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Liquidity constraints, consumption, and debt repayment: Evidence from macroprudential policy in Turkey

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Liquidity Constraints, Consumption, and Debt Repayment: Evidence from Macroprudential Policy in Turkey[1]

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Abstract

Using account-level credit card data from a large Turkish bank, we study the impact of a unique credit card policy that increases minimum payment on consumption and debt repayment. We show that the policy reduces credit card spending and debt, boosts existing debt repayment, and reduces credit card delinquency. The credit card debt of affected consumers falls on average by 50% two years into the policy implementation. An increase in minimum payment has a stronger effect than a decrease of similar magnitude. We build a benchmark life-cycle model with soft liquidity constraint to explain the reduction in credit card spending.

Keywords: Liquidity Constraints, Credit Constraints, Anchoring, Consumption, Spending, Debt, Credit Cards, Household Finance, Fiscal Policy.

JEL Classification: D12, D14, D91, E21, E51, E62, G21

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1. Introduction

Household debt can crumble the economic health of a country, especially that of a developing one. Mian, Sufi, and Verner (2017) show that an increase in household debt leads to a decline in economic growth for a sample of thirty developed economies. Household credit-card borrowing has attracted considerable attention in the literature, because credit cards are an expensive source of credit with complex contract terms (Gomes, Haliassos, Ramadarai, 2021). In many emerging economies, consumer credit plays a prominent role (Müler, 2018). In Turkey, consumer credit grew from TL4.4 billion in 2002 to more than TL45 billion by December 2010[1]. Such rapid and unsustainable growth in consumer debt raised severe concerns about the systemic risks in the Turkish banking sector and the overall economy. Regulators and policymakers can pursue traditional monetary or macroprudential policies to fight the unsustainable growth in consumer credit. Increasing interest rate is a typical monetary policy response during leverage accumulation; however, it has a negative externality and might cause a temporary recession that incentivizes borrowing and unintentionally results in higher rather than lower leverage (Korinek and Simsek, 2016). An alternative response without such externalities might be a targeted macroprudential policy such as enforcing higher debt repayment, reducing credit card spending, or restructuring debt (d'Astous and Shore 2017; Medina and Negrin 2022).

In this paper, we study a novel macroprudential policy pursued by the Turkish Banking Regulation and Supervision Agency (BRSA) to restrict rampant growth in credit card debt. We explore two credit card payment policies that enforce higher minimum payments and assess their impact on credit card spending, debt repayment, and delinquency. The first policy (Minimum Payment (MP) treatment) entails sequential increases in the required minimum payment ratio over consecutive six-month intervals. The new minimum payment ratio depends on the individual's credit card limit and increases from 20% in December 2010 to somewhere between 25% and 40% at the end of the 36-month-long policy implementation. The second policy (Cash Advance (CA) treatment) mandates that every credit card holder pays at least half of his monthly balance three or more times in a calendar year; otherwise, he loses the privileges of cash advances and credit card limit increases until he pays the outstanding credit card balance in full.

[1] Average TRY/USD exchange rate in our sample is 1.66. Average TRY/USD exchange rate after the policy is 1.79. All dollar values for the regression results are reported using the latter exchange rate.

This minimum policy was intended to increase savings by reducing the rapid growth in consumer credit. The goal was to reduce the unpaid portion of the monthly credit card balance and alter payment habits to reduce overall household debt (CBRT, 2014). The cash advance policy was intended to restrict credit supply for credit users who could not pay their debt. These policies might reduce household debt by two channels: directly, by increasing debt payments, or indirectly, by reducing credit card spending. Thus, they provide a unique setting to analyze the impact of a targeted macroprudential policy on household behavior. We employ a difference-in-differences methodology to estimate the policy's impact. We compare changes in outcomes over time for consumers who pay a low fraction of credit card debt to consumers who pay a large portion of their credit card debt before the policy announcement. The low-payers are likely to be affected by the two policies, but not the high-payers. Thus, low-paying consumers form the treatment, while high-payers form the control group. We utilize a rich dataset from a major Turkish bank to conduct our empirical tests. It contains monthly account-level credit card information for more than 1.1 million individuals from January 2010 to February 2013.

The difference-in-differences strategy requires that the outcomes of the treatment and control groups maintain parallel trends in the absence of the policy. To validate this identifying assumption, we show that outcomes for the treatment and control groups move together before the policy announcement, with parallel trends in credit card spending, debt, and delinquency. The treatment and the control groups are defined by consumers' payment behavior *before* the policy announcement. Thus, the treatment group is based on the likelihood of being treated rather than the actual treatment after the policy. This identification relies on the assumption of persistence in payment behavior. We validate the persistence assumption by showing that debt payment behavior is persistent over time in the absence of the policy. The result is consistent with Jørring (2020)'s finding that incurring avoidable card fees is a persistent behavior across several years in the U.S. Also, we avoid selecting the actual treatment by establishing the treatment and control groups before the policy announcement. Lastly, the treatment and the control groups do not change over time, i.e., they do not depend on real-time treatment. Hence, the treatment group consists of consumers making low payments before the announcement, precisely those likely to be treated by the policy.

We find that the policy substantially reduces credit card spending and debt. Overall, consumers affected by the MP and the CA treatments reduced their credit card spending by 17.34% on average after the policy. Their credit card debt decreased by 49.90% (TL415.69 or $232.40) by the end of the second year after the policy implementation. Extrapolating to the entire economy,

we get approximately a 2.97% (TL1.07billion or $0.60 billion) drop in total debt. On the other hand, the proportion of debt paid increases by 24.45% on average. For consumers affected by the CA treatment only, credit card spending and total debt decreased by about TL109.14 ($60.97) and TL158.79($88.71), respectively. The latter amounts to a 19.1% reduction in credit card debt which implies a 7.56% (TL2.72 billion or $1.52billion) reduction in the total credit card debt in the economy.

We use the baseline results to make inferences about credit card spending and debt elasticity to changes in the payment policy. For example, we find that a one percentage point increase in target payment ratio reduces credit card spending by 0.59%, reduces credit card debt by 0.64%, and increases the proportion of debt paid by 0.37% on average. Overall, increasing the target payment ratio forces consumers to reduce their credit card spending and repay more debt.

We also use new credit cards as an alternative control group in our difference-in-differences strategy. The policy mandates a fixed 40% minimum payment ratio for new credit cards during the first twelve months. In other words, new cards are only impacted by the CA rule but not the MP rule for at least one year. We use the sample of new cards as the control group and run our baseline regressions to estimate the MP treatment effect. We find that treated consumers reduce their spending and debt versus new credit card holders by TL410 ($229) and TL630.74 ($352.37), respectively. Moreover, the proportion of debt paid increased on average by 22.28%.

We further exploit the rules for new credit cards to study the impact of reducing minimum payment on credit card spending and debt. As mentioned above, the policy required that all new credit cards have a minimum payment ratio of 40% for the first twelve months, with an option to decrease the minimum payment at the end of that period. Relying on this rule, we exploit the variation in the timing of the minimum payment decrease for new cards opened in different months. We use a panel data regression to estimate changes in average spending and debt six months before and six months after the minimum payment decrease. We find that credit card spending remains similar, debt increases by TL12.75, and the proportion of debt paid falls by 2.58%. This finding implies that a decrease in the payment ratio exerts less force on spending and debt than an equivalent increase. While the analysis has limitations since the positive and negative shock affect different consumers, our results suggest that there is asymmetry in credit card spending and debt response to minimum payment changes.

To strengthen the identification strategy, we also employ an alternative treatment definition based only on credit card limits that remain fixed throughout our sample. Consumers on the lower end of the credit card limit distribution are likely to be impacted by the policy and face more difficulties meeting the new minimum payment requirement. Therefore, we define the treatment group as consumers with credit card limits below the median. Similar to our main results, we find that those with lower credit limits reduce spending and debt after the policy compared to those with higher credit limits.

Why do BRSA's policy reduce credit card spending and increase debt repayment? We explain the reduction in spending with the model of soft liquidity constraints and precautionary savings (Carroll and Kimball, 1996, 2021; Carroll, 2001). In contrast to hard-constrained consumers whose borrowing capacities are limited, soft-constrained consumers can borrow more but face a higher cost of borrowing as they increase their debt. For example, while credit limit is a hard liquidity constraint, minimum payment requirement is a soft liquidity constraint. The model predicts that consumers decrease consumption and increase precautionary savings if soft liquidity constraints are tightened. We build a benchmark life-cycle model with soft liquidity constraint and simulate the consumption and debt response for soft-constrained consumers following a policy shock akin to that implemented by BRSA. In our case, the cost of borrowing increases due to announced, scheduled policy shock that increases minimum payment requirement from 20% to 40% in the following two years. Our simulation results show that there is a 16.4% drop in consumption after the policy announcement. Moreover, we find that the debt is 35.5% lower than the baseline case after two years. The magnitude from our simulation is qualitatively and quantitatively consistent with our main empirical findings. A detailed discussion of the underlying theoretical models (Carroll and Kimball, 1996 and 2021, and Fernandez-Corugedo, 2002), simulation parameters, and results with accompanying figures is shown in section A.4 of the Appendix.

We explain the higher debt repayment with a consumption model under liquidity constraints or consumers' anchoring bias. We find more robust evidence to support the anchoring bias explanation. First, we show a consistent bunching pattern around each new required minimum payment ratio, implying that both constrained and unconstrained borrowers anchor to the minimum payment. Second, we show that the proportion of consumers paying near but above the minimum ratio increases after the policy, which is also consistent with anchoring behavior.

Lastly, we study the policy's impact on credit card delinquencies. We find that 30-day (60-day) delinquencies fall on average by 2.33% (0.43%) for the CA treatment and 7.41% (5.58%) for the combined MP and CA treatment. This result stands contrary to the findings in the recent literature. For example, d'Astous and Shore (2017) find that higher minimum payment results in 4.33% more delinquencies and defaults. Why do we find that delinquencies fall in a more restrictive credit environment?

We think that the policy's impact on delinquencies stem from two conflicting effects: the liquidity and the reminder effect. The former implies a rise in delinquencies for heavily constrained individuals that fail to meet the new minimum payment requirements, i.e., a liquidity-driven effect. The latter implies a reduction in delinquencies because policy-driven changes in minimum payment at consecutive six-month intervals serve as a salient reminder to credit card holders to make the minimum payment, provided they have the means. The policy's net effect on delinquencies depends on which of the two effects dominates. We show some evidence that the liquidity effect might not be very strong in our setting. First, the decrease in consumption is primarily driven by the reduction in non-discretionary consumption. Second, consumers with lower debt balances are the ones that drive the reduction in delinquencies. These results suggest that households who are less liquidity constrained might explain the reduction in delinquencies.

We argue that the policy effects we uncover cannot be explained by alternatives such as substituting credit card spending with debit cards or other assets, switching to credit cards in other banks, or switching to personal loans or other consumer credit options. First, we do not have checking account information but proxy for it using basic investment account and car ownership information. We show that the policy has a substantial effect regardless of car or investment account ownership, implying that consumers did not switch from credit cards to cash or other assets. Moreover, we show that the policy reduced consumption of debt revolvers much more than non-revolvers implying that simple substitution with cash for the liquidity-constrained is not feasible. Second, switching to credit cards in other banks is futile since the policy affects all credit cards equally, and interest and penalty rates are almost uniform across all credit cards because the Central Bank of Turkey sets them. Third, we find that the policy similarly affects individuals with and without personal loans, ruling out the story that consumers easily switch from credit cards to other credit types. Lastly, new credit cards were subject to the highest minimum payment ratio, eliminating any remaining benefits from switching.

This paper contributes primarily to the broad literature that focuses on consumption and saving in the face of liquidity constraints and the role of credit cards in consumer finances. We contribute by studying the impact of liquidity constraints on consumers' spending and debt payment behavior (Gross and Souleles 2002; Aydin 2016; d'Astous and Shore 2017; Agarwal et al. 2018; Ganong and Noel 2020). Gross and Souleles (2002) find that credit card debt jumps by as much as $350 for accounts that experienced an increase in credit card limit. Their results are consistent with models of liquidity constraints and buffer stocks.[2] Aydin (2016) shows that a rise in credit card limits results in higher credit card debt and spending, especially in durables and services, concluding that relaxed credit constraints lead to higher consumption without changes in permanent income. d'Astous and Shore (2017) show that liquidity-constrained borrowers decrease their credit card spending to meet the increased minimum payment. Our results are consistent with d'Astous and Shore (2017). Using credit card limits, Agarwal et al. (2018) jointly estimate consumers' marginal propensity to borrow (MPB) and banks' marginal propensity to lend (MPL), and show that the interaction between them across different types of consumers is key to understanding the aggregate impact of credit card policies.

Our paper also contributes to the literature on the impact of consumer credit regulations. Existing literature studies several types of credit card regulation: limits on credit card fees (Agarwal et al. 2015), information disclosures/nudges (Agarwal et al. 2015; Seira, Elizondo, and Laguna-Muggenburg 2016; Adams et al. 2022; Laibson 2020), minimum payment change (d'Astous and Shore 2017; Castellanos et al. 2018; Keys and Wang 2019; Medina and Negrin 2022). For example, Agarwal et al. (2015) show that regulatory limits on credit cards fee can save US consumers almost $12 billion a year through reduced borrowing costs. However, it finds little to no effects of nudges/informational disclosures, consistent with other studies in this area. The consensus is that nudges are not effective in changing consumers' borrowing/saving, and payment behavior (Adams et al. 2022). Medina and Negrin (2022) study a regulatory change in the Mexican credit card market and find that a minimum payment change affects the debt repayment of constrained and unconstrained consumers. They find that around 30% of unconstrained consumers tend to pay whole-number multiples of the minimum payment, a behavioral response similar to anchoring. d'Astous and Shore (2017) and Keys and Wang (2019) also show that higher minimum payments result in more delinquencies, while we find evidence of a decline in delinquencies. Our findings suggest that delinquencies can potentially decline

[2] Other related studies include Wilcox (1989, 1990), Parker (1999), Souleles (2000, 2002), Browning and Collado (2001), Hsieh (2003), and Stephens (2003), among others.

following a targeted macroprudential policy if there is a strong behavioral response to such a policy.

Third, our paper directly contributes to the vast literature on the consumption response to various fiscal, monetary, and macroprudential policies.[3] Our work is closely related to the work by Agarwal, Liu, and Souleles (2007), Aaronson, Agarwal, and French (2012), and Agarwal and Qian (2014), who examine consumption changes resulting from tax rebates, minimum wage changes, and fiscal policy changes in Singapore. This paper is also a part of recent efforts to understand the effectiveness of macro-prudential policy (Agarwal, Bubna, and Lipscomb, 2020; Fu, Qian, and Yeung, 2012; Akinci and Olmstead-Rumsey, 2015; Cerrutti, Claessens and Laeven, 2015; McDonald, 2015; Tressel and Zhang, 2016, Korinek and Simsek, 2016). We also contribute to the literature and show that constrained consumers' consumption and debt response to a minimum payment increase can potentially be larger than a response to an equivalent decrease. While our findings of policy impact following a minimum policy decrease are suggestive, they are consistent with the recent survey evidence about asymmetries between the marginal propensity to consume in response to positive and negative unanticipated income shocks (Christelis et al., 2017; Baugh et al., 2021).

The remainder of the paper is organized as follows. Section 2 provides background information about the credit card market in Turkey and discusses essential details about BRSA's policy. Section 3 provides details about the data and empirical methodology. Section 4 presents the results. We discuss additional empirical results in Section 5 and conclude in Section 6.

2. Background and Data

2.1 BRSA's policy background and implications

As of December 2016, more than 58 million credit cards were held by Turkey's 74 million citizens, making it the second-largest credit card user in Europe. The explosive growth in the Turkish credit card market can be attributed to several factors. First, GDP per capita almost tripled

[3]For literature on consumption response to fiscal policies see Shapiro and Slemrod (1995), Souleles (1999, 2000, 2002), Parker (1999), Browning and Collado (2001), Hsieh (2003), Stephens (2003, 2006, and 2008), Johnson, Parker and Souleles (2006), Parker, et al. (2013) and Gine and Kanz (2015). For recent papers on the effectiveness of macro-prudential policies see Keys et al. (2009), Brunnermeier et al. (2009), Galati and Moessner (2014), Freixas, Laeven and Peydró (2015), Claessens (2015), and Cerutti, Claessens, and Leaven (2016).For papers that study the interaction of monetary and macro-prudential policies see Cecchetti (2009), Borio and Drehmann (2009a), Fernández and García Herrero (2009) among others.

between 2002 and 2010, and consumer spending accounts for 70% of Turkey's GDP[4]. Most of this increase in consumer spending was financed by debt, including personal loans, household loans, and credit cards. Household debt as a proportion of disposable income increased from 4.7% in 2002 to 50.4% in 2012[5].

Rapid growth in consumer loans in Turkey was a cause for alarm among bank regulators, the government, and the central bank. The Turkish Banking Regulation and Supervision Agency (BRSA) announced the credit card tightening policy in December 2010. This policy constitutes an important precedent in Turkish banking regulation. For the first time, the government decided to enact a restrictive macroprudential policy aimed at credit cards. At the time, low-income individuals who rolled over their debt, often with multiple credit cards, maintained their living standard by making minimum or near-minimum monthly payments. The policy would impact them the most. On the other hand, the policy change would not affect the individuals who paid their balance fully or significantly more than the minimum every month. A survey by the Interbank Card Center shows that the ratio between the former and the latter was approximately 20-to-80 as of 2010. These findings indicate that the policy would likely impact about one in five credit card holders. Section A.1 in the Appendix further discusses the critical results of this survey and outlines the main institutional differences between the US and Turkish credit card markets.

The policy contains some unique features that we exploit in our empirical analysis. First, the policy introduced a stepwise payment rule that progressively increased the required minimum payment over time depending on one's credit card limit (minimum payment rule). The schedule for implementing this rule is shown in Table A.1. In effect, the minimum payment ratio would increase to somewhere between 22% and 40% by January 2014, as depicted in Figure 1. This rule applied to existing credit cards; new credit cards were treated by a different rule, which we explain below. The second rule of the policy mandated that if a borrower failed to pay half or more of his credit card outstanding balance at least three times in a calendar year, he would lose the privileges of cash withdrawals at ATMs and credit card limit hikes until the balance was paid in full (cash advance rule). The BRSA's policy increased the target payment by between 5% and 30% over time, depending on one's credit card limit. This policy provides a unique setting to study the impact of a substantial increase in the target payment on credit card spending and debt.

