying:

$$\varphi < 0 \quad \Longleftrightarrow \quad \phi_2 < 1$$

Therefore, under the assumptions in (2), $\frac{\partial d_2}{\partial w}$ is strictly negative. To show that $\frac{\partial d_2}{\partial w}$ increases with income, implying that debt repayment is stronger for lower levels of income, we rearrange the terms in (15):

$$\begin{aligned}
\frac{\partial d_2}{\partial w}\left[\varphi - \sigma\beta^2\frac{c_1^{2\sigma-1}}{c_2^{2\sigma}} - \beta\sigma\frac{c_1^{\sigma}}{c_2^{\sigma+1}}\right] &= \beta\sigma\frac{c_1^{\sigma-1}}{c_2^{\sigma-1}}\frac{c_1}{c_2}\left[\frac{1}{c_1} + \frac{1+r}{c_2}\right] \\
\frac{\partial d_2}{\partial w}\left[c_2\varphi - \sigma\beta^2(\gamma^u)^{\frac{2\sigma-1}{\sigma}} - \beta\sigma\gamma^u\right] &= \beta\sigma(\gamma^u)^{\frac{\sigma-1}{\sigma}}\left[1 + (1+r)\frac{c_1}{c_2}\right] \\
\frac{\partial d_2}{\partial w}\left[c_2\varphi - \sigma\beta^2(\gamma^u)^{\frac{2\sigma-1}{\sigma}} - \beta\sigma\gamma^u\right] &= \beta\sigma(\gamma^u)^{\frac{\sigma-1}{\sigma}} + \beta\sigma(1+r)\gamma^u
\end{aligned} \tag{17}$$

We then argue that all terms on the right-hand side of (17) are increasing in y_1 for any $\sigma > 1$, as they depend on y_1 only through γ^u, which is increasing in y_1:

$$\frac{\partial\beta\gamma^u}{\partial y_1} = \frac{\partial d_2}{\partial y_1}\varphi \tag{18}$$

We know that (2) implies $\varphi < 0$. In turn, differentiating (14) with respect to y_1 yields:

$$\frac{\partial d_2}{\partial y_1} = \frac{\sigma}{c_1}\beta\gamma^u \left[\varphi - \frac{\sigma}{c_1}(\beta\gamma^u)^2 - \frac{\sigma}{c_2}\beta\gamma^u\right]^{-1} \tag{19}$$

which is also negative, since the term outside the bracket is positive, while the sum inside the bracket is negative for the price schedule in (2) as shown above. Therefore, $\frac{\partial\beta\gamma^u}{\partial y_1}$ is positive. Intuitively, for borrowers and under non-constant q, the relative price of c_1 falls as y_1 increases. Other things equal, the desired consumption slope tilts toward c_1, so $\gamma^u = \left(\frac{c_1}{c_2}\right)^\sigma$ increases.

On the left-hand side of (17), the second and third term inside the bracket also increase with y_1 for the same reason, so $-\sigma\beta^2(\gamma^u)^{\frac{2\sigma-1}{\sigma}} - \beta\sigma\gamma^u$ is decreasing in y_1. We can show that the first term in the bracket also decreases with y_1:

$$\frac{\partial c_2\varphi}{\partial y_1} = -\frac{\partial d_2}{\partial y_1}\varphi + c_2\frac{\partial\varphi}{\partial y_1} \tag{20}$$

We have shown that $\varphi < 0$ and $\frac{\partial d_2}{\partial y_1} < 0$, so the first term is negative. The second term is also negative, since $c_2 > 0$ and $\frac{\partial\varphi}{\partial y_1} < 0$:

$$\begin{aligned} \frac{\partial\varphi}{\partial y_1} &= 2\frac{\partial^2 q}{\partial d_2^2}\frac{\partial d_2}{\partial x} + \frac{\partial^3}{\partial d_2^3}d_2\frac{\partial d_2}{\partial x} + \frac{\partial^2 q}{\partial d_2^2}\frac{\partial d_2}{\partial y_1} \\ \Rightarrow \quad \frac{\partial\varphi}{\partial y_1} &= \frac{\partial d_2}{\partial y_1}\left(3\frac{\partial^2 q}{\partial d_2^2} + d_2\frac{\partial^3 q}{\partial d_2^3}\right) = \frac{\partial d_2}{\partial y_1}\Phi < 0 \end{aligned} \tag{21}$$

where the last inequality follows from $\frac{\partial d_2}{\partial y_1} < 0$ and $\Phi > 0$ for $\phi_1 \in (0,1)$. Therefore, the right-hand size of (17) increases in y_1 and the bracket in the left-hand size decreases in y_1, so $\frac{\partial d_2}{\partial w}$ is increasing in y_1.