[4] Central Bank of the Republic of Turkey; Turkish Statistical Institute
[5] Financial Stability Report, CBRT

The official implementation date for both rules was June 17, 2011, exactly six months after the announcement on December 17, 2010. The post-policy period in our empirical analysis is based on the announcement date and starts in January 2011. At each subsequent six-month interval, the policy mandates additional minimum payment increases. In other words, in each July and January between 2011 and 2013, there was an increase in the new minimum payment ratio.

Credit card accounts opened after December 2010 had a different rule. The required minimum payment ratio was set at 40% for at least a year following the activation of a new card. The legal minimum was 40%, but the banks reserved the right to specify a higher minimum ratio. After the first year, the minimum payment ratio for new cards was also allowed to change to comply with the running minimum payment schedule at that time (Table A.1). In other words, new credit card users could have experienced a reduction in the minimum payment ratio after the first year of credit card use. We use this crucial policy aspect to examine how consumption and debt change when the target payment is reduced.

2.2 Data

We use a proprietary panel data set from a major Turkish bank (the Bank) headquartered in Istanbul. During the sample period we studied, it was among the top 10 largest banks by total assets and number of employees in Turkey[5]. Similarly, the Bank was among the top 10 banks in terms of credit card market share in Turkey[6]. The Bank's capital ratio, banking, and other fees are analogous to the rest of the Turkish banking sector. It had close to 300 branches all over Turkey and more than a million customers with diverse demographic backgrounds.

We have complete information on monthly credit card spending and payment from January 2010 to February 2013 for the Bank's 1,143,278 customers, including their demographic information. Moreover, our dataset contains monthly credit card spending across 25 categories defined by the Bank. The data is also rich in other consumer characteristics. For each account, in addition to monthly credit card statement information (Figure A.1), we observe the card limit, number of different credit cards owned, number of transactions, and demographic information, including age, gender, education, occupation, marital status, address, and the initial credit card approval date.

[6] Banking Regulation and Supervision Agency

We filter the original data in multiple ways for our empirical tests. First, we remove all inactive credit card holders, i.e., the consumers with no credit card activity. Second, we exclude cardholders who always pay the entire balance since the policy does not influence them. Finally, we exclude all the new accounts that were opened during our sample period. This sample of new cards cannot be directly used in the baseline regressions because of missing values and different minimum payment requirements for new accounts. However, we use this sample of new credit cards in an alternative regression specification that tests for the effect of the MP treatment on credit card debt and spending. The final sample that excludes the new cards includes around 13.45 million observations.

Table 1, Panel A shows basic descriptive statistics using the entire data set, excluding full payers and separately for treatment and control groups. Several interesting observations stand out. The average age in our sample is around 41, with the youngest consumer at 21 and the oldest at 89. Males and married individuals dominate our sample, and the average consumer is educated at the high school level. On average, 31% of consumers pay below the required minimum payment level, while around 30% pay less than half of the monthly balance. These consumers are the primary candidates to be treated by the policy. Finally, in terms of debt repayment, credit card holders pay 72% of their monthly balance on average, which hovers around TL580 ($324). Overall, these figures suggest that the policy likely impacted about a quarter of consumers in our sample.

The treatment and control group comparison shows they have approximately the same amount of debt, but the treatment group has spending and payment about half the control group's size. The treatment group pays 4x more in interest and around 6x more in penalties than the control group. Treatment has higher utilization but makes smaller payments. On average, 30% in the treatment group pay less than the minimum, and 50% pay less than half of the minimum balance compared to 10% for the control group. Demographic variables show no difference between treatment and control groups regarding education, age, marital status, or gender.

Moreover, both groups are equally likely to own an investment(savings) account with the bank or carry a personal loan, implying that their differences are not also driven by non-credit-card debt or savings. We do not directly observe the degree of prudence in our sample; however, these descriptive statistics suggest that neither group is more likely to save or borrow from other sources. Our sample only contains information about the presence of investment(savings) accounts and personal loans but not their magnitudes. Hence, the above descriptive statistics are

limited in how much they reveal important factors such as savings, prudence, or other unobservable characteristics.

Panel B compares our final sample to the sample from the Interbank Card Center (ICC) survey or the average figure for the entire population of credit card holders, where available. We see that our data closely resembles the ICC's aggregate population data regarding credit card spending and limits. Moreover, the Bank's presence closely mirrors Turkey's overall banking business distribution. The above evidence suggests that our sample is representative of a broader Turkish population and the banking system.[10].

3. Empirical Methodology

The unique policy we study in this paper introduces several challenges with empirical estimation. First, the policy is implemented nationwide and applies to all credit card holders. It is difficult to find a comparison group to identify the policy effect. Second, the decision to pay below the minimum payment is endogenous. It is challenging to distinguish between endogenous selection into treatment and the causal effect of the policy. Third, the policy introduces two separate rules that overlap in time. Moreover, the CA-rule superimposes the MP-rule, so estimating the latter's effects is not straightforward.

To overcome the first empirical challenge, we consider those who pay less than the new minimum as our treatment group and define those who pay more as the control group. The policy change does not affect the control group since their behavior always satisfies the policy requirement. Thus, we employ a difference-in-differences methodology to estimate the differential impact of BRSA's policy on the spending and debt over time between the treatment group and the control group.

To solve the second challenge, we use the payment behavior before the policy announcement to further refine the definition of the treatment and control groups. Namely, the treatment group is based on the likelihood of being treated based on the consumers' behavior before the policy rather than the actual treatment after the policy. For example, if credit card holders' payments are generally low before the policy announcement, they are more likely to stay low after the policy. In other words, low-paying consumers are more likely to be treated by the policy. Note that the treatment and control groups do not change over time and do not depend on the actual treatment.

We establish the treatment and the control groups before the policy announcement to avoid the selection into the actual treatment.

Our identification relies on the following two assumptions. First, the treatment and the control groups should have parallel trends in credit card spending and debt before the announcement of the policy. This assumption is a standard identification assumption in a difference-in-differences estimation. Second, the payment behavior is persistent over time before the policy announcement: those who make low payments this month are more likely to make lower payments in the future. The second assumption is specific to our setting since we define the treatment group based on their likelihood of being treated. We test these assumptions in Section 4.1. The assumption is also consistent with Jørring (2020)'s finding that incurring avoidable card fees is a persistent behavior across several years in the U.S.

We address the third empirical challenge by defining separate treatment variables for the first rule of the policy - the minimum payment treatment (MP), and the second rule of the policy - cash advance treatment (CA). We use the information on credit card limits in Table A.1 to define the MP treatment. It includes consumers whose average minimum payment twelve months before the policy announcement is less than the minimum payment ratio for their credit card limit bracket. For example, the minimum payment for a consumer with a TL17,000 credit card limit goes from 20% to 30% by the end of the policy's second year. This consumer would be included in the treatment group if they paid less than 30% on average in the twelve months before the announcement. Figure 2 illustrates MP treatment and control groups for consumers with credit card limits less than TL15,000 and between TL15,000 and TL20,000. Note that a consumer who pays 23% of his credit card balance in December 2011 and must start paying at least 25% in January 2012 is not necessarily in the MP treatment group. We emphasize that the treatment only depends on payment behavior and credit card limits *before* the policy announcement in December 2010, but not after.

Based on the second rule of the BRSA's policy, we define the second treatment variable, the 'cash advance treatment,' or CA treatment for short. Namely, the second policy rule applies when a consumer fails to pay at least 50% of his credit card debt three or more times (months) in a calendar year. Therefore, his credit card limit gets frozen, and cash advances get suspended until the credit card debt has been settled. Specifically, the CA-treatment is equal to 1 if a borrower pays less than 50% of his monthly credit card balance three or more times during the twelve months before the policy announcement (December 2010).

Since some consumers receive both the MP treatment and the CA treatment, we start by defining three mutually exclusive groups: the MP-only treatment, the CA-only treatment, and the combined MP and CA treatment. 39.6% of consumers in our sample belong to the CA-only treatment. 5.95% are affected by MP and CA treatments, and none are affected by MP-only treatment. The MP-only treatment is an empty set by construction. For example, consider consumers with a credit card limit of TL16,000. Those who paid less than 30% before the policy constitute the combined MP and CA treatment.

On the other hand, those who pay between 30% and 50% on average comprise the CA-only treatment. Therefore, we cannot separate the effect of MP treatment. Instead, we use the following baseline specification to estimate the average response to BRSA's policy:

$$S_{i,t} = \alpha + \beta_1 \times 1_{CA} \times 1_{post\ Dec\ 2010} + \beta_2 \times 1_{MP+\ CA} \times 1_{post\ Dec\ 2010} + u_i + v_t + \varepsilon_{i,t} \quad (1)$$

$S_{i,t}$ is the outcome variable, such as credit card spending, debt, percent of debt paid, interest charges, and penalty fees. 1_{CA} is an indicator variable with a value of 1 if the consumer is in the CA-only treatment group, and $1_{MP+\ CA}$ is an indicator variable with a value of 1 if the consumer is affected by both the MP and the CA treatments. 1_{post} is a post-policy indicator variable with a value of 1 for months following the policy announcement in December 2010. The twelve-month pre-policy period we use for treatment definitions starts in January 2010 and ends in December 2010. We emphasize that both the MP and CA treatments are defined before the policy announcement and stay fixed throughout our sample period. This approach helps us eliminate endogenous selection into treatment from the causal effect we purport to estimate. In addition, it allows us to add individual fixed effects to control for unobserved time-invariant individual heterogeneity.

We construct standard errors to account for (i) serial correlation in outcomes within accounts over time and (ii) correlation in outcomes across accounts with the same type of credit card within a city. We specify cluster-robust standard errors at the city × product type level. The number of product types varies across cities producing 612 clusters.

The second regression specification aims to estimate the dynamic effect of the policy on credit card spending and debt. We interact $1_{MP+\ CA}$ with five time indicators: 0, 6, 12, 18, and 24 months after the policy announcement, respectively.

$$S_{i,t} = \alpha + \beta_1 \times 1_{CA} \times 1_{post\ Dec\ 2010} + \beta_2 \times 1_{MP+CA} \times 1_{post\ Dec\ 2010}$$

$$+\beta_3 \times 1_{MP+CA} \times 1_{post\ Jun\ 2011} + \beta_4 \times 1_{MP+CA} \times 1_{post\ Dec\ 2011}$$

$$+ \beta_5 \times 1_{MP+CA} \times 1_{post\ Jun\ 2012} + \beta_6 \times 1_{MP+CA} \times 1_{post\ Dec\ 2012} + u_i + v_t + \varepsilon_{i,t} \qquad (2)$$

The third specification aims to overcome the third empirical challenge, i.e., estimating the MP treatment separate from the CA treatment. We capture the MP treatment effect using a sample of new credit cards opened after the policy announcement as the control group. The policy mandated that all new credit cards have a minimum payment ratio of 40% for at least twelve months following the account activation. We use this policy change to estimate the effect of the MP treatment during this twelve-month period when new cards have a fixed minimum payment ratio of 40%. The dependent variables are the same as in the baseline specification.

$$S_{i,t} = \alpha + \beta_1 \times 1_{MP} \times 1_{post\ Dec\ 2011} + \beta_2 \times 1_{MP} \times 1_{post\ Jun\ 2012}$$

$$+ \beta_3 \times 1_{MP} \times 1_{post\ Dec\ 2012} + u_i + v_t + \varepsilon_{i,t} \qquad (3)$$

Our final regression specification also relies on the sample of new cards but estimates the effect of a decrease in the minimum payment ratio on credit card spending and debt. The sample here does not include all new credit card holders but only those for whom we observe a fall in the minimum payment ratio from 40% to 25%. This change in the minimum payment occurs one year after the new card activation. We exploit the variation in the timing of the minimum payment decrease due to different account opening months. The dependent variables are credit card spending, debt, and the proportion of debt paid.

$$S_{i,t} = \alpha + \beta_1 \times 1_{MPdecrease_{i,t}} + u_i + v_t + \varepsilon_{i,t} \qquad (4)$$

$1_{MPdecrease_{i,t}}$ is an indicator that equals 1 if the minimum payment is below 40% for individual *i* at time *t*, and 0 otherwise. β's are the focal point of our analysis as they measure the differential response of spending and debt of the treated consumers to each additional change in the minimum payment ratio.

4. Empirical Results

Consumers might respond to the policy in different ways. First, they could decide to meet only the required minimum payment and avoid delinquency, but consequently, lose the privilege of cash withdrawals and credit card limit changes because of the policy's second rule. This option might or might not affect their spending patterns. Second, they could abide by both policy rules and keep their cash withdrawal and credit card limit options intact. This choice would most likely reduce credit card spending and speed up repayment of existing credit card debt. Finally, delinquency and default might be the only option for borrowers with severe liquidity constraints. Consumers can default even with higher credit card payments and lower consumption, as shown in d'Astous and Shore (2017).

In this section, we present our main findings. We first provide validations for assumptions about our empirical strategy. Next, we use the sample of existing credit cards to estimate the spending and debt response following the announcement of the BRSA's policy. Moreover, we exploit the sample of new credit cards and estimate the impact of reducing minimum payment. Finally, we discuss the possible explanations and the consequences of the policy.

4.1 Validation of Assumptions

Our identification relies on two assumptions. First, the treatment and control groups should have parallel credit card spending and debt trends before the policy announcement. Second, the payment behavior should be persistent over time before the announcement of the policy. In other words, if the payment behavior is persistent, the consumers we identify as the treatment group before the policy announcement are highly likely to be treated by the policy.

The central assumption of the difference-in-differences strategy is that the control and treatment groups should have parallel trends. Figure 3 shows the difference-in-difference coefficients from an event-study perspective for credit card spending, debt, and 60-day delinquency. Observations on the left side of the '2010m12' line should be interpreted as the average difference in credit card spending (top left), debt (top right), and delinquencies (bottom) between the treatment and the control groups before the policy. Similarly, everything to the right of the line shows the policy effects, i.e., after-policy differences in spending, debt, and delinquency between the treatment and the control groups. If the parallel-trends assumption is valid, the difference-in-difference coefficients before the policy announcement should not be statistically different from zero. Figure

3 shows strong support for the common trend assumption. The graphs show the difference-in-difference regression coefficients and the 95% confidence intervals. Before the policy, most coefficients bundle around zero for all three variables. Immediately after the policy, however, we see a substantial change in the coefficient magnitudes, consistent with the natural experiment and difference-in-difference regressions as the proper empirical set-up for studying BRSA's policy. We discuss the after-policy changes in spending, debt, and delinquencies in detail in Sections 4.2 - 4.4.

The main concern in our empirical analysis is to have a treatment variable that robustly identifies consumers likely to be impacted by the policy. If our treatment group consists of constrained consumers, their low-payment behavior will likely persist over time. In a recent paper, Jørring (2020) finds strong evidence of persistent payment behavior. Namely, they document that incurring avoidable overdraft charges or fees due to missing minimum payments is a behavior pattern that persists over multiple years. They estimate that paying an avoidable late fee last year increased the probability of sustaining an avoidable late fee by 15 percentage points, which increases the probability of incurring a mistake by 1.6 times. Similarly, suffering an avoidable overdraft fee last year increases the probability of paying one this year by 14 percentage points, which doubles the probability of an avoidable overdraft fee. They estimate that experiencing more than one avoidable late fee this year increases the probability of incurring an avoidable late fee by 58 percentage points, which increases the probability of incurring a mistake by four times. Similarly, sustaining more than one avoidable overdraft fee this year increases the probability of experiencing an avoidable overdraft fee the following year by 51 percentage points, which increases the probability of incurring a mistake by more than five times.

We test this assumption by analyzing the persistence in the payment behavior of treated and non-treated consumers before the policy. Figure 4 shows the results. The data here only includes the twelve months before the policy announcement to avoid any policy effects. Panel A shows a scatter plot for the current and previous month's payment ratios for two separate consumer groups. The left (green) cluster consists of low-payers, i.e., the consumers that pay below the minimum. The cluster on the right (blue) includes the high payers, who consistently pay higher than the minimum. We see that both low-payers and high-payers lie close to the 45-degree line. The treated consumers remain treated in the subsequent month; their previous payment history robustly predicts future payment behavior. Panel B shows the average payment behavior over eight consecutive months for low and high-payers. Similar to Panel A, we observe persistent behavior for both groups. Low payers, i.e., the treated consumers, remain treated in the

subsequent months; they consistently pay less the 50% of their credit card balance over the eight months. High-payers consistently pay significantly more than the minimum. Therefore, these results support the crucial assumption of persistence in payment behavior over time.

Next, we conduct two separate tests for this crucial assumption of persistence in payment behavior and show the results in Table 2. In Panel A, we divide our sample into quintiles based on payment behavior between January and June 2010 and observe the likelihood that individuals remained in the same quintile in December 2010. In Panel B, we separate our sample into payers below and above the minimum in the first several months of 2010 and test if these two groups show persistent behavior in the rest of 2010.

In Panel A, we observe that individuals in the bottom quintile between January and June 2010 are most likely (0.403) to remain in the lowest quintile in December 2010. Similar results hold for the second quintile (0.414) and the fifth quintile (0.788). Our treatment for the minimum payment rule captures individuals in the lowest two quintiles, and the transition matrix shows that their payment behavior remains persistent before the policy is announced. For those who pay less than 20%, 63.8% (=0.403+0.235) remains in the lowest two payment quintiles. For those who pay between 20%-40%, 63.0% (=0.216+0.414) remains in the lowest two payment quintiles. In other words, individuals we assign to the MP treatment group based on their pre-policy behavior are most likely to be treated after the policy is implemented. Similarly, individuals in the top quintiles between January and June 2010 will most likely remain in the top quintiles in December 2020[7]. In other words, those assigned to the control group will most likely remain in the control group after implementing the policy.

In panel B, we show the persistence of payment below the minimum payment within one year. Since our treatment captures payment below the required minimum, this analysis directly shows the persistence of being treated by the policy. In Columns (1) to (3), we show persistence within 2010. Column (1) shows the probability of payment below the minimum after paying above the minimum in the x^{th} month earlier in 2010. Column (2) shows the probability of payment below the minimum after paying below the minimum in the x^{th} month earlier in 2010. For example, a payment above the minimum in the first month of 2010 implies a 3% probability of payment below the minimum in the rest of the year. For those who paid below minimum payment in the first month, the probability of payment below minimum in the rest of 2010 is 23.3%. Column (3) shows the p-value of the t-test that column (1) equals (2). The difference between columns (1)

[7] Similar results hold for 2011 and 2012. These results are available upon request.

and (2) is significant at the 1% level. The results suggest that those who paid below the minimum are more likely to pay below the minimum within one year in 2010, i.e., those consumers assigned to the treatment group *before* the policy are most likely to be treated.

In sum, we show that the payment behavior is persistent within one year. Based on their pre-policy behavior, individuals we assign to the MP treatment group are most likely to be treated after the policy is implemented.

4.2 Baseline Difference-in-Difference Regressions

4.2.1 Main impact of the policy

Consumers' response to BRSA's policy is twofold: a reduction in credit card spending and an increase in debt repayment.

Table 3 shows the estimates for the policy's impact. Panel A shows the average CA treatment effect or the combined CA and MP treatment effect using Equation (1). We find that the treated consumers' credit card spending and debt decrease. Consumers in the CA treatment reduce their credit card spending by TL 109.14 ($61), or 17.61%, and credit debt by TL158.79 ($88.37), or 19.1%. In addition, the proportion of debt paid falls by 11.06%, thus reducing the interest and penalty charges.

The consumers in the combined treatment reduced their credit card spending by TL107.46 ($60.03) on average. Additionally, their debt balance, penalty, and interest payments fall by TL282.91 ($158.05), TL36.85 ($20.59), and TL8.84 ($4.94), respectively. The change in spending represents about a 17.34% drop relative to the average spending level. The decline in debt is much more substantial, almost 34%. On average, treated consumers pay down an additional 24.45% of their debt.

Panel B presents the dynamic effect of the policy at each consecutive six-month interval using Equation (2). Both debt and spending decrease at monotonically higher magnitudes at subsequent six-month intervals. Two years into the policy implementation, monthly credit card spending, and debt declined by TL174.45 ($97.46; 28.14%) and TL415.69 ($232.23; 49.90%), respectively. The proportion of debt paid grows monotonically over time, increasing by an impressive 29.4% after two years. This behavior naturally drives down the penalty and interest charges; they fall by

TL45.68 ($25.52) and TL10.02 ($5.60), respectively. Therefore, the policy seems effective in reducing the treated consumers' credit card spending and debt[8].

Our results allow us to make inferences about credit card spending and debt elasticity to changes in the target payment ratio. This elasticity is analogous to the idea of 'marginal propensity to borrow' in Aydin (2016). We use the results in Table 3 to impute these elasticities. For example, in the CA treatment, increasing the target payment ratio from 20% to 50% reduces credit card spending by 17.61% and credit debt by 19.1%. This result implies that a one percentage point increase in the target payment ratio reduces credit card spending by 0.59% and credit card debt by 0.64%. Moreover, it increases the proportion of debt paid by 0.37% on average.

Overall, over the two years of the policy's implementation, credit card debt has been reduced by 49.90% and credit card spending by 28.14% for consumers affected by both policy rules. As mentioned above, for consumers affected by the CA rule only, credit card spending and debt fall on average by 17.61% and 19.1%, respectively. To better understand the macroeconomic implications of BRSA's policy, we extrapolate from our sample to the entire economy, assuming our sample represents the entire country. The consumers that are affected by both rules of the policy constitute about 5.95% of our sample. This figure implies that the corresponding reduction in the total debt in the economy would be 2.97% (=49.90%*5.95%), which is about TL1.07 billion[9]. The cash advance rule, independent of the minimum payment rule, affects about 39.6% of consumers in our sample. This proportion implies a reduction in total debt in the economy by 7.56% (=39.6%*19.1%), which is about TL2.72 billion.

To further test robustness of our estimated policy impact on spending and debt, we repeat the analysis using an alternative treatment definition. Utilizing credit card limit as a proxy for liquidity, we expect consumers on the lower end of the credit card limit distribution to face more difficulties in meeting the new minimum payment requirement. Therefore, we define the treatment group as consumers with credit card limits below the median and test the policy impact on spending, debt, and 60-day delinquency. The results are reported in Table 7. Columns (1)-(2) report a considerable reduction in spending (TL257.90 or $144.18) and debt (TL274.37 or

[8] For robustness we also run regression is Table 3 but drop MP+CA from treatment and include only consumer treated by the CA rule. The estimates remain qualitatively and quantitatively very similar to those in Table 3. We think the reason for the similar results is that the estimates for CA-only capture the differences between CA-only group and the control group. These estimates should not be affected by adding or excluding another treatment group. Moreover, we have individual-month level credit card data, so all specifications include individual fixed effects. These results are available from the authors upon request.

[9] Total credit card debt in 2010 was around TL36 billion based on the data of the Central Bank of Turkey.

$153.39) for this alternative treatment group. Average reduction in spending is more than double of that in Table 3 (TL 107.46), while debt falls by a similar amount as in Table 3 (TL 282.91). This suggest that the low end of the credit card limits distribution indeed captures the most constrained consumer, which we expect to reduce consumption more than other consumers affected by the policy.

Our results uncover the substantial impact of the policy; however, our sample is limited to a single bank which raises a question about the inferences regarding the policy's effect on the broader population. This is the most significant limitation of our study; however, the Central Bank of Turkey report that uses aggregate data supports our findings. The Central Bank Report's Financial Stability Report (CBRT, November 2014) uses aggregate data to show that the growth in credit card spending slowed down from around 30% in 2011 to 15% in October 2013, right during our sample period and before the subsequent credit card policy implemented in October 2013. Additionally, the report shows that the growth rate in credit card balances with installments dropped from about 80% in May 2011 to slightly more than 40% in December 2011. Moreover, the Central Bank Report finds that BRSA's 2011 policy reduced loan conversion rates from 53% in June 2011 to 40% in October 2013, before the following policy became effective. Finally, the non-performing loan (NLP) ratio decreased from about 7.5% in June 2011 to slightly less than 5% in October 2013. Some of this change is likely driven by business cycle developments (CBRT, 2014); however, these findings imply that BRSA's policy had a visible impact in reducing the aggregate growth of credit card spending and debt.

The baseline results in Table 3 show a significant impact of BRSA's policy, but they ignore important distributional considerations. Typically, less educated, self-employed, or employees in high-risk sectors are more vulnerable to economic shocks and more likely to have problems servicing their debts in recessions. Is BRSA's policy equally effective for the repayment behavior of groups with different background income risks? We address this question by repeating the baseline analysis across groups separated based on education and income volatility, respectively. In addition, we are interested in whether BRSA's policy impacts individuals with low education and more volatile earnings differently, as they are more likely to be affected by BRSA's policy. The results are shown in Table A.10 in the Appendix. Panel A shows the results for low and high-education groups. Spending and debt fall by TL113 and TL288 for low-education groups and TL91 and TL343 for the high-education group, respectively. These results show that the policy impact is similar across education categories. Panel B shows similar results for low- and high-income volatility groups, respectively. The coefficients show similarity here, too, albeit

individuals with more volatile earnings are affected more. Spending and debt fall by TL109 and TL310 for the safer income group and TL149 and TL338 for the riskier income group.

This finding of similar policy impact across different education and income categories is unexpected, but there are similar examples in the literature. For example, Jappelli and Pistaferri (2014) find that years of education have either a positive or negative relationship with MPC after a fiscal policy, depending on the inclusion of other variables measuring income, financial assets, or liquidity constraints. While the expected relationship between education and MPC is negative, Jappelli and Pistaferri find the opposite in most of their specifications. Holm, Natvik, and Fagereng (2021) find that after a large lottery, MPC is virtually unaffected by education and income. Moreover, Parker et al. (2013) and Johnson, Parker, and Souleles (2006), who evaluate the impact of the 2001 and 2008 economic stimulus payments, find no statistical difference in spending propensity across different income categories.

As the above-mentioned influential studies show, the lack of differential policy impact across education and income categories is unexpected but not necessarily striking. We also emphasize the uniqueness of BRSA's policy, making it challenging to find closely related and directly comparable studies. Nonetheless, (lack of) heterogeneity in policy impact based on income and education is a valuable and important topic for further research. We offer two possible explanations for our results. First, there might be other unobservable borrower characteristics, other than education and income/wealth, that correlate better with consumption sensitivity, risk tolerance, or patience, all of which would imply a more substantial heterogeneity in policy response. Second, even though we might use education or income volatility as rough proxies for wealth, it does not imply that individuals with high levels of education, low-income volatility, or high wealth, in general, would necessarily behave differently if most of their assets are illiquid. Kaplan and Violante (2014) show that even wealthy households behave hand-to-mouth if their assets are illiquid. In Turkey, housing constitutes the largest and most important form of wealth. Since housing is a highly illiquid form of wealth, it might explain why even borrowers with low-income volatility and high educational attainment respond similarly to the BRSA's policy. Access to richer data would allow us to test for these alternative explanations. However, our current data set limits our ability to investigate these issues further.

4.2.2 Isolating the effect of the minimum payment change

As mentioned in Section 3, we cannot directly estimate a separate MP treatment effect using Equations 1 and 2; all consumers in the MP treatment are also in the CA treatment. However, the

specification in Equation 3 makes it possible to isolate the MP treatment. It exploits the rule that all credit cards opened after the policy announcement must have a fixed minimum payment ratio of 40% for the first twelve months. After one year, their minimum payment ratio can be changed to comply with the minimum payment schedule applicable or stay at 40%. Therefore, we have a sample of new credit cards that are only affected by the CA rule but not the MP rule for an entire year.

We utilize this sample of new credit cards as the new control group because it is not subject to any changes in the minimum payment during this time; however, the CA rule still affects both the treatment and the control groups. Running difference-in-difference regressions on these two groups neutralizes the effect of the CA rule and singles out the MP treatment effect.

The results are shown in Table 4. For the sake of comparison with the sample used in Table 3, we first report the descriptive statistics in Panel A and the regression estimates in Panel B. The new card sample's average monthly spending is about 6% lower than in the main sample. Moreover, the average debt is about 21% lower than the main sample, and they pay 82% of their debt which is higher than the main sample. Finally, new cardholders are, on average, younger than the main sample. The possible reason for the difference is that new cardholders spend more carefully and use their credit card less than existing cardholders.

The regression estimates in Panel B of Table 4 show that the treated consumers significantly reduce their spending and debt relative to the new credit card holders. Consequently, the proportion of debt paid surges, and consumers pay less for interest and penalty charges. The results are qualitatively and quantitatively comparable to our baseline findings in Table 3. In other words, the MP rule substantially impacted consumption and payment behavior. By the end of the twelve months with a fixed minimum payment ratio, the treated consumers reduced their spending and debt versus the new credit card holders by TL409.89 ($228.99) and TL630.74 ($352.37), respectively. Moreover, the proportion of debt paid increased by 22.28%, reducing the average interest and penalty payments by TL4.5 ($2.5) and TL18 ($10), respectively. Finally, elasticity analysis using coefficients in Table 4 implies that a percentage point increase in the minimum payment ratio reduces credit card spending and debt by 6.60% and 7.57%, increasing the proportion of debt paid by 2.22%.

Figure 5 shows the MP treatment effect on credit card spending and debt from an event study perspective. The coefficients on the right of the ‘2011m12’ line represent the MP treatment

effects, while the coefficient on the left shows the difference in credit card spending and debt before increasing the minimum payment ratio to 22%. We see a significant decrease in spending and debt following the change in Figure 5. The pre-change coefficients show that the parallel trend assumption is satisfied. However, we want to note a potential drawback in the event study done in Figure 5. Namely, the treatment group is already treated before December 2011. Therefore, even though we have common trends before January 2012, the previous treatment could overstate the coefficients plotted in Figure 5. Overall, we believe that Table 4 and Figure 5 show that the policy's minimum payment rule had a sizeable effect on credit card spending and debt.

4.2.3 The effect of minimum payment reduction

We further explore the policy on new credit cards and study the impact of lower minimum payments on credit card spending and debt. A small sample of around 10,000 new credit card accounts experienced a reduction in the minimum payment ratio from 40% to 25% after the first twelve months. We use this sample and Equation (4) to test the response of credit card spending and debt to a decrease in the required minimum payment. The results are shown in Table 5. The change in spending is negative but not statistically significant. Debt increases by TL12.75 ($7.12), while the proportion of debt paid falls by 2.58%. These estimates indicate that the decrease in the minimum payment affects debt payment behavior but has no significant impact on spending. Medina and Negrin (2022) also find that consumers reduce their debt payments when the minimum payment ratio is lowered, albeit their focus is on unconstrained consumers. Compared to the results in Table 3, there seems to be a discernible asymmetry in consumers' response to a minimum payment decrease relative to an increase of a similar magnitude. As shown in Table 5, debt payment falls, and consumers pay higher penalty and interest charges; however, the coefficients we obtain are economically much smaller than those following a minimum payment increase.

Note that these coefficients are not directly comparable as the sample in Table 5 is much smaller resulting in less power, and the treatment group is different from that in Table 3. While our findings of policy impact following a minimum policy decrease are suggestive, they are consistent with the recent survey evidence about asymmetries between the marginal propensity to consume in response to positive and negative unanticipated income shocks (Christelis et al., 2017; Baugh et al., 2021).

We discuss several possible explanations behind the asymmetric effect of minimum payment changes on spending and debt repayment of constrained consumers. First, reducing the minimum payment ratio is not as binding a constraint on consumers as a tightening credit card policy. The higher required minimum is both restrictive and binding on liquidity-constrained consumers. An alternative to not paying is becoming delinquent. On the other hand, a lower required payment relaxes the borrowing constraints and produces no additional restrictions. Second, paying the penalty after missing a minimum payment is a painful experience that consumers try to avoid. Agarwal et al. (2013) find that consumers learn through negative feedback; paying the penalty this month substantially avoids extra fees and penalties in the next month. Third, a minimum payment decrease is not likely to have the same magnitude of response as a minimum payment increase; there is no penalty or another source of negative feedback mechanism that pushes consumers to learn and change their behavior quickly.

4.3 Possible explanations

We have documented that the BRSA's policy reduces credit card spending and increases debt repayment over time. We report the results for spending and debt behavior jointly throughout the paper; however, they are separate decisions driven by potentially very different rationales. Therefore, in this subsection, we consider them separately. We first discuss the explanations for the reduction of credit card spending. Then, we discuss why consumers increase debt repayment.

4.3.1 Consumption response: Soft Liquidity Constraints

The post-policy reduction in consumption is consistent with the model of soft liquidity constraints and precautionary savings (Fernandez-Corugedo, 2002; Carroll and Kimball, 1996, 2021). While the standard hard liquidity constraint is a constraint on the amount of debt, the soft liquidity constraint does not limit the borrowing but makes it costlier to borrow more. For example, while credit limit is a hard liquidity constraint, minimum payment requirement is a soft liquidity constraint. According to the model, consumers will decrease consumption and increase precautionary savings in the presence of hard or soft liquidity constraints. The model produces the same outcomes regardless of whether the constraint is currently binding or will become binding in the future. The model posits that the introduction of liquidity constraint increases the precautionary saving motive around the levels of wealth where the constraint becomes binding. In other words, consumers' motive for precautionary savings is strengthened by the desire to make constraints less likely to bind. The drop in the consumption we observe in our results can

be interpreted as an attempt by the treated consumers to avoid or minimize the chances of being treated by the policy.

Relying on this theoretical framework, we employ a model based on consumption and precautionary saving with hard and soft constraints to confirm that our hypotheses and empirical results are grounded in theory. The general theoretical model for consumption under soft liquidity constraints is found in Fernandez-Corugedo (2002), which is based on the consumption model under hard liquidity constraints in Carroll and Kimball (1996, 2021).

The standard consumption problem, examined by Carroll and Kimball (1996), is one of a representative consumer that maximizes time-additive discounted utility from consumption u(c). Carroll and Kimball (2021) prove that introducing a hard borrowing constraint at all times makes the marginal value function V_t convex at the point where the constraint begins to bind, even if utility functions are quadratic. With the quadratic utility, this leads to precautionary saving behavior in the face of liquidity constraints because the expected marginal utility of savings increases.

Fernandez-Corugedo (2002) proves that soft liquidity constraints result in the same consumption and precautionary saving behavior as hard liquidity constraints. More formally, Fernandez-Corugedo (2002) builds on Carroll and Kimball (1996, 2021) to provide a general benchmark model for consumption under soft liquidity constraints by introducing a function for the cost of borrowing/soft constraint into the consumption problem without specifying a functional form. Following the notation and the standard consumption in Carroll and Kimball (1996, 2021), Fernandez-Corugedo (2002) adjusts the problem by introducing the cost of borrowing function $f(w_t\text{-}c_t)$ into the budget constraint.

$$V_t(w_t) = max_{c_t} u(c_t) + E_t \sum_{s=t+1}^{T} \left[\prod_{j=t+1}^{s} \tilde{\beta}_j \right] u(c_s)$$
$$w_{t+1} = \tilde{R}_{t+1}[(w_t - c_t) - f(w_t - c_t)] + \tilde{y}_{t+1} \; and$$
$$terminal \; condition \; c_T \leq w_T$$

While hard constraints assume that $w_t\text{-}c_t \geq 0$ at all times, this condition is not required under soft constraints. The soft constraint/cost of borrowing function $f(w_t\text{-}c_t)$ can either be discontinuous or continuous. Solving the consumption problem yields the following Euler equation(s):

$$u'(c_t) = E_t \tilde{\beta}_{t+1} u'(c_{t+1}) \tilde{R}_{t+1}[1 - f'(w_t - c_t)] \; in \; the \; continous \; case, or$$
$$u'(c_t) = \max [E_t \tilde{\beta}_{t+1} u'(c_{t+1}) \tilde{R}_{t+1}[1 - f'(w_t - c_t)], E_t \tilde{\beta}_{t+1} u'(c_{t+1}) \tilde{R}_{t+1}] \; in \; the \; discontinous \; case$$

The implication of the above Euler equation, given that $[1 - f'(w_t - c_t)] > 1$, $u' > 0$, and $u'' < 0$, is that when the constraint binds, the consumption will be reduced in period t and increased at time $t + 1$.

Fernandez-Corrugedo (2022) first proves that introducing the soft constraints for a given level of savings changes the slope of the marginal value function, i.e., it makes it more convex. They show that the more convex the -f' is, the more convex the marginal value function will be, resulting in the behavior of the soft-constrained consumer that more closely resembles that of the hard-constrained consumer.

The policy we study in this paper increases the minimum payment, hence tightens the soft liquidity constraints for credit card consumers. Namely, it does not limit borrowing but makes it costlier to borrow. This cost is manifested in a higher minimum payment ratio, implying a higher effective interest rate unless a consumer can meet the new minimum payment. Since BRSA's policy implements a higher cost of borrowing only when the minimum payment is not met, it is akin to the discontinuous case in Fernandez-Corugedo (2002). This higher cost of borrowing should reduce consumption and increase precautionary saving (reduce debt) at the time of the policy to prevent the policy-induced soft constraints from binding. Note that in the benchmark model, we assume there is no friction in debt payment behavior.