B Data Appendix

B.1 More details on the credit registry

Debt data are obtained from the Chilean credit registry maintained by the Financial Market Commission (CMF). The registry provides information on the stock of debt and new loan originations for the universe of bank loans in Chile. Stock data come from the R04 table, which reports the outstanding balance of each individual's bank debt at a monthly frequency from January 2009 to the present. The information is classified into five categories of credit: consumer loans, disposable credit limit, mortgages, and commercial credit. For each category, the dataset also provides delinquency information, detailing the amount in arrears across several buckets of days past due.

Consumer loans correspond to all loans extended to individuals for consumption purposes. The disposable credit limit measures the maximum amount available to an individual through credit lines and credit cards, net of their current utilization. Student loans are reported under commercial loans for individuals; however, because this information is only available until June 2020, we exclude this category from our analysis.

Data on new loan originations come from the D32 table, which covers the period from January 2012 to the present. This dataset includes the lending institution identifier and key loan terms—such as interest rate, maturity, and amount—for loans structured with installment payments.[15]

B.2 Construction of Revolving and Non-Revolving Debt Variables

We do not observe revolving credit separately from non-revolving credit (in installments). However, for each individual and at each point in time, we can decompose the total outstanding amount of performing debt into these two components by combining information on the stock of debt and new loan originations. The procedure is as follows:

1. Identify cases with and without revolving credit.

   If the variable disposable credit limit is missing for an individual, the individual does not have a credit line or credit card, so we set unused revolving credit to zero and classify all performing debt as non-revolving. Otherwise, we proceed to the next step.

2. Estimate the stock of performing non-revolving credit from installment loans origination.

[15] Specific details on the construction of the R04 and D32 tables are publicly available on the Financial Market Commission's website (in Spanish).

Using the new loans dataset, we construct an estimated stock of performing non-revolving credit at the loan level, S^e_{ilt}, for each loan l to each individual i in the sample at time $t \in \{\text{Jan. 2019, present}\}$. The estimate assumes: (i) no prepayments, (ii) no grace period, (iii) no loan renegotiation, and (iv) a fixed-payment amortization schedule. For a loan issued at time $s \in \{\text{Jan. 2012, present}\}$ with maturity m, principal A, and monthly interest rate r, the estimated outstanding balance is:

$$S^e_{ilt} = \begin{cases} A(1+r)^{t-s} - C\dfrac{(1+r)^{t-s}-1}{r}, & \text{if } t-s < m, \\ 0 & \text{otherwise} \end{cases}$$

where the monthly payment C is given by:

$$C = A\frac{r(1+r)^m}{(1+r)^m - 1}.$$

At the individual level, the estimated stock of performing non-revolving credit is $S^e_{it} = \sum_l S^e_{ilt}$. Because, in the data, any monthly payment that is overdue is classified as debt in arrears, this estimate should closely approximate the stock of performing non-revolving debt.

3. Classify performing debt into revolving and non-revolving components.

   We compare S^e_{it} with the observed total performing stock of debt and derive the stock of performing revolving debt:

$$PerformingRevolvingDebt_{it} = PerformingDebt_{it} - S^e_{it}.$$

B.3 More details of the withdrawals data set and measurement of pension balances in the first withdrawal

The administrative records of pension withdrawals include the withdrawal number (first, second, or third), the request and payment dates, the amount withdrawn, and the total balance in the individual's pension account at the time of withdrawal.

For the second and third withdrawals, the total pension balance is directly observed. For the first withdrawal, however, the total balance is not reported. Instead, we observe the fraction of the account balance that the withdrawal represents, and we recover the implied balance by dividing the withdrawn amount by this fraction. Because this fraction is rounded to the nearest integer, the recovered balance is measured with error. The magnitude of this error depends on both the underlying balance and the withdrawal amount. This measurement issue is negligible for observations near the first kink at 35 UF: even for individuals withdrawing the maximum allowed amount, the resulting error is below 0.5 UF (around USD20).

At higher kinks, however, observations corresponding to withdrawals not equal to exactly 10% of the pension balance—the maximum fraction allowed—may be affected by this rounding problem. To conduct the analysis at these higher kinks for the first withdrawal, we restrict attention to a subsample of individuals for whom we can recover the pension balance using an auxiliary dataset from the pension regulator.