Relying on the above model, we simulate life-cycle consumption and debt paths under three scenarios: hard constraint, soft constraint with 20% minimum payment requirement, and a tightened soft constraint with 40% minimum payment requirement. We run the simulation using annual frequency. The results and a more detailed discussion are shown in Section A.4 of the Appendix, but we provide a summary below.

Our empirical results show that consumers reduce consumption and debt, consistent with the theoretical work of Carroll and Kimball (1996, 2021) and Fernandez-Corugedo (2002). When the policy is announced, there is a significant drop in consumption relative to the pre-policy scenario. In our simulated model, the consumption falls 14.78% (16.4%) relative to the baseline case following the policy announcement at age 45 with single and multiple policy changes, respectively. Moreover, total debt consistently decreases over time following the policy announcement. In line with our empirical results, we estimate the change in debt two years after the policy announcement. In the simulation, debt drops 25.7% for a single policy shock and 39.3%

for multiple policy shocks. These results are shown in Figure A.7 in the Appendix. Overall, our simulations are consistent with theoretical expectations and our empirical results.

4.3.2 Debt Repayment

In addition to the reduced spending, we find that the treated consumers significantly increase their debt repayment. Moreover, we show that many consumers pay strictly at or more than the required minimum payment (Table 3, columns 3,4). Lastly, we also find weak evidence that reducing the required minimum payment results in higher credit card debt (Table 5). So, why do the treated consumers make higher payments towards their credit card balance after the minimum payment increase and vice versa?

There are two possible explanations: liquidity constraints and anchoring bias (Medina and Negrin, 2022). The liquidity constraints explanation predicts that the treated consumers would be paying strictly at the new minimum, but not more. Anchoring bias predicts that some treated consumers would be paying above the new minimum due to anchoring to the payment information shown on the monthly statement. This behavior is not the result of optimizing their consumption function but anchoring to the minimum payment information saliently displayed on the credit card statement.

Previous research provides ample evidence that low credit card debt payments are consistent with anchoring (Stewart, 2009; Hershfield and Roese, 2015; Guttman-Kenney, Leary, and Stewart, 2018; Keys and Wang, 2019). Vihriälä (2022) is a recent paper showing that low credit card payments can be explained partially by anchoring and not solely by liquidity constraints. In contrast to our paper, Vihriälä (2022) directly observes liquidity (end-of-month deposits) and shows that even individuals with ample liquidity make minimum or near-minimum payments. Additionally, Vihriälä (2022) shows that low payments are not driven by the default-option effect (auto-pay options without manual input) because of limited attention or rounding, as minimum payments in his sample are already round numbers.

We do not have access to liquidity information in our data set and cannot directly replicate tests in Vihriälä (2022). However, we run a test that shows if there is ‘bunching’ at the new minimum payment ratio. First, for each individual-month, we check the applicable minimum payment ratio based on BRSA’s policy (Table A.1) and calculate the monthly amount paid as a percentage of the monthly statement balance. Then, we create a histogram of the percentage amount paid for each required minimum payment ratio, shown in Figure 6. Panels A to E show these histograms

for all individuals bound by a minimum payment ratio of 20%, 22%, 25%, 28%, and 30%, respectively. All histograms show a clear bunching pattern around the binding minimum payment ratio.

We run a similar test for robustness but try to understand if the bunching behavior repeats for the same types of individuals that face progressively higher minimum payment ratios over time. Utilizing the information in Table A.1, we separate our sample into four groups based on credit card limit: less than 5,000TL, 5,000-15,000TL, 15,000-20,000TL, and more than 20,000TL. We then create a set of histograms for each group showing the distribution of the monthly percentage amount paid at each required minimum payment ratio. As a result, each histogram shows distribution from a different period for a particular credit card limit group based on BRSA's rollout schedule (Table A.1). The results are reported in Figure A.3 in the Appendix and show clear signs of bunching at every required minimum payment ratio for each of the four groups. Overall, evidence in Figures 6 and Figure A.3, in conjunction with Table A.9, supports the anchoring bias as the primary explanation behind the significant increase in debt repayment we uncover.

As an additional robustness check of bunching, i.e., anchoring behavior, we estimate the impact of the policy on the variable *P*, which represents the proportion of consumers that pay at or below the new minimum (Keys and Wang 2019). Table A.9 shows the result of difference-in-difference regression, where *P* is the dependent variable. Column 1 shows that the proportion of at-or-below minimum payers falls by about 6.98% for CA treatment and more than 30% for the MP+CA treatment. These estimates point to a substantial increase in consumers who pay some amount higher than the minimum. A severely constrained consumer would be inclined to precisely pay the new minimum, but not more, as argued above. However, consumers that pay more than the minimum are not necessarily constrained. The liquidity constraints story can only marginally explain the significant increase in debt repayment we uncover in Table 3. Anchoring seems to play a much more vital role in explaining the substantial increase in debt payment after the policy. Furthermore, lower debt payment after reducing the minimum payment is consistent with the anchoring story. Therefore, in Table A.9, we find evidence consistent with anchoring bias and show that it portends a sizeable impact on credit card payment behavior.

Another possible explanation is that the debt payment behavior is driven by mean reversion. Specifically, it might be the case that the low-paying households would pay more, and the high-paying households would pay less in the future. Figure 4 shows a clear pattern of persistence

rather than mean reversion in payment behavior. Therefore, mean reversion is an unlikely explanation for the debt payment behavior we obtain in Table 3.[10]

Finally, it is worth mentioning two other possible mechanisms through which BRSA's policy might affect consumer behavior: heuristics such as utilization targeting and dynamic inconsistencies in debt repayment via contract choice. Credit card utilization is surprisingly stable over the life cycle, business cycle, and for individuals (Fulford and Schuh, 2020). Moreover, Gross and Souleles (2002) suggest that consumers may have stable target utilization rates due to precautionary motives or borrowing heuristics. If utilization targeting were the explanation behind our results, we would have to observe a reduction in credit card limit for the treatment group during BRSA's policy. We do not observe the dynamics of credit card limits in our sample; however, there was no policy targeting credit card limits or other formal or anecdotal evidence of widespread forced or voluntary reduction in credit card limits at the time of the policy. Therefore, utilization targeting is not a likely mechanism behind the consumers' response to BRSA's policy.

Dynamic (time) inconsistency refers to the consumers' tendency to prefer present over future gratification. This behavior is also known as the present bias. In the context of credit cards, it implies that consumers delay paying down debt to consume more in the present, believing they will be patient enough to pay their debt in the future. However, they repeat this behavior in the future, further delaying their debt paydown. As a result, time-inconsistent individuals are more likely to carry credit card debt and have substantially larger amounts of it (Meier & Sprenger, 2010). We cannot directly test the dynamic inconsistency hypothesis since we do not have information about consumers' time preferences. However, if present bias were the mechanism behind consumers' response to BRSA's policy, there would have to be a reduction in consumers' preferences towards present consumption while the policy is implemented. In other words, we would have to observe that treated consumers display less present biasedness at each minimum payment increase to justify the drop in consumption and rise in debt repayment we uncover. This change would have to happen while the policy is implemented. Otherwise, the policy would need to cause substantial, sudden, and sequential changes in consumer preferences. Literature shows

[10] In untabulated results we also run regressions to test for mean reversions. We regress proportion of debt paid, proportion of consumers making minimum payments, interest, and penalty charges on their lagged versions controlling for total debt and lagged total debt. The regression uses data before the policy to analyze the possibility of mean-reverting behavior without any confounding policy effects. All coefficients are positive and statistically significant, rejecting the hypothesis that consumers exhibit mean-reverting behavior. Regressions results are available from the authors upon request.

that people are, on average present biased (Imar, Rutter, and Camerer, 2021) and that preferences are stable once formed (Hoeffler and Ariely, 1999). Therefore, present bias is unlikely to be the correct mechanism for explaining consumer response to BRSA's policy.

4.4 Consequences of the policy: credit card delinquency

In this section, we analyze the consequences of the BRSA's policy for credit card delinquencies. Since the policy tightens borrowing constraints, one could expect an increase in delinquency due to difficulties in paying a higher minimum payment at the lower end of the payment distribution.

We use a difference-in-differences strategy to test for post-policy changes in delinquencies. Figure 3 shows that there are parallel trends before the policy announcement. We run difference-in-differences regressions using Equations (1) and (2) and present the results in Table 6. The dependent variables are 30-day and 60-day delinquency. Columns 1 and 2 report the average coefficients for CA and MP+CA treatments. Columns 3 and 4 also consider the dynamic changes in delinquencies for the MP+CA treatment. Surprisingly, all the coefficients are negative and statistically and economically significant. 30-day delinquencies fall by 2.33% on average for consumers in the CA treatment and 7.41% for the MP+CA treatment group. For the 60-day delinquency, these declines are 0.43% and 5.58%, respectively. The delinquencies decline more in the later stages of the policy, dropping by about 7.90% and 6.93% two years into the policy implementation for the 30-day and 60-day delinquency, respectively. These results suggest that the treated consumers remain relatively resilient in reducing their consumption and paying down debt as the policy imposes additional increases in the required minimum payment. They are not only able to avoid delinquencies but also reduce them.

To further understand the heterogeneous response of delinquency to BRSA's policy, we run a test with an alternative treatment definition. The credit card limit is a good proxy for liquidity, and consumers on the lower end of the credit card limit distribution are likely to be impacted by the policy and face more difficulties in meeting the new minimum payment requirement. Therefore, we define the treatment group as consumers with credit card limits below the median and test the policy impact on spending, debt, and 60-day delinquency. The results are reported in Table 7. Column (3) shows that 60-day delinquency increases by 0.27%. This finding contrasts Table 6, where we observe a reduction in delinquencies.

Our findings on delinquencies are mixed and different from recent literature. For example, d'Astous and Shore (2017) find a 4.33% rise in delinquencies for delinquent credit card users in

the two-year window after a minimum payment increase. Similarly, Keys and Wang (2019) find a one percentage point increase in delinquency following an increase in the floor minimum payment. Why do delinquencies fall in a more restrictive credit environment? Why do we observe the different responses in delinquencies when we use different treatment and control groups?

We think there are two forces at play regarding policy's impact on delinquencies: the liquidity effect and the reminder effect. These two effects have opposite impacts on delinquencies; the response depends on which effect dominates the other.

The liquidity effect means that increasing the minimum payment tightens the liquidity constraints for borrowers for whom the minimum was binding before the policy. As a result, constrained borrowers have to increase payments and reduce spending after the policy. The most constrained borrowers might fail to meet the new minimum even after reducing spending and increasing payments and thus are more likely to be delinquent. We believe our alternative treatment definition captures these borrowers, uncovering the above-mentioned liquidity effect shown in Table 7 and documented in d'Astous and Shore (2017) and Keys and Wang (2019).

The reminder effect implies that the policy serves as a reminder to meet the new minimum payment and thus reduce delinquencies. Borrowers on the higher end of the payment distribution already pay enough to meet the new minimum and are indifferent to the policy. However, borrowers on the lower end of the payment distribution need to increase their payments to match the new policy. These are still constrained borrowers but with sufficient capacity to reduce spending and increase payments to meet the new minimum. For them, the policy acts as a forceful nudge or a reminder to adjust their behavior enough to satisfy the new policy requirements. Again, that is precisely what d'Astous and Shore (2017) find: current credit card accounts in the lower end of the payment distribution reduce spending and increase payment just enough to meet the mandatory increase. Only the previously delinquent consumers who fail to increase the minimum payment enough to meet new requirements experience an increase in delinquencies. Likewise, Campbell and Grant (2022) find that digital repayment reminders to delinquent borrowers reduce delinquency and increase the repayment rate for at least 12 months after the reminder. Moulton et al. (2015) similarly find that consistent contact with mortgage borrowers significantly reduced delinquencies. Agarwal et al. (2008) finds that credit card holders learn through negative feedback (paying a fee), which reminds them to avoid a similar fee in the future. Other papers with similar findings include Roll and Moulton (2019) and Barboni, Cárdenas, and de Roux (2022).

The liquidity effect implies that the decline in delinquency rates should be the lowest for constrained consumers. On the other hand, the delinquency rates could rise for severely constrained individuals. To test the liquidity effect, we use the following two proxies to measure liquidity constraints: outstanding credit card debt and the level of non-discretionary consumption.

We first look at the heterogeneous effect on delinquency based on outstanding credit card debt. The results are shown in Figure 7. The horizontal axis plots the debt burden quintiles, while the vertical axis shows the average effects on delinquency rates after the policy. The delinquencies fall by around 10-11% for the lowest two quintiles, around 2.5% for the middle quintile, and less than 1% for the top two quintiles. Interestingly, even the most indebted individuals still manage to avoid a higher delinquency rate after the policy. However, these results still imply that the heavily constrained individuals struggle the most with the new policy. On the other hand, less-constrained individuals find it much easier to reduce their consumption and delinquencies after the policy.

Our second test is based on the level of non-discretionary consumption. We show the impact of policy on discretionary and non-discretionary consumption in Table A.11 and discuss the results in section A.3 of Appendix. Discretionary consumption includes non-essential goods and services such as alcohol, tobacco, jewelry, travel, restaurants, sports, and entertainment. We find that consumers with high pre-policy discretionary spending reduce this spending to meet the new minimum payment and avoid delinquency. Non-discretionary consumption also declined, but significantly less compared to discretionary spending. This result is likely due to the greater difficulty in reducing consumption of basic life necessities where certain minimums need to be maintained to preserve the existing standard of living. Therefore, a reduction in delinquency is likely due to the relative ease with which some treated consumers reduce their (discretionary) consumption.

In conclusion, our evidence suggests that a combination of liquidity and reminder effects drives delinquency volatility. When we use low payers as treatment group, the reminder effect dominates the liquidity effect, as the net impact is reducing delinquencies. When we use consumers with low credit limit as the treatment group, the liquidity effect dominates the reminder effect, as the net impact is increasing delinquencies. In other words, on average, a higher share of consumers is severely constrained and fail to make the minimum payment compared to the consumers who have the means to pay the minimum but might need to be reminded about the latest minimum payment requirements.

5. Discussion

Our results suggest a significant reduction in consumption and credit card debt. However, since we do not observe total consumption, we cannot immediately rule out possible substitution from credit cards to other forms of liquidity with little to no impact on consumption. First, consumers might fully substitute credit cards with debit cards, cash, or other assets, implying no real impact of BRSA's policy on total consumption. Second, consumers may switch to credit cards from other banks. Third, they might switch to other types of consumer credit such that the total consumption remains unaffected. We provide detailed discussion regarding these three issues in Section A.3.3 of the the Appendix, but summarize our findings below

Consumers with little assets cannot simply substitute credit card spending with spending from debit cards or other assets, because they lack such assets in the first place. To test this hypothesis, we separate our sample into groups based on car ownership and investment account availability, using both as rough proxies for illiquid and liquid assets. We find that both groups are similarly impacted by the policy (Table A.12), implying that liquidating assets to replace credit card spending cannot fully explain the spending response we uncover. Therefore, observing a policy-driven reduction in consumption for low-cash/low-asset consumers implies a consumption decrease and not just a substitution from credit card to spending from other assets. We further test this substitution effect by separating our sample into 'revolvers' and 'non-revolvers.' The former roll over their debt, and the latter mostly use credit cards as a transactional tool. The results show that revolvers reduce their spending more than the non-revolvers, implying a real drop in consumption, since revolvers, by definition, lack resources to simply switch to other sources of liquidity (Table A.13).

Consumers can also switch from one bank to another. We only have data from a single bank, so we cannot provide direct evidence of all consumer spending and consumption. However, switching to other credit cards in current or new banks is unlikely for several reasons. First, the policy is implemented across all banks in Turkey simultaneously. Second, maximum interest and penalty charges for all credit cards are imposed by the Central Bank of Turkey (CBRT). Thus, there is no incentive to switch banks or credit cards in terms of interest rates or minimum payment requirements.; substitution to credit cards at other banks would bring no benefit. Finally, there is a disadvantage to switching to another bank or opening a new credit card account at the same bank. In both cases, the consumer would operate under a 40% minimum payment requirement for at least a year, a strict mandate of BRSA's policy for all new accounts. Therefore, a consumer

has no incentive to open a new credit card account at any bank, as his borrowing costs would only increase.

Another way to escape BRSA's policy is to turn from credit cards to other unsecured consumer credit options. To test this explanation, we separate our sample into individuals with and without personal loans and run our baseline specification. The results show that the presence of personal loans does not change how credit cardholders react to BRSA's policy; it similarly affects individuals with and without personal loans. These findings suggest that switching from credit cards to other forms of credit does not fully explain the effects of BRSA's policy.

Finally, a more distant but plausible alternative to credit cards is overdraft accounts. Consumers can switch from high-minimum payment credit cards to checking accounts with overdraft features. Our data set does not contain information about checking account balances and overdrafts, but evidence from Alan et al. (2017), that also uses Turkish banking data, suggests that overdraft usage in Turkey is less widespread, less understood, and more expensive than credit cards, implying that it would not serve as a useful alternative to credit cards in the context of avoiding higher minimum payments from BRSA's policy.

6. Conclusion

Using a unique policy implemented by Turkey's Banking Regulation and Supervision Agency, we find that constrained consumers significantly decrease their spending and ramp up their debt repayment after the policy implementation. The policy consists of two components: a progressively higher minimum payment ratio and the requirement to pay 50% of the credit card balance at least three times a year. Both rules were effective in reducing credit card spending and debt. We also find that decreasing the minimum payment ratio results in higher debt for the treated consumers but does not affect spending.

These results improve our understanding of consumption and debt response to consumer credit regulation (Agarwal et al., 2015). Our findings on decrease in spending are consistent with Carroll and Kimball's (1996, 2021) and Fernandez-Corugedo's (2002) theoretical work on consumption under soft liquidity constraints. The two policy rules we study in this paper impose a soft liquidity constraint under which a consumer maintains his borrowing capacity but at a higher cost, implied by a higher minimum payment ratio. By reducing consumption, the consumer effectively reduces the interest and penalty payment, and avoids potential loss of borrowing capacity. Our results on

higher debt payments are consistent with the explanations that consumers exhibit anchoring bias in credit card payment. Our evidence on delinquencies is mixed but suggests delinquency rate might decline after a credit tightening policy. One possible explanation is that the reminder effect of the tightening policy outweighs the liquidity effect. Although surprising, we show this result is plausible because consumers reduce their discretionary consumption significantly and non-discretionary consumption only marginally. The relative ease in reducing non-essential consumption explains the simultaneous decline of consumption and delinquencies.

Lastly, we note that our results are inconclusive regarding consumer welfare. While our findings indicate that delinquencies and especially debt dropped after the policy, it is beyond the scope of our paper to claim if the policy was overall successful and welfare improving. The policy is seemingly effective in reducing debt, but it also reduces consumption for the treated consumers. Moreover, the length of our data set prevents us from testing any long-term effects of the policy that would shed more light on the overall impact on consumer welfare. Therefore, it is difficult to judge the net effect of reduced access to liquidity caused by BRSA's policy, and we avoid taking a particularly positive or negative stance regarding the overall impact of the policy.

Our results have important implications for the design of macroprudential policies, especially in the context of credit cards. Future research on similar macro-prudential policies is necessary to shed more light on the effectiveness of expansionary macroprudential policies. Moreover, the effectiveness of these policies in the long run is still unknown. Further research should aim to empirically test the long-term effects of such policies and potentially recommend their ideal design. Lastly, BRSA's policy is interesting since it announces multiple changes in liquidity to happen at predetermined dates. Our paper provides evidence that consumption might contemporaneously respond to current and near-future liquidity changes, as both were embedded in the BRSA's policy; however, our empirical setup cannot estimate direct consumption effects from future changes in liquidity. On the other hand, Ganong and Noel (2020) find that current consumption is responsive to current but not future changes in liquidity. Additional research is needed to successfully disentangle response to current and future liquidity changes.

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Table 1: Sample summary and comparison

Panel A reports the basic summary statistics for different credit card spending and debt-related variables and basic demographic information. The sample in Panel A excludes full payers to provide descriptive statistics that apply to the sample used in regressions. Panel B reports the comparison between our full sample and either the aggregate figures from the entire population of credit card holders or the sample used in the survey conducted by Interbank Card Center in terms of average spending and credit card limit distribution. Panel B also reports the geographical distribution of bank branches for the Turkish banking system and the bank whose data we use in our sample.

Panel A: Descriptive Statistics	Full Sample				Treatment		Control	
Variable	Mean	StDev	Min	Max	Mean	StDev	Mean	StDev
Spending Total	619.92	1472.00	0	310765	412.13	960.34	793.72	1772.40
No. of Transactions	6.88	11.38	0	2335	5.12	8.66	8.35	13.04
Debt	833.07	1616.40	0	311524	820.17	1400.77	843.86	1776.70
Amount Paid	579.29	1370.93	0	293392	383.86	887.19	742.75	1653.61
Interest	6.18	17.94	0	6117	10.55	21.69	2.51	12.96
Penalty	18.17	56.65	0	9699	33.38	73.99	5.46	30.98
Percentage Paid	0.72	0.37	0	1	0.53	0.38	0.88	0.27
Paid Below Minimum	0.19	0.39	0	1	0.33	0.47	0.07	0.25
Paid Below 50%	0.31	0.46	0	1	0.55	0.50	0.11	0.32
Utilization	0.31	16.53	0	14925	0.41	0.47	0.23	22.39
Credit Limit	4577.62	6516.32	0	500000	2871.47	4239.52	6004.63	7646.81
Age	40.80	9.71	21	89	40.40	9.82	41.14	9.61
Male	0.87	0.33	0	1	0.86	0.34	0.88	0.32
Married	0.82	0.38	0	1	0.80	0.40	0.84	0.36
Education Level	3.08	1.28	1	8	2.95	1.25	3.18	1.30
Investment	0.19	0.39	0	1	0.15	0.36	0.22	0.41
Personal Loan	0.03	0.18	0	1	0.02	0.14	0.05	0.21

Panel B: A representative sample

	Average Cash Withdrawals/Spending
Aggregate	361
Our sample	383

Distribution of CC limit	ICC Survey	Our Sample
Less than TL 2000	55%	50%
TL 2,000-5,000	24%	25%
TL 5,000 -10,000	10%	15%
TL 10,000 and more	11%	10%

	All Banks' branches (%)	Our Sample Bank Branches (%)
İstanbul	28.46	37.28
Ankara	9.87	8.24
İzmir	7.16	5.02
Antalya	4.08	3.58
Bursa	3.55	3.23
Konya	2.21	2.87
Kocaeli (İzmit)	2.16	2.15
Gaziantep	1.56	2.15
Kayseri	1.43	1.43
Manisa	1.40	1.79
Samsun	1.25	1.08
Trabzon	1.01	1.08
Diyarbakır	0.83	0.30

Table 2: Persistence in payment behavior

Panel A shows the transition matrix depicting the likelihood of moving between quintiles of percentage payment between January 2010 and June 2010 to quintiles of percentage payment in December 2010. In Panel B, we separate our sample into a group that paid below the minimum and a group that paid above the minimum in the first several months of 2010. We then test if these groups showed persistent behavior in the remaining months of 2010. Column (1) shows the probability of payment below the minimum after paying above the minimum in the x^{th} month earlier in 2010. Column (2) shows the probability of payment below the minimum after paying below the minimum in the x^{th} month earlier in 2010. Finally, column (3) shows the p-value of the t-test that column (1) equals (2).

Panel A: Percentage payment transition matrix for the year 2010

		%Payment in Dec 2010				
		0-20%	20%-40%	40%-60%	60%-80%	80%-100%
%Payment in Jan-Jun 2010	0-20%	0.403	0.235	0.064	0.034	0.264
	20%-40%	0.216	0.414	0.095	0.044	0.231
	40%-60%	0.172	0.249	0.112	0.068	0.399
	60%-80%	0.133	0.162	0.089	0.07	0.546
	80%-100%	0.087	0.054	0.034	0.036	0.788

Panel B: Persistence in payment below and above the minimum payment

	Probabilty of payment below mininum in rest of 2010		
	Paid Above Minimum in x.month	Paid Below Minimum in x.month	p value
	(1)	(2)	(3)
1.month	0.030	0.233	0.000
2.month	0.029	0.239	0.000
3.month	0.028	0.247	0.000
4.month	0.026	0.248	0.000
5.month	0.025	0.255	0.000
6.month	0.023	0.257	0.000

Table 3: Spending and debt response to the policy announcement

This table reports difference-in-difference regression estimates for spending, total debt, the proportion of debt paid, interest charges, and penalties. Panel A shows the average impact of the CA treatment and the combined MP+CA treatment, and Panel B shows the impact at each policy date for the combined MP+CA treatment. All treatment variables are defined based on credit card limits between January 2010 and December 2010. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

Panel A

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(4)	(5)
CA * post	-109.1361***	-158.7894***	0.1106***	-3.3505***	-5.8946***
	(7.3982)	(7.4175)	(0.0027)	(0.0891)	(0.1480)
(MP + CA) * post	-107.4648***	-282.9110***	0.2445***	-8.8440***	-36.8476***
	(12.1831)	(17.2600)	(0.0051)	(0.3790)	(1.6082)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	13440334	13440334	13440334	13440334	13440334
Adjusted R-squared	0.569	0.637	0.431	0.486	0.571

Panel B

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(4)	(5)
CA * post	-109.1361***	-158.7894***	0.1106***	-3.3505***	-5.8946***
	(7.3982)	(7.4175)	(0.0027)	(0.0891)	(0.1480)
(MP + CA) * post-0m	-67.6908***	-150.6539***	0.1736***	-7.0460***	-21.3177***
	(6.0249)	(7.9873)	(0.0057)	(0.2815)	(0.7965)
(MP + CA) * post-6m	-77.5242***	-232.4805***	0.2322***	-8.8905***	-35.9680***
	(9.1168)	(13.0662)	(0.0057)	(0.3946)	(1.6092)
(MP + CA) * post-12m	-111.2760***	-321.0888***	0.2687***	-9.2240***	-42.3467***
	(13.5291)	(20.3467)	(0.0051)	(0.4111)	(1.8791)
(MP + CA) * post-18m	-151.0403***	-383.1599***	0.2870***	-9.8233***	-44.8134***
	(18.6039)	(26.8760)	(0.0047)	(0.4379)	(2.1066)
(MP + CA) * post-24m	-174.4484***	-415.6929***	0.2940***	-10.0214***	-45.6816***
	(20.8499)	(26.8181)	(0.0049)	(0.4074)	(2.0028)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	13440334	13440334	13440334	13440334	13440334
Adjusted R-squared	0.569	0.638	0.431	0.486	0.572

Table 4: Using new credit cards as the control group

This table reports descriptive statistics and difference-in-difference regressions estimates for the policy effect using an alternative control group definition. The control group only includes consumers that opened a credit card account after the policy announcement in December 2010. The sample used in this table starts in July 2011 and includes new credit cards with the minimum payment ratio fixed at 40%. Panel A shows descriptive statistics for this sample, while Panel B shows the regression estimates. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level.

Panel A: Descriptive Statistics for a sample of new cards only

Variable	Mean	StDev	Min	Max
Spending Total	583.98	1651.34	0	347672
No. of Transactions	5.36	9.20	0	1152
Debt	655.46	1728.43	0	346806
Amount Paid	484.62	1484.99	0	346806
Interest	4.45	19.11	0	2106
Penalty	7.62	39.35	0	5070
Percentage Paid	0.82	0.34	0	1
Paid Below Minimum	0.12	0.33	0	1
Paid Below 50%	0.19	0.39	0	1
Utilization	0.21	0.30	0	41
Credit Limit	4429.04	6129.90	0	570000
Age	37.55	10.57	18	87
Male	0.81	0.39	0	1
Married	0.78	0.42	0	1
Education Level	3.34	1.43	1	8

Panel B: Diff-in-diff regression estimates using a sample of new cards only

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(4)	(5)
MP * post-12m	-157.3524***	-245.3844***	0.0928***	-1.0566***	-8.2174***
	(9.9180)	(10.2348)	(0.0035)	(0.0959)	(0.3902)
MP * post-18m	-309.3681***	-458.2700***	0.1708***	-2.9787***	-13.7440***
	(16.2669)	(17.0619)	(0.0061)	(0.1057)	(0.4738)
MP * post-24m	-409.8906***	-630.7352***	0.2228***	-4.4892***	-18.0323***
	(19.9827)	(17.9523)	(0.0082)	(0.1906)	(0.5124)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	2409806	2409806	2409806	2409806	2409806
Adjusted R-squared	0.556	0.633	0.562	0.588	0.712

Table 5: New credit cards – a reduction in the minimum payment

This table reports the panel data regressions estimating the effect of reducing the minimum payment ratio on credit card spending and debt. The sample includes only the new credit card accounts opened after the policy announcement. The sample in this table consists of new cards that experienced a reduction in the minimum payment ratio from 40% to 25%. It covers a twelve-month period, including the six months before the change in the minimum payment ratio from 40% to 25% and the six months after. The independent variable is a dummy that takes a value of 1 in a month when the minimum payment ratio for a new credit card falls from 40% to 25%. The independent variable is the interaction between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level.

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(4)	(5)
MP decrease*post	-0.5688	12.7535***	-0.0258***	0.5335***	1.3789***
	(5.5790)	(4.9145)	(0.0036)	(0.0638)	(0.1679)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	118786	118786	118786	118786	118786
Adjusted R-squared	0.650	0.721	0.485	0.528	0.564

Table 6: Changes in the delinquency rate

This table reports the difference-in-difference regressions estimating the policy effect on 30-day and 60-day delinquency. Column 1 reports the average impact of the two policy rules, the CA treatment and the combined MP+CA treatment. Column 2 shows the impact at each policy date for the combined MP+CA treatment. All treatment variables are defined based on credit card limits between January 2010 and December 2010. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

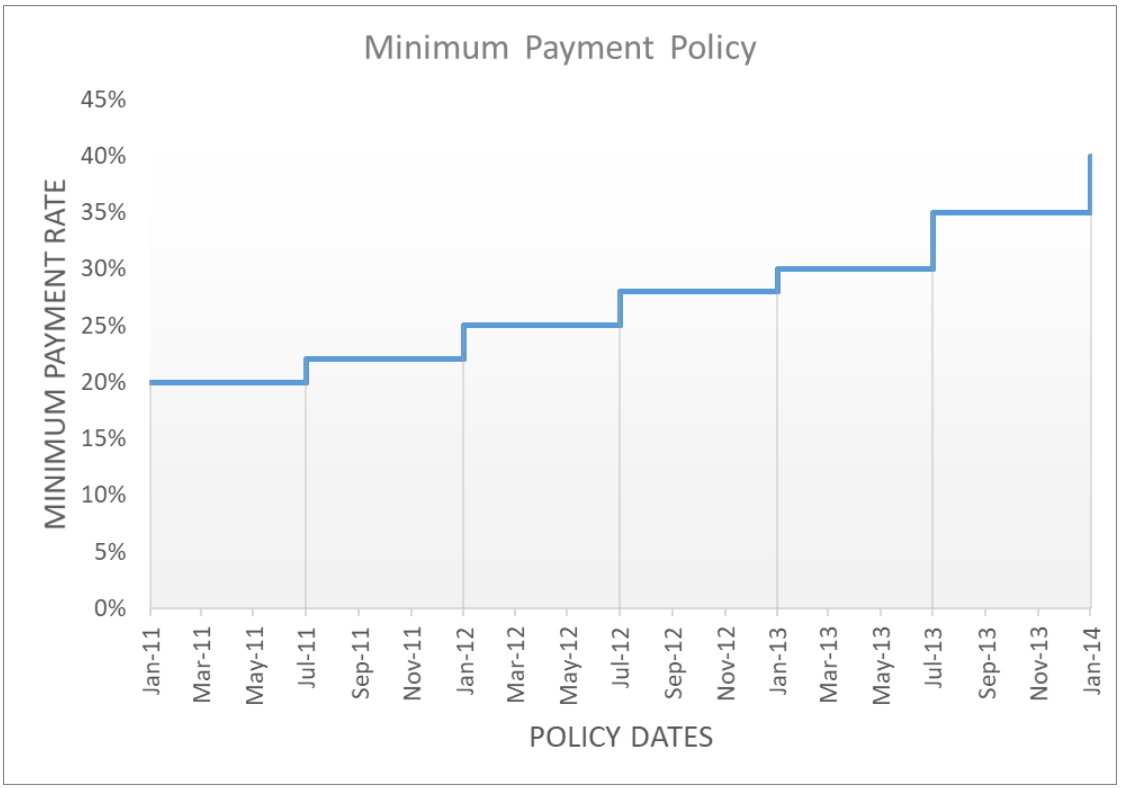
Dep.Var.	30-day delinquency	60-day delinquency	30-day delinquency	60-day delinquency
	(1)	(2)	(3)	(4)
CA * post	-0.0233***	-0.0043***	-0.0233***	-0.0043***
	(0.0017)	(0.0010)	(0.0017)	(0.0010)
(MP + CA) * post	-0.0741***	-0.0558***		
	(0.0048)	(0.0033)		
(MP + CA) * post-0m			-0.0669***	-0.0410***
			(0.0041)	(0.0030)
(MP + CA) * post-6m			-0.0737***	-0.0533***
			(0.0042)	(0.0031)
(MP + CA) * post-12m			-0.0768***	-0.0606***
			(0.0054)	(0.0035)
(MP + CA) * post-18m			-0.0774***	-0.0637***
			(0.0057)	(0.0037)
(MP + CA) * post-24m			-0.0790***	-0.0693***
			(0.0060)	(0.0038)
Individual FE	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
Observations	13440334	13395291	13440334	13395291
Adjusted R-squared	0.239	0.313	0.239	0.313

Table 7: Alternative Treatment Based on Credit Card Limit

This table reports the difference-in-difference regressions estimating the policy effect on spending, debt, and 60-day delinquency, defining the treatment group as borrowers below the median credit card limit. Columns 1 and 2 report the average impact of the policy on spending and debt, respectively. Column 3 reports the policy impact on 60-day delinquencies. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

Dep.Var.	Spending	Debt	60-day Delinquency
	(1)	(2)	(3)
Treatment * post	-257.9042***	-274.3745***	0.0027***
	(17.6338)	(18.6388)	(0.0004)
Individual FE	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes
Observations	13440106	13440106	13395063
Adjusted R-squared	0.571	0.638	0.090

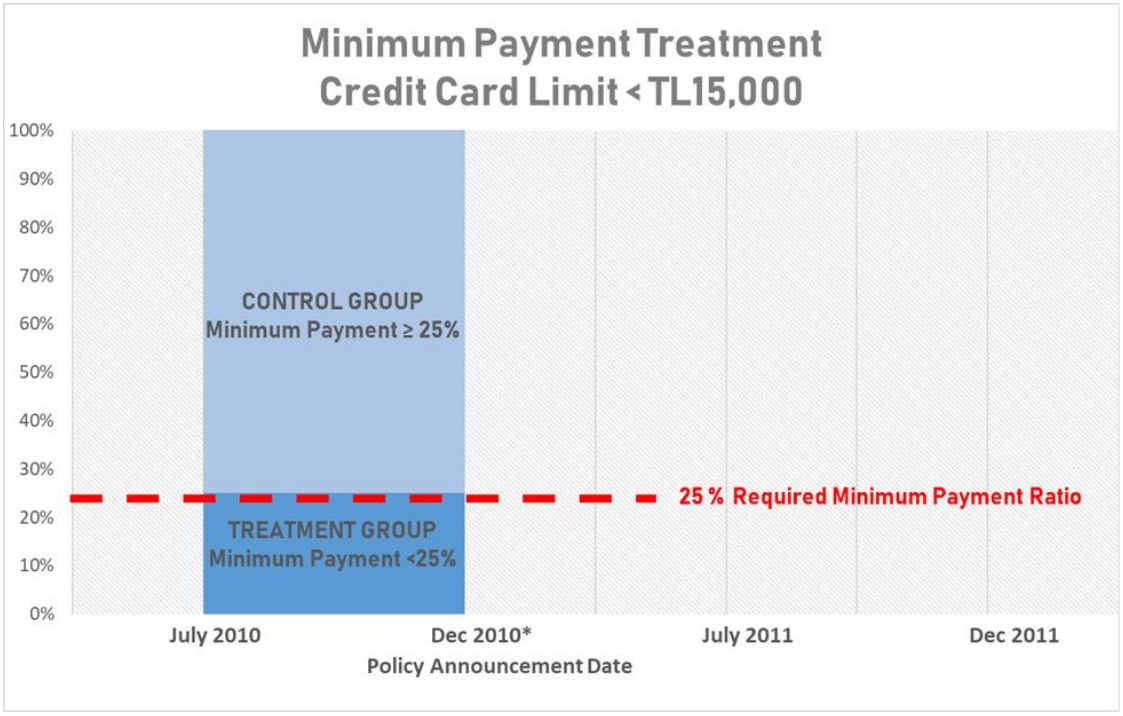
Figure 1: Minimum payment policy: changes in minimum payment over time