B.4 Main Sample Construction

Using the administrative records provided by the pension regulator, we observe all three withdrawal waves. We construct a separate sample for each wave. Of the universe of pension investors (11,180,098 in June 2020), 10,806,228 submitted a request during the first withdrawal, 8,401,958 during the second, and 8,151,110 during the third.

We illustrate the sample-construction procedure using the first withdrawal. We begin by restricting the sample to individuals holding some form of debt—mortgage and/or consumer debt—measured within the three months preceding the withdrawal. This step reduces the sample to approximately 5.7 million individuals. To avoid potential manipulation of pension balances that could compromise our empirical strategy, we keep only those individuals who submitted their withdrawal request on the first day of the withdrawal window and received the corresponding payment within one month. For the first withdrawal, this corresponds to requests submitted on 30 July 2020 and payments disbursed until August 2020, yielding 2,136,582 observations.

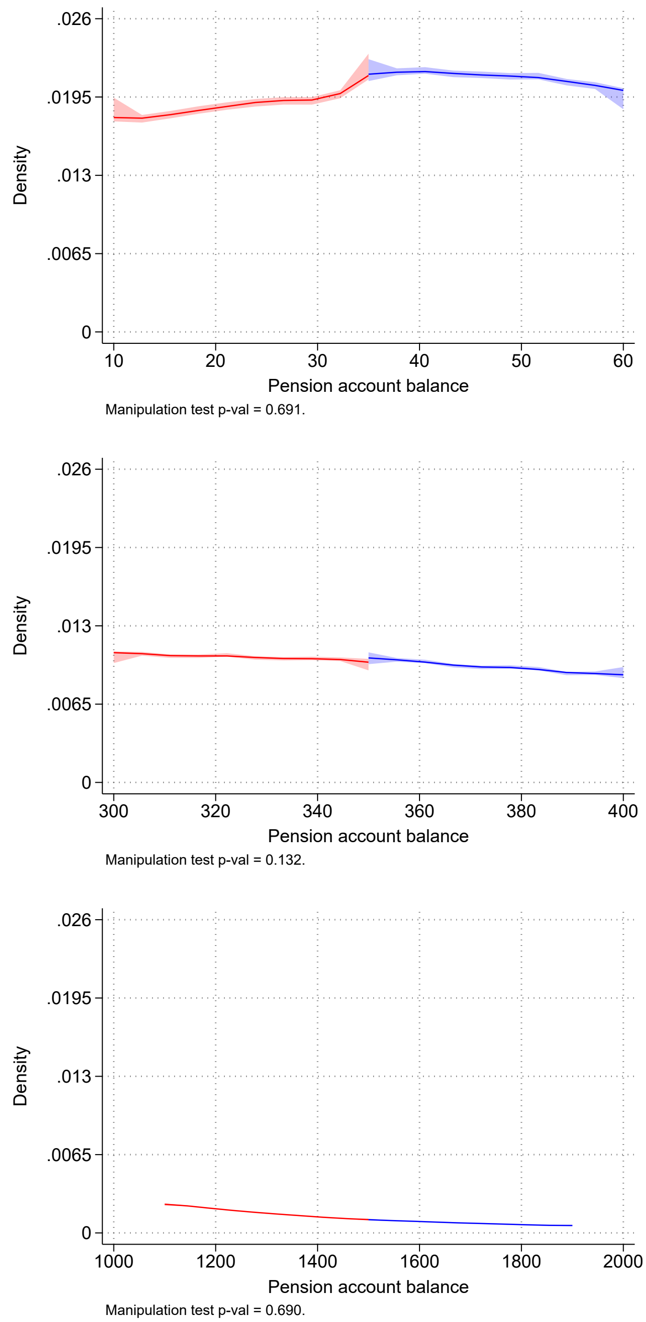
Next, for the first withdrawal only, we exclude pension records exhibiting reporting anomalies, reducing the sample to 1,512,441 individuals. The RDK design then imposes a bandwidth restriction around each kink (e.g., ±25 UF around the first kink in our baseline specification), resulting in 171,721 observations. After incorporating the full set of covariates, the estimation sample for the first withdrawal at the 35-UF kink consists of 151,208 individuals. An analogous sample-construction procedure is applied to the second and third withdrawals.

B.5 Cuenta 2 Sample Construction

The auxiliary dataset from the pension regulator employs a different individual identifier and therefore cannot be directly merged with the other data sources. As a result, the sample used in the voluntary savings regressions does not condition on debt holdings. Moreover, withdrawal amounts are not directly observed in this dataset; instead, they are inferred from large declines in pension balances around each withdrawal event. While this procedure may introduce some measurement error in the estimated withdrawal amounts—primarily due to unobserved pension fund returns—a comparison of our first-stage estimates with those from the main sample indicates that the results are very similar.