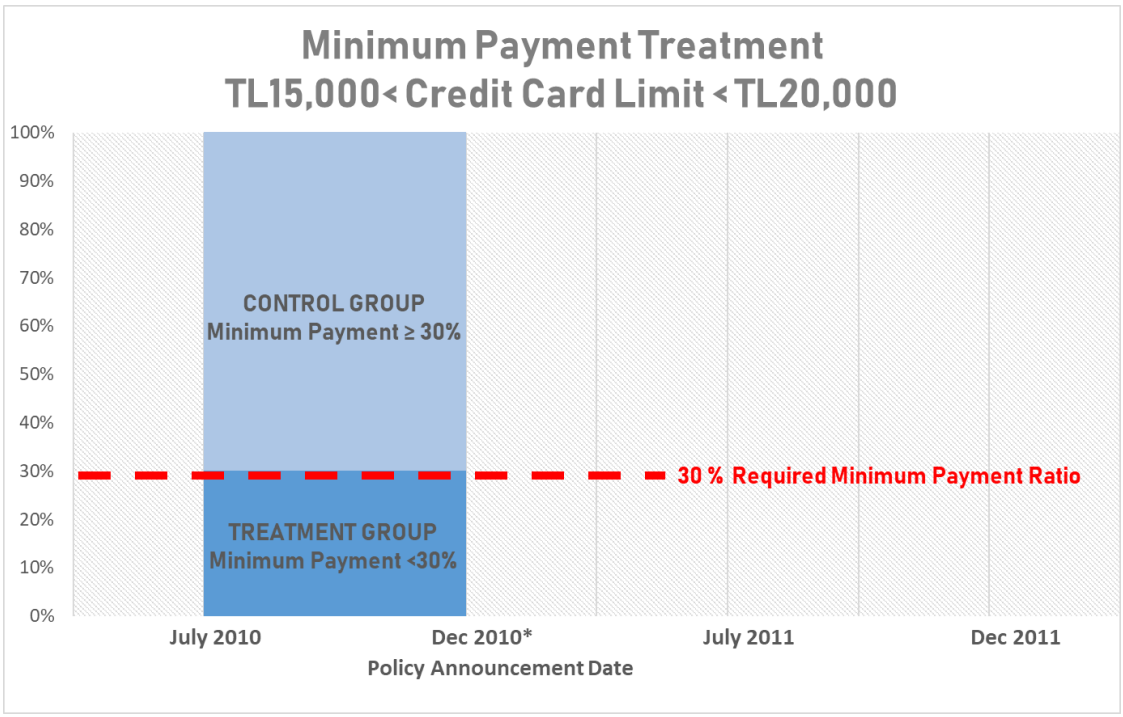
Notes: This figure presents the required minimum payment ratio progression after implementing BRSA's policy. The minimum payment ratio was increased every six months starting in July 2011 until it reached 40% in January 2014 for credit cardholders with limits of TL20,000 or more. The resulting minimum payment ratio for accounts with credit card limits less than $20,000 was capped at a level lower than 40%, depending on their credit card limit bracket. Details are provided in Table A.1.

Figure 2: Treatment vs control

Panel A



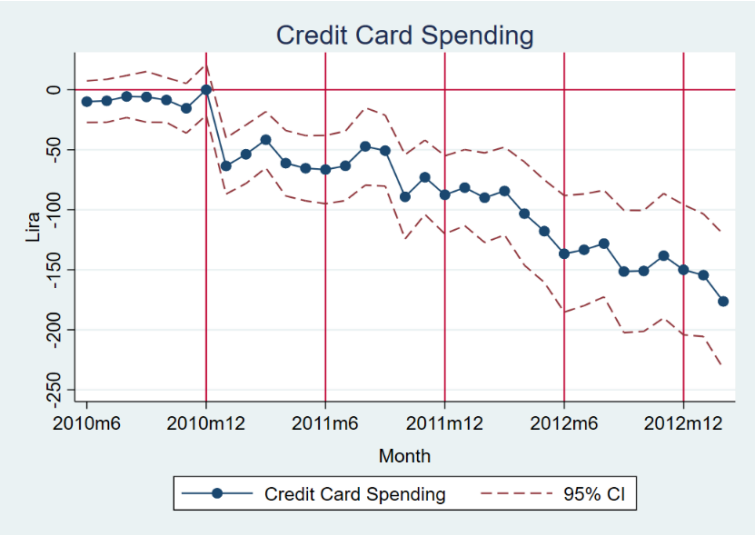
Panel B



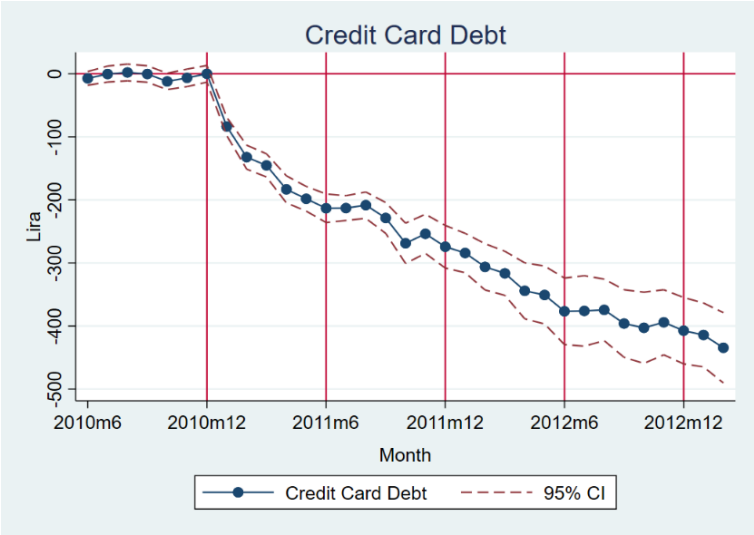
Notes: This figure illustrates the definition of treatment and control groups. Panel A depicts the treatment and control for consumers with a credit card limit of less than TL15,000. Panel B depicts the treatment and control for consumers with credit card limits between TL15,000 and TL20,000. The two groups are defined based on the likelihood of being treated in the twelve months before the policy announcement rather than actual treatment after the policy. The two groups remain fixed and are independent of the actual treatment after the policy announcement.

Figure 3: Policy effect on credit card spending, debt, and delinquencies: Event study estimates

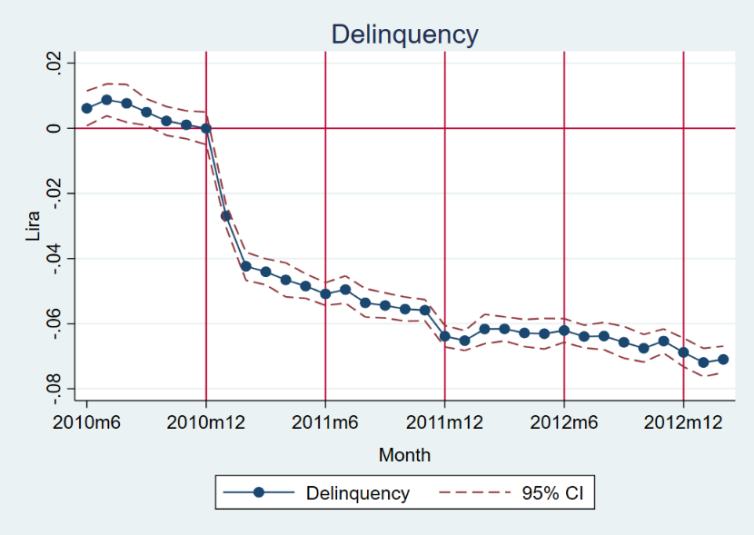
Panel A: Credit Card Spending



Panel B: Credit Card Debt



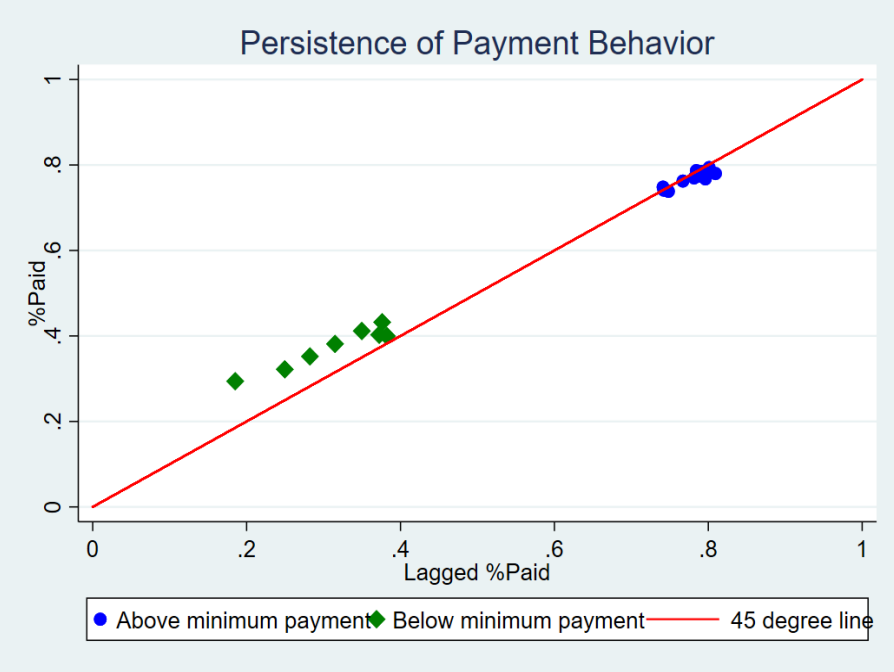
Panel C: Credit Card Delinquency



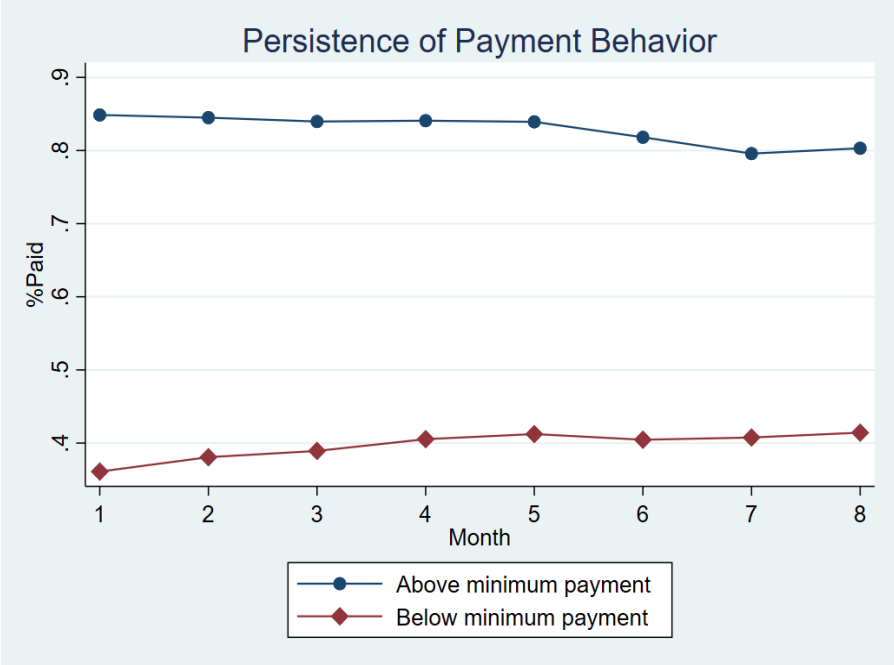
Notes: Figure in Panel A presents the event-study type analysis depicting the difference in credit card spending between the treatment and the control groups before and after the policy announcement in December 2010. All months after '2010m12' depict the change in credit card spending between the treatment and the control group attributable to the policy announcement. Figure in Panel B similarly shows the event study estimates for the difference in credit card debt between the treatment and the control group. Finally, the figure in Panel C shows the event-study estimates for the difference in 60-day delinquencies between the treatment and the control group before and after the policy announcement. The dots show the estimated coefficients, and the bars striking through them show the 95% confidence intervals.

Figure 4: Persistence in payment behavior

Panel A: Payment behavior in the current and previous months compared



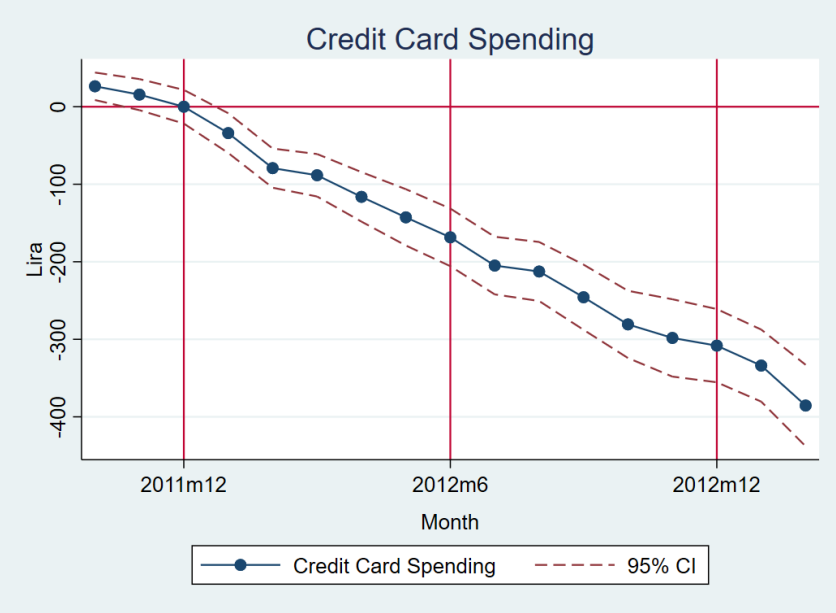
Panel B: Payment behavior for low-payers and higher-payers over eight months



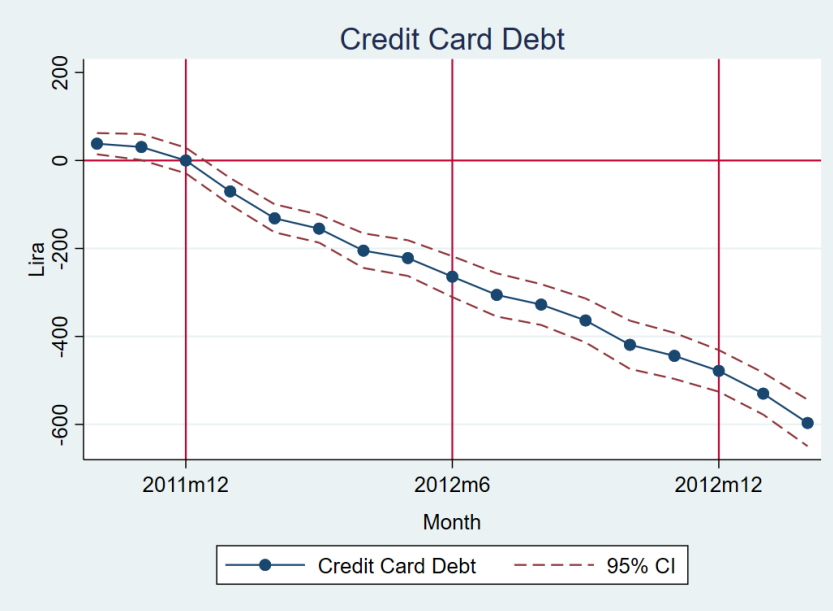
Notes: This figure shows the persistence in payment behavior for low-payers and high-payers before the policy announcement in December 2010. Panel A compares the relationship between payment behavior in the current and the previous month. The green cluster on the left shows the low-payers (treatment group), and the blue cluster on the right shows the high-payers (control group). Panel B shows persistence in payment for eight subsequent months for the low and the high payers. The red line depicts payment over time for the low-payers (treatment group), and the top blue line shows the payment behavior for the high-payers (control group). Low payments, on average, follow low payments, and high payments follow high payments; payment behavior is persistent.

Figure 5: MP treatment effect on credit card spending and debt

Panel A: Credit Card Spending



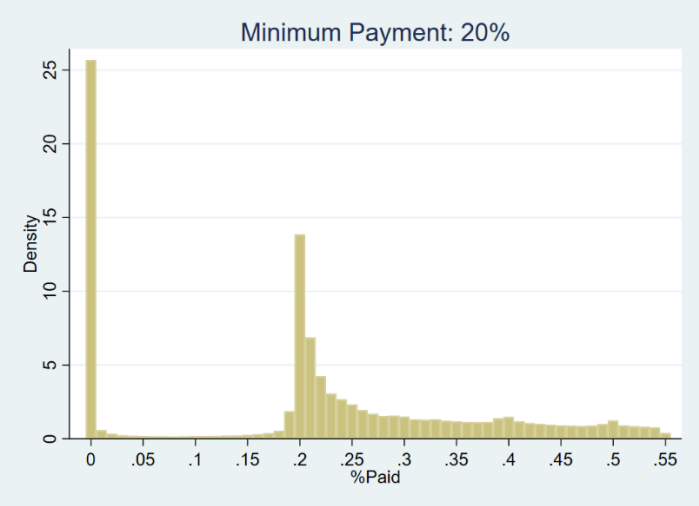
Panel B: Credit Card Debt



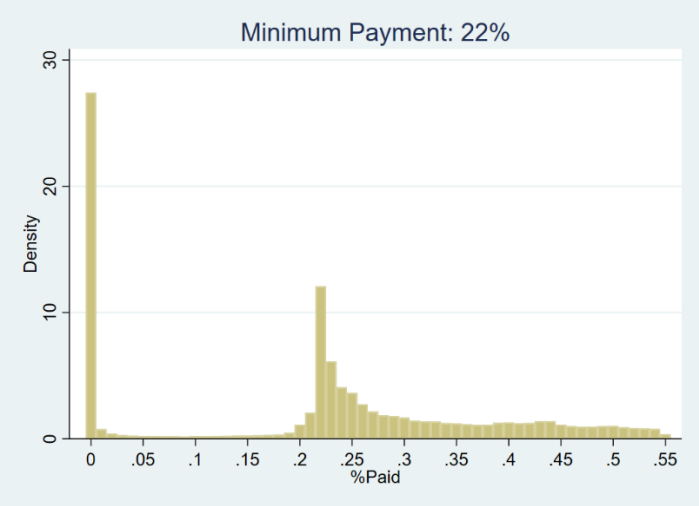
Notes: The figure in Panel A presents the event-study type analysis depicting the difference in credit card spending between the treatment and the control groups before and after December 2011. The control group consists of only the new credit cards opened after the policy announcement that do not experience a change in the required minimum payment for an entire calendar year. As a result, the plotted difference-in-difference coefficients represent only the MP treatment effect. All months after '2011m12' depict the change in credit card spending between the treatment and the control group attributable to the treatment. The figure in Panel B similarly shows the event study estimates for the difference in credit card debt between the treatment and the control group. The dots show the estimated coefficients, and the bars striking through them show the 95% confidence interval.

Figure 6: Bunching around required minimum payment ratios

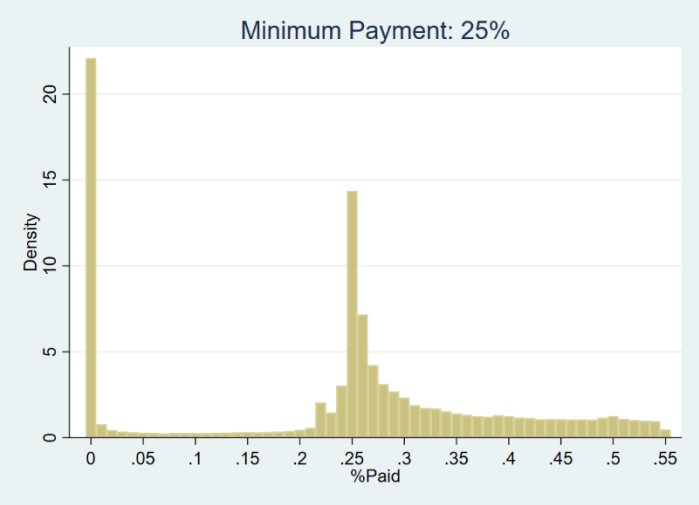
Panel A: %paid dist. at minimum payment ratio of 20%



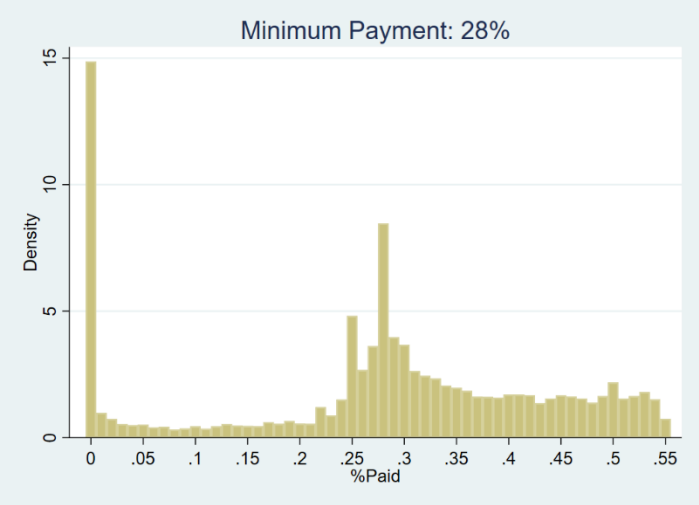
Panel B: %paid dist. at minimum payment ratio of 22%



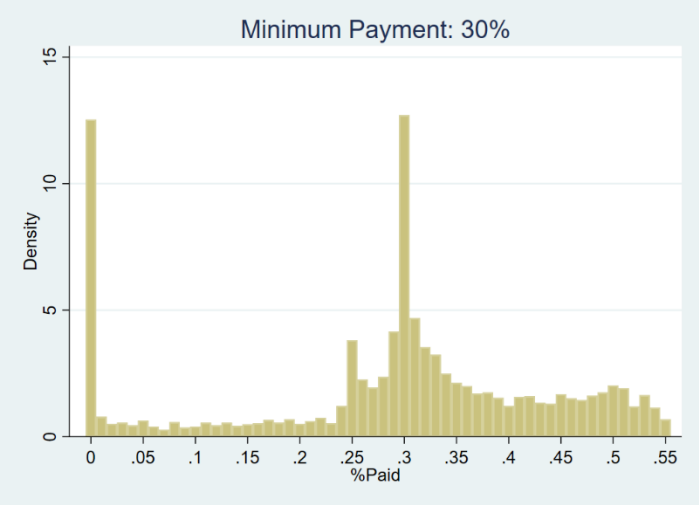
Panel C: %paid dist. at minimum payment ratio of 25%



Panel D: %paid dist. at minimum payment ratio of 28%

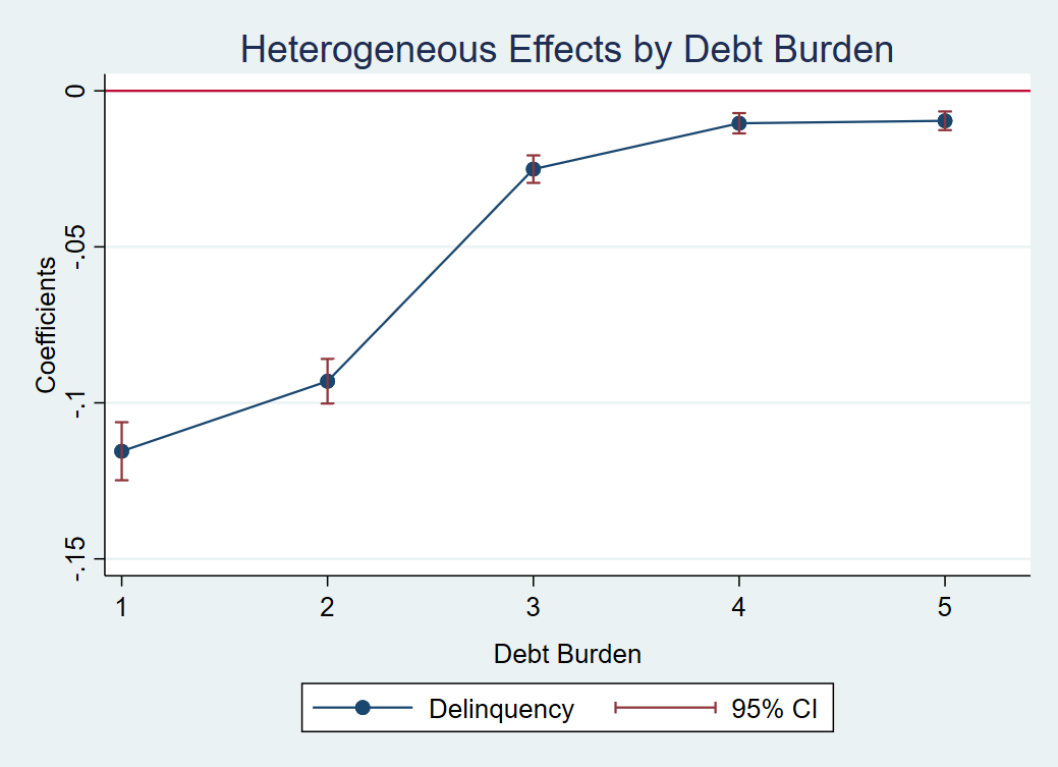


Panel E: %paid dist. at minimum payment ratio of 30%



Notes: This figure shows the histogram of the percentage of monthly credit card balance paid at different required minimum payment ratios. Panels A-E show the histograms for minimum payment ratios of 20%,22%,25%, 28%, and 30%, respectively.

Figure 7: Delinquency across debt burden quintiles



Notes: This figure shows the average change in the rate of delinquencies after the policy. The sample is divided into quintiles based on the individual's debt burden, measured as an unpaid monthly credit card balance. The horizontal axis shows the debt burden quintiles, and the vertical axis shows the average change in delinquency rates after the policy. The dots show the estimated delinquency rates, and the bars striking through them show the 95% confidence intervals

Appendix

A.1 Institutional background

As of December 2016, more than 58 million credit cards were held by Turkey's 74 million citizens, making it the second-largest credit card user in Europe. The explosive growth in the Turkish credit card market can be attributed to several factors. First, GDP per capita almost tripled between 2002 and 2010, and consumer spending accounts for 70% of Turkey's GDP[11]. Most of this increase in consumer spending was financed by debt, including personal loans, household loans, and credit cards. Household debt as a proportion of disposable income increased from 4.7% in 2002 to 50.4% in 2012[12]. Second, credit was and still is readily attainable in Turkey. Banks use aggressive marketing techniques, including booths in crowded urban areas offering on-the-spot credit card approval. Further, instant approval made credit card or personal loan applications available on smartphones and ATMs. The Turkish population financed their newfound prosperity with debt, reducing their savings to historically low levels.

To further understand the Turkish credit card market, we compare some crucial elements between the Turkish and US markets.

The minimum payment rules and penalty fees for late payment are quite different for Turkish and US credit cards. First, there is no floor in the Turkish case. The minimum payment is a percentage of the outstanding credit card balance. Before December 2010, it was 20% across all credit card users but increased progressively to 40% after implementing the new policy. As a result, the average minimum payment is much smaller in the US than in Turkey. The minimum payment in the US is typically between 1% and 4% of the balance. Second, penalty fees are also structured differently between the two markets. In the US, late payment penalties are usually fixed at $25 to $35, arguably relatively high, given that the minimum payment is, on average, less than $100. In Turkey, the late penalty fee depends on the rate set every quarter by the Central Bank of Turkey.

Panel A of Figure A.2 presents a chart of penalty rates over our sample period. Monthly penalty rates varied from 2.62% to 3.55%. Panel B shows the late payment penalty for different monthly payment levels. Panel B was created assuming a minimum payment requirement of 20%. There are no late fees charged for payments of 20% or higher. However, for payments below 20%, the penalty is assessed as the difference between the minimum payment and the actual payment, multiplied by the penalty rate and adjusted for the number of days between the payment due date and the next statement date. For example, consider the following scenario: credit card debt of TL3000, minimum payment rate of 20%, penalty rate of 3%, January 15 as the statement date, January 25 as the payment due date,

[11] Central Bank of the Republic of Turkey; Turkish Statistical Institute
[12] Financial Stability Report, CBRT

February 15 as the next statement date, and the actual payment of TL300 made before the payment due date. The late fee on the February 15 statement would be TL6 ([(600-300)*3%*20/30]).

Similarly, with no payment, the penalty would be TL12. However, this is only the late payment fee, excluding the interest rate regularly charged for outstanding credit card balances. Table A.2 shows the calculation of all interest and penalty charges using the example above. In general, the late payment penalty is much lower in Turkey; however, regular interest charges are comparable to those in the United States.

Finally, the distribution of payment behavior is strikingly different in the two markets. For example, not more than 30% of credit cardholders in the US can be classified as full payers, based on Agarwal et al. (2015). This figure is much lower than 80% of full payers in Turkey, based on the survey results of the Interbank Card Center (ICC), a centralized entity for clearing and settlement of all credit and debit card transactions in Turkey.

A.2 Robustness checks

We conduct several tests to check the robustness of our main results. First, we run the baseline regressions using the policy implementation instead of the policy announcement as the alternative policy date. We find qualitatively identical and quantitatively very similar results, shown in Table A.3. Second, we use an alternative definition of treatment to see if the results in Table 3 still hold (Table A.4). Here, the treatment group consists of consumers that pay below the minimum for at least three out of twelve months before the policy. Third, we use propensity score matching (PSM) to define the treatment and control variables (Table A.5). Fourth, we conduct a falsification test where we randomly assign individuals into treatment and control groups (Table A.6). Fifth, we separate the MP treatment into three categories to see if any specific group drives the results within the treated consumers (Table A.7). The categories are based on the minimum payment ratio before the policy. They include the following brackets: less than 20%, 20%-25%, and 25%-30%, respectively. This test also provides insights into the difference between constrained and unconstrained consumers' spending and debt payment behavior. Finally, we test if the main results hold after including full payers in our sample (Table A.8). All five tests support our main findings and conclusions.

First, we repeat the analysis from Table 3 but use the policy implementation instead of the policy announcement as the official start of the policy. In other words, the post-policy variable in our regressions is equal to 1 for months after June 2011 (instead of December 2010). The goal is to estimate consumption response following the implementation, ignoring the period before the policy announcement. The definition of this treatment variable is identical as in the baseline case except that it is measured using consumers' behavior in the six months before the policy implementation, i.e., between January 2011 and June 2011. Therefore, the pre-policy sample includes the period between January and June 2011, while the post-policy period starts in July 2011 and goes for the following

twenty-four months. The results are reported in Table A.3. The regression coefficients confirm all the results in Table 3. The spending and debt fall after the policy is implemented, and they decline more at each subsequent six-month interval. The coefficients are very similar in magnitude in most cases, but there are some slight differences. Spending seems to decline more on average following the policy implementation than the policy announcement. Debt, on the other hand, declines more if post-announcement months are included. This effectively reveals that consumers started paying more debt right after the announcement but only started reducing consumption after the policy was implemented. This makes sense since changing consumption habits, especially if it involves a reduction, is always an unpleasant and challenging task.

Second, we check our main results by using an alternative treatment definition. In this version, the treatment group consists of individuals that failed to make the minimum payment four or more times between January 2010 and December 2010. By extension, the control group includes consumers that pay the minimum at least three times in the same period. The results are shown in Table A.4. All the coefficients are very similar to the baseline results in Table 3. It shows that the main results in our paper are very robust to alternative definitions of the treatment variable, indicating that the decline in credit card spending and debt is a valid and firm empirical fact we establish in this paper.

Third, we use propensity score matching (PSM) to define the treatment and control variables in an alternative way. Using demographic and credit-card-related variables for PSM, we ensure that the treatment and control groups are closely comparable. As a result, we reduce potential bias due to confounding variables in the original definition of our treatment and control. We use PSM to predict the likelihood of being treated by the policy overall, not by separate policy rules. For that reason, we only have one PSM-treatment definition, in contrast to having both CA and MP+CA treatments as in the original case. The results are shown in Table A.5. Panel A reports the average effect of the policy using the PSM treatment, and Panel B looks at the dynamics of the policy impact. The results are qualitatively and quantitatively similar to Table 3 and confirm our intuition about the policy effects. Most importantly, Table A.5 provides additional support regarding our definitions of the treatment and control groups; they robustly capture the policy effects even after controlling for differences in demographics and other credit card-related variables.

Fourth, we conduct a falsification test, randomly assigning individuals into treatment and control groups. The cash advance rule treats around 27% of our sample (when full payers are excluded), and 13% are treated by cash advance and minimum payment rules. Using these proportions, we randomly allocate consumers into the CA and the combined MP+CA treatments. We then run our baseline difference-in-difference regression using these random treatment assignments. A negative and significant relationship would raise the concern that simple spurious variation drives the documented impact of the policies. The results are shown in Table A.6. None of the coefficients is

statistically or economically significant. Thus, the results indicate that the identification of our main findings is not due to random variation.

Fifth, we separate MP treatment into three categories based on minimum payment ratios: less than 20%, 20-25%, and 25%-30%. We run the same difference-in-difference regressions as in Panel A of Table 3 for each of the three levels. The results are presented in Table A.7 show that any specific category does not drive the reduction in credit card spending and debt; consumers reduce their spending and debt regardless of the specific minimum payment category they belong to. All the coefficients are in the order of magnitude we see in Table 3. However, it is interesting that the spending falls the most for the last category, but debt repayment is the highest for the second category, i.e., consumers with a minimum payment ratio between 20%-25%. In other words, consumers with the highest minimum payment requirements reduce their consumption the most, but not necessarily their debt. This is consistent with the theory of consumption under liquidity constraints. The most constrained consumers reduce their consumption the most in order to break away from those constraints. Other treated consumers, although less constrained, also reduce their consumption proportional to their constraints.

Finally, we replicate those results, including full payers, and report the findings in Panel A and B of Table A.8. The results are quantitatively and qualitatively very similar to the results using the baseline sample in Table 3. However, the results are somewhat stronger when the full payers are included, indicating that our baseline sample is more conservative but yields virtually identical results. For comparison, we also include descriptive statistics for the entire sample and the control group, keeping the full payers in both cases. When we compare the control group without the full payers (Table 1) and the control group with full payers in Panel D of Table A.8, we see that the latter has lower average monthly spending and debt. In addition, they are similar in terms of age, gender, and payment ratio. This suggests that full payers have lower spending. Moreover, since they pay their debt in full, they also have lower debt, on average.

A.3 Heterogeneity in consumption response

A.3.1 Heterogeneity across demographic traits

In addition to the aggregate results, we study how BRSA's policy affects different consumer groups based on characteristics such as gender, age, marital status, and occupation. We discuss the results here but report the results in Table A.14.

We find that males, married individuals, and private-sector employees experience a uniformly larger decline in spending and debt than females, singles, and public-sector employees. On the other hand, delinquencies drop somewhat more for females, singles, and public-sector employees. Older consumers reduce their debt more and their

spending less than younger consumers. Delinquencies also drop somewhat more for younger individuals. The detailed results are shown in Panel A and B of Table A.14. We observe the most drastic differences in credit card debt and spending between the genders. The reduction of spending and debt for males is even more dramatic if we analyze these coefficients within the context of Turkish society. Male credit cardholders constitute about 85%, and married consumers about 83% of our sample. The fact that males and married consumers see a more substantial drop in consumption is not surprising, as Turkey is still, by and large, a male-dominated society; men are the sole or primary breadwinners in the family.

Furthermore, in most cases, individuals with private-sector jobs have higher employment uncertainty and more volatile income. On average, the private sector salaries are higher than those in the public sector employees but have less job security, resulting in higher income sensitivity. The results we observe for the two employment categories are consistent with Agarwal et al. (2017), who studied consumption response to a large, unexpected interest rate hike in Turkey in 2014. They also find that consumers with less stable income and employment show a stronger effect on consumption and cash demand in response to this unexpected monetary policy shock. The differences in debt across all these characteristics seem more pronounced for the MP+CA treatment than the CA treatment. The policy seems to affect all consumers, regardless of demographics, but the impact is marginally stronger for males, married individuals, and private-sector employees.

A.3.1 Heterogeneity based on consumption type: Is the policy's impact on delinquencies driven by reduction in discretionary consumption?