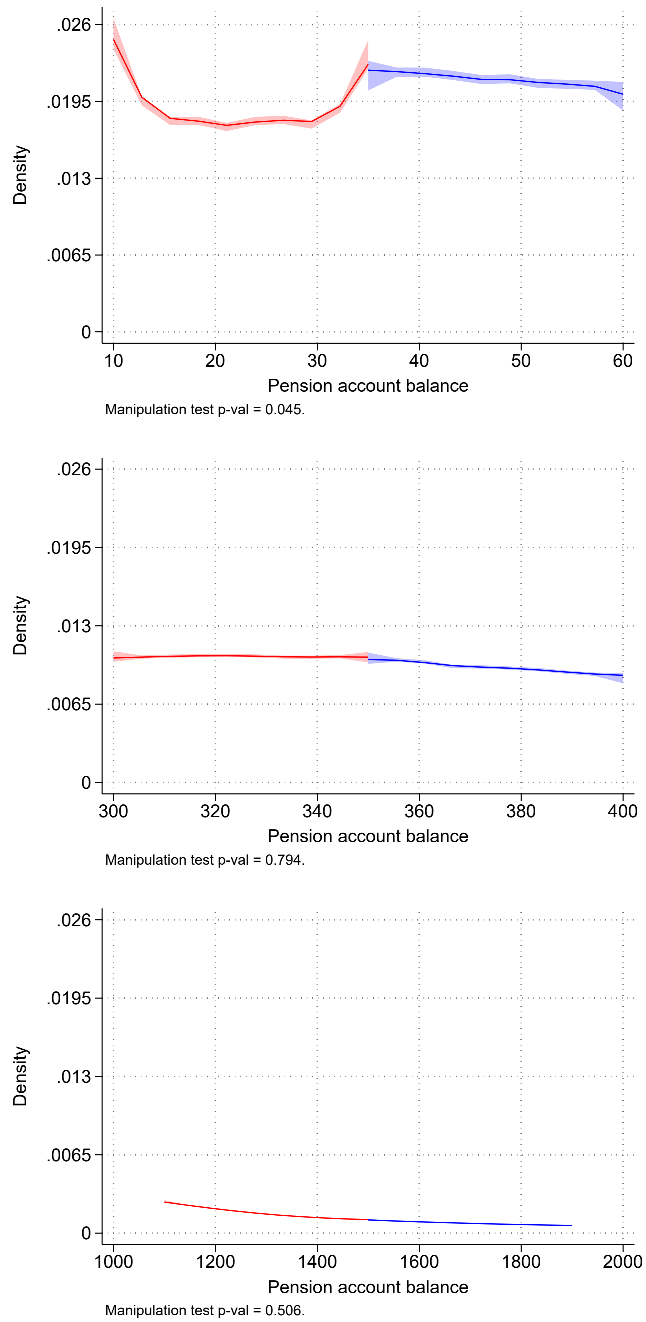
C Additional Figures

Figure A.1: Manipulation test around each kink in the second withdrawal



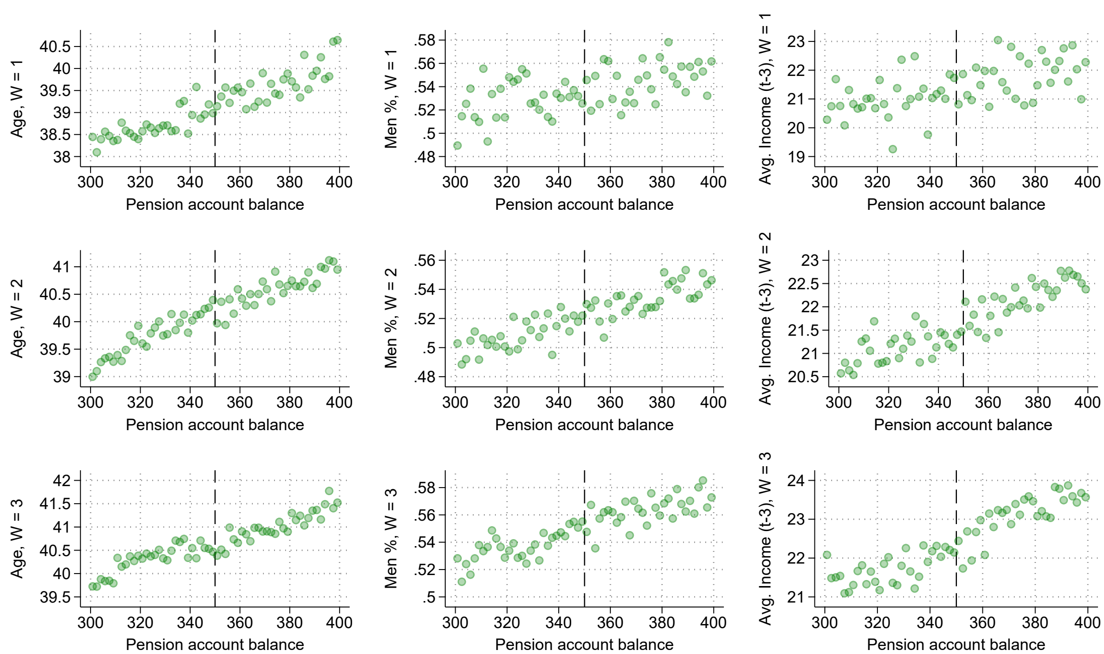
Notes: The figure shows the distribution of individuals around each kink (35, 350, and 1500) in the second withdrawal. The distribution is independently estimated from either side of the kink. The p-value reported below each panel corresponds to the manipulation test of Cattaneo, Jansson, and Ma (2018).

Figure A.2: Manipulation test around each kink in the third withdrawal



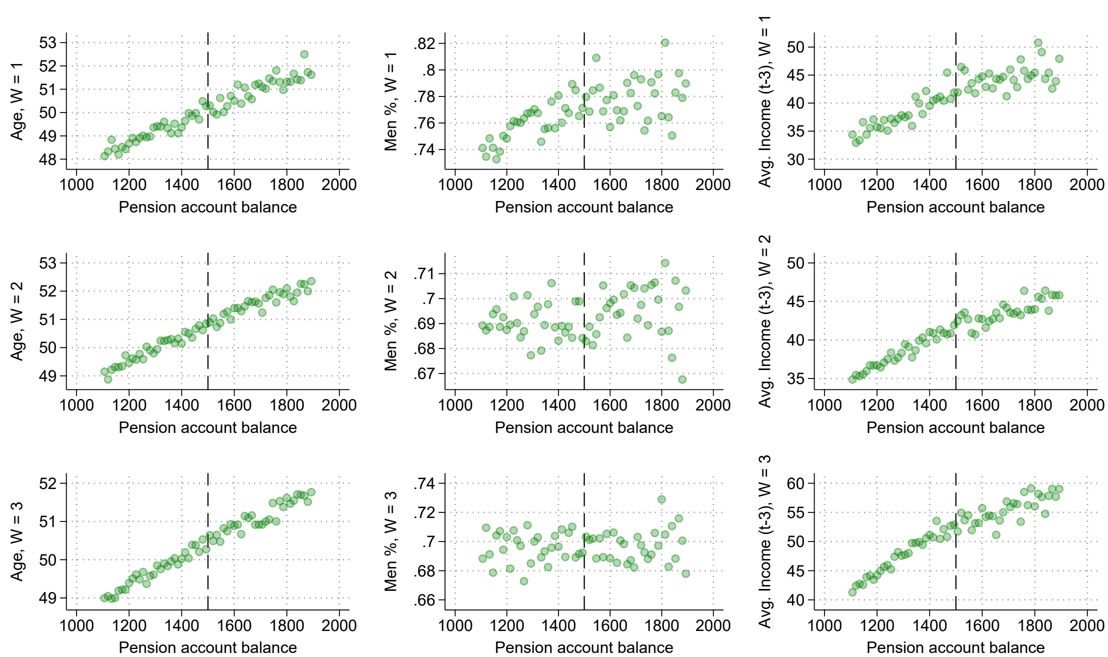
Notes: The figure shows the distribution of individuals around each kink (35, 350, and 1500) in the third withdrawal. The distribution is independently estimated from either side of the kink. The *p*-value reported below each panel corresponds to the manipulation test of Cattaneo, Jansson, and Ma (2018).

Figure A.3: Smoothness of observable variables around the second kink in each withdrawal



Notes: The figure shows the averages of age, the dummy for men, and monthly income conditional on the pension account balance. The sample corresponds to individuals around the second kink (UF350). Each panel corresponds to a different withdrawal (W=1,2,3).

Figure A.4: Smoothness of observable variables around the third kink in each withdrawal



Notes: The figure shows the averages of age, the dummy for men, and monthly income conditional on the pension account balance. The sample corresponds to individuals around the third kink (UF1500). Each panel corresponds to a different withdrawal (W=1,2,3).