The next test of heterogeneous response to BRSA's policy looks at the change in discretionary and non-discretionary consumption. We hypothesize that the reduction in delinquencies we uncover in Table 6 might be possible if lower consumption is primarily driven by discretionary consumption. Table A.11 reports the average discretionary and non-discretionary consumption changes for the CA and combined MP+CA treatments. Discretionary consumption includes non-essential goods and services such as alcohol, tobacco, jewelry, travel, restaurants, sports, and entertainment. We find that consumers cut down much more on discretionary than non-discretionary consumption. Namely, the discretionary consumption falls on average by TL91.12 ($50.90) and TL 87.39 ($48.82) for the CA, and the MP+CA treatments, respectively. The non-discretionary consumption falls by TL16.49 ($9.21) for the CA treatment and TL16.11 ($9) for the MP+CA treatment. It shows that consumers with relatively higher discretionary spending cut down on their purchases to meet the new minimum payment and avoid delinquency. Non-discretionary consumption declined, but the magnitude is much smaller than the former. This result is likely due to the greater difficulty in reducing the consumption of basic life necessities such as food, groceries, hygiene, and healthcare products and services. In sum, we find that a decline in discretionary consumption mainly drives the reduction in overall consumption, and consumers with less outstanding debt drive the reduction in delinquencies. Therefore, the

drop in the overall delinquency rate is likely due to the relative ease with which some treated consumers can reduce their (discretionary) consumption.

A.3.3 Heterogeneity based on asset ownership and debt behavior: are consumers switching from credit cards to other forms of liquidity?

Our results indicate that the policy had a sizeable impact on credit card spending and debt payment behavior. However, whether the policy changed total consumption is not evident. There are three concerns we need to address. First, consumers might fully substitute credit cards with debit cards and cash, with no real impact of BRSA's policy on total consumption. Second, consumers in the treatment group may switch to credit cards from other banks. Third, they might switch to other types of consumer credit such that the total consumption remains unaffected. We provide detailed discussion regarding these three issues below.

A.3.3.1 Substituting credit card spending with spending from cash, debit card or other assets

Consumers may switch from credit cards to other assets, such as debit cards, savings, and investment accounts. If this switching behavior were behind our results, we should predict a larger spending reduction for consumers with more assets and no spending reduction without these additional assets. Therefore, observing a policy-driven reduction in consumption for consumers with fewer assets implies a consumption decrease and not just a substitution from credit cards to other assets. Even though we do not have checking account information, our sample contains information about the presence of an investment account or car ownership that can serve as a proxy for liquidity. We separate our sample into groups based on an investment account or car ownership and run our baseline specifications. Results are shown in Table A.12. As reported in Panel A, individuals with no investment account reduce their spending and debt by TL107.5 and TL272.29, respectively. Investment account holders reduce spending and debt by TL85.4 and TL328.37. Both groups are similarly impacted by the policy, although the former reduces their spending more, while the latter reduces their debt more than the control group. Second, Panel B shows that spending and debt drop significantly for both groups but more for car owners. Namely, spending and debt for car owners fall by TL 160 and TL681, while only falling by TL103 and TL270 for individuals with no car. Table A.12 shows that even for consumers with fewer assets, BRSA's policy substantially impacts the treated individuals; the results suggest that liquidating savings/investment assets cannot fully explain the spending effects.

Furthermore, switching to debit cards or cash is unlikely for two reasons. First, it is challenging for consumers with low cash to substitute credit with debit cards or cash easily. Second, there is little to no incentive for consumers with much cash to engage in this substitution. Substitution with debit cards or cash can only happen for consumers with enough cash holdings. Consumers with low cash cannot simply substitute credit card debt with cash or debit card

balances because they lack those resources in the first place. Therefore, observing a policy-driven reduction in consumption for low-cash consumers implies a consumption decrease and not just a substitution from credit card to cash/debit card spending.

Additionally, we test for potential substitution effects from credit cards to cash or debit cards by investigating the heterogeneity in consumption across 'revolvers' and 'non-revolvers.' Consumers with low cash are often 'revolvers,' i.e., they roll over their debt every month because they lack the resources to pay it off entirely, and this practice allows them to maintain a consistent level of consumption by pushing the payment to future dates. Non-revolvers are defined as consumers that make full payments every month from the beginning of the sample but before policy implementation, i.e., between January 2010 and June 2011 (18 months). On the other hand, revolvers make at least one payment smaller than 100% of the balance during those 18 months. We also create an alternative definition of payments only during the last six months before the policy implementation, not from the beginning of the sample (6 months). We run difference-in-difference regressions separately for revolvers and non-revolvers, reporting only the coefficients for credit card spending. The results are shown in Table A.13.

Table A.13 tells a consistent story: severely constrained consumers were forced to reduce their consumption more and sooner than the less constrained consumers. Panel A shows that revolvers reduce their spending more than non-revolvers, regardless of the type of treatment or the definition of revolvers. The coefficients in Panel B uncover an interesting dynamic. The revolvers reduce their spending much faster than the non-revolvers; however, by the end of the policy, the gap is reduced or completely reversed, depending on the revolver definition. Both groups reduce their spending; however, unlike non-revolvers with relatively higher cash holdings, revolvers have no financial capacity to quickly move their spending from credit cards to debit cards or cash. Hence, the reduction in revolvers' consumption we uncover likely reflects an actual drop in consumption.

We observe that non-revolvers also reduce their credit card spending. Since we have no debit card or cash spending data, it is not easy to attribute their reduction in credit card spending to a drop in real consumption or substitution from credit to debit cards. However, the substitution explanation is unlikely since non-revolvers have no real incentive to substitute their credit card spending. When a consumer substitutes a credit card with a debit card, he has to pay the total amount for all purchases immediately instead of postponing the payment to a future date. Even if a consumer can pay the total amount upfront, it is still beneficial to pay with a credit card now and pay the balance at the end of the billing cycle without incurring interest charges. A consumer would do so to keep cash in case of an emergency, collect points, miles, or cash-back rewards that were a significant competition focus among Turkish credit cards. Overall, low-cash consumers have no means, and high-cash consumers have no incentive to switch from credit cards to debit cards or cash.

Anecdotal evidence also suggests it is challenging for many consumers to substitute credit cards with cash, debit cards, or other types of consumer loans. The popular Turkish press indicated that many consumers were anxious and in a state of panic when they learned that the policy would affect them. Consumers' Rights Association warned BRSA that they would be responsible for suicides, divorces, and family dramas if they implemented the policy. Such extreme responses to BRSA's policy would not be possible if most consumers could switch from credit cards to debit cards or other cheaper forms of credit. Indeed, many consumers relied heavily on multiple credit cards to roll over their monthly debt. That practice was done out of necessity by many low-income and liquidity-constrained consumers, and it became a common practice. BRSA's policy made this practice difficult or impossible; hence, consumers' outrage was more than vocal. This evidence suggests that it was challenging for many consumers to substitute credit cards with cash, debit cards, or other types of consumer loans.

A.3.3.2 Switching to credit cards in other banks

We only have data from a single bank, so we cannot provide direct evidence of all consumer spending and consumption. However, switching to other credit cards in current or new banks is unlikely for several reasons. First, the policy is implemented across all banks in Turkey simultaneously. Second, maximum interest and penalty charges for all credit cards are imposed by the Central Bank of Turkey (CBRT). In other words, maximum interest and penalty rates do not vary across banks or credit cards. Akin et al. (2011) show that almost all banks in Turkey, except some small banks, have charged the maximum rates since the interest rate ceiling implementation started in 2006. They show that the competition in the Turkish credit market is driven almost exclusively by non-price factors; in terms of interest rates, Turkish banks behave in a *de facto* monopolistic manner. Finally, it is essential to note that the policy is implemented at a card level, not individual or bank; hence, switching banks or cards does not provide any 'relief' regarding BRSA's policy. Thus, there is no incentive to switch banks or credit cards in terms of interest rates or minimum payment requirements.; substitution to credit cards at other banks would bring no benefit.

As a result of the interest rate ceiling policy implemented in 2006, individuals with existing credit cards at different Turkish banks are likely to have had very similar terms and conditions, which was the case after 2006 in Turkey. It is questionable if consumers would optimally allocate spending and debt payment across multiple cards following the BRSA's policy, even if that were not the case. A recent study by Gathergood, Mahoney, Stewart, and Weber (2019) find that individuals do not optimally allocate payments across credit cards to minimize the cost of borrowing. Instead, they allocate repayments according to a balance-matching heuristic where the repayment on each card is matched to its balance. Ponce, Seira, and Zamarripa (2017) similarly find that consumers with multiple credit cards do not minimize their borrowing costs using their cheaper cards. On the contrary, debt revolvers usually borrow on a higher-interest card, increasing their borrowing cost by 31% relative to the minimum. The two studies show evidence that consumers do not necessarily behave in a cost-minimizing way, even when it is feasible.

Finally, we conduct our analysis using the difference-in-differences methodology. There are no differential incentives for those in the MP treatment group to switch to credit cards from other banks; the policy would still affect them similarly. However, there is a disadvantage to switching to another bank or opening a new credit card account at the same bank. In both cases, the consumer would operate under a 40% minimum payment requirement for at least a year, a strict mandate of BRSA's policy for all new accounts. Therefore, a consumer has no incentive to open a new credit card account at any bank, as his borrowing costs would only increase.

A.3.3.3 Switching to other credit types

Consumers may turn from credit cards to other unsecured consumer credit to avoid stricter policy requirements. If this switching behavior drove our results, we should predict a larger spending reduction for consumers with other unsecured consumer credit types while predicting no spending reduction for exclusively credit cardholders. Therefore, observing a policy-driven reduction in consumption for consumers with no other credit types implies a consumption decrease and not just a substitution from credit cards to other assets. To test this explanation, we utilize the sample of individuals in our data set who carry personal loans. We separate our sample into individuals with and without personal loans and run our baseline specification. The results are reported in Panel C of Table A.14 in the Appendix. The results show that the presence of personal loans does not change how credit cardholders react to BRSA's policy; it similarly affects individuals with and without personal loans. Spending and debt for personal loan holders drop by TL75 and TL512, and TL100 and TL273 for individuals without personal loans. These findings suggest that switching from credit cards to other forms of credit does not fully explain the effects of BRSA's policy. A more appropriate test here would investigate whether the policy has an impact on the usage of personal loans (the intensive margin) or on the propensity to open a personal loan (the extensive margin); however, our data set, unfortunately, does not contain information on the dynamics of usage of personal loans or other sources of credit and liquidity.

Another plausible alternative to credit cards is overdraft accounts. Consumers can switch from high-minimum payment credit cards to checking accounts with overdraft features. Our data set does not contain information about checking account balances and overdrafts, but evidence from Alan et al. (2017) reveals several reasons overdrafts are not a competition to credit cards in the Turkish context. Namely, overdrafts are more expensive than close substitutes such as credit cards and disproportionately priced to credit risk. Second, Alan et al. (2017) find that between September 2011 and April 2012, during the implementation of BRSA's policy, 18.4% of their sample[13] overdrafted at least once with an average daily balance of TL4.42. Third, overdrafts start accruing interest immediately, whereas credit cards in Turkey start accruing interest ten days after the monthly statement date. Finally,

[13] Sample used in Alan et. al., 2017 comes from Yapi Kredi, one of the top 5 largest banks in Turkey.

Turkish regulators found that banks often failed to provide necessary disclosures about overdraft usage and charges, making access to this information difficult. These facts and findings suggest that overdraft usage is less widespread, less understood, and more expensive than credit cards, implying that it would not serve as a plausible alternative to credit cards in the context of avoiding higher minimum payments from BRSA's policy.

In sum, consumers in the treatment group have no incentive to switch to credit cards from other banks or to other types of consumer loans. Moreover, consumers are unlikely to substitute credit cards with debit cards or cash, at least not entirely. Our results suggest that the BRSA's policy affects not only credit card spending but also real consumption.

A.4 Model Simulation of Consumption and Debt for Soft-Constrained Consumers

We employ a model based on consumption and precautionary saving with hard and soft constraints to confirm that our hypotheses and empirical results are grounded in theory. The general theoretical model for consumption under soft liquidity constraints is found in Fernandez-Corugedo (2002), which is based on the consumption model under hard liquidity constraints in Carroll and Kimball (1996, 2021). Fernandez-Corugedo (2002) shows that consumer behavior under soft liquidity constraints is similar to that under hard constraints but with a lesser magnitude. In other words, consumers will reduce consumption and increase precautionary savings under hard and soft liquidity constraints, albeit to a larger extent in the former case. Soft liquidity constraint can be best understood as the increase in the cost of borrowing, without losing the borrowing capacity.

We briefly review the consumption model under both hard and soft constraints to emphasize the similarities and differences.

The standard consumption problem, examined by Carroll and Kimball (1996) is one of a representative consumer that maximizes time-additive discounted utility from consumption $u(c)$. More specifically, labeling consumption in period t c_t, labor income $\tilde{y}_t$, and gross wealth w_t, gross interest rate $\tilde{R}_t$, and time preference factor $\tilde{\beta}_t$, the consumption problem can be written (using value function representation) as follows:

$$V_t(w_t) = max_{c_t} u(c_t) + E_t \sum_{s=t+1}^{T} \left[\prod_{j=t+1}^{s} \tilde{\beta}_j \right] u(c_s)$$

$$s.t$$

$$w_{t+1} = \tilde{R}_{t+1}[(w_t - c_t)] + \tilde{y}_{t+1}$$

$$and$$

$$terminal\ condition\ c_T \leq w_T$$

Solving the consumption problem yields the following Euler equation that implies that consumption is maximized when marginal utility of consumption at the time t equals the discounted marginal utility of consumption at time $t+1$:

$$u'(c_t) = E_t \tilde{\beta}_{t+1} u'(c_{t+1}) \tilde{R}_{t+1}$$

For discussion below, let's define savings as,

$$s_t = w_t - c_t \ \forall \ t$$

Carroll and Kimball (2021) look at the implications for consumption and savings behavior associated with hard constraints or the condition that savings, $s_t \geq 0$ at all times. This implies that consumers cannot borrow at any point in their lifetime. Carroll and Kimball (2021) prove that introducing the restriction that $s_t \geq 0$ at all times makes the marginal value function V_t convex at the point where the constraint begins to bind, even if utility functions are quadratic. With the quadratic utility, this leads to precautionary saving behavior in the face of liquidity constraints because the expected marginal utility of savings increases. In other words, constraints induce precaution because constrained agents have less flexibility in responding to shocks when the effects of the shocks cannot be spread out over time. The precautionary motive is heightened by the desire (in the face of risk) to make future constraints less likely to bind.

To prove that the marginal value function becomes more convex, Carroll and Kimball (2021) show that introducing the liquidity constraint leads to an increase in the slope of the marginal value function V_t at the points where the constraint is binding. This creates a kink in the marginal value function, making it convex. If this kink interacts with risks associated to either the labor income process, the rate of return or both, then the expected marginal utility of savings will increase. The implication is that under hard liquidity constraints, the marginal propensity to consume is higher and the consumption level lower than the equivalent case without liquidity constraints.

Fernandez-Corugedo (2002) proves that soft liquidity constraints result in the same consumption and precautionary saving behavior as hard liquidity constraints. In other words, introducing a soft constraint in the next periods leads to less consumption and precautionary savings in the current period. Moreover, Fernandez-Corugedo (2002) shows that the amount of precautionary savings is lower under soft and hard constraints. The intuition behind this result is simple: when consumers cannot borrow, they must have savings to avoid shocks that could leave them with low income levels. Therefore, relaxing the borrowing constraint means consumers do not need these (high) savings to avoid adverse shocks to income.

More formally, Fernandez-Corugedo (2002) builds on Carroll and Kimball to provide a general model for consumption under soft liquidity constraints by introducing a function for the cost of borrowing/soft constraint into the consumption problem without specifying a functional form. Following the notation and the standard consumption model above, Fernandez-Corugedo (2002) adjusts the problem by introducing the cost of borrowing function $f(w_t - c_t)$ into the budget constraint.

$$V_t(w_t) = max_{c_t} u(c_t) + E_t \sum_{s=t+1}^{T} \left[\prod_{j=t+1}^{s} \tilde{\beta}_j \right] u(c_s)$$

$$s.t$$

$$w_{t+1} = \tilde{R}_{t+1}[(w_t - c_t) - f(w_t - c_t)] + \tilde{y}_{t+1}$$

$$and$$

$$terminal\ condition\ c_T \leq w_T$$

The soft constraint/cost of borrowing function $f(w_t - c_t)$ can either be discontinuous or continuous. In the first case, the function kicks in after savings fall below a threshold, i.e., when savings are negative or if debt reaches a particular level. In the continuous case, the cost function will look like an asymmetric adjustment cost function. It is assumed that $f'(.) < 0$, $f''(.) > 0$, and $f'''(.) \leq 0$, i.e., cost of borrowing increases as borrowing increases.

As above, solving the consumption problem yields the following Euler equation(s):

$$u'(c_t) = E_t \tilde{\beta}_{t+1} u'(c_{t+1}) \tilde{R}_{t+1}[1 - f'(w_t - c_t)]\ \ in\ the\ continuous\ case, or$$

$$u'(c_t) = \max\left[E_t \tilde{\beta}_{t+1} u'(c_{t+1}) \tilde{R}_{t+1}[1 - f'(w_t - c_t)], E_t \tilde{\beta}_{t+1} u'(c_{t+1}) \tilde{R}_{t+1}\right]\ in\ the\ discontinuous\ case$$

The implication of the above Euler equation because of $[1 - f'(w_t - c_t)] > 1$, $u' > 0$, and $u'' < 0$, is that when the constraint binds, the consumption will be reduced in period t and increased at time $t + 1$.

Fernandez-Corrugedo first proves that introducing the soft constraints for a given level of savings changes the slope of the marginal value function, i.e., it makes it more convex. They show that the more convex the $-f'$ is, the more convex the marginal value function will be, resulting in the behavior of the soft-constrained consumer closely resembling the behavior of the hard-constrained consumer. Next, Fernandez-Corrugedo also proves that (income or rate of return) risk at a point when soft constraint begins to bite is essential to increase the expected marginal value function and therefore increase the marginal utility of savings (and the level of savings). This proof is identical to Carroll and Kimball's (2021), further showing that hard and soft constraints similarly impact consumer behavior. The above two proofs are sufficient to conclude that introducing the cost of borrowing constraint can induce

precautionary savings when a consumer faces risk, leading to a strictly positive probability that a soft constraint will bind in the next period. In sum, soft constraints make the marginal value function more convex while the risk increases the marginal utility of savings leading to more savings and less consumption.

Therefore, introducing the (soft) liquidity constraint next period leads to precautionary savings because the higher expected marginal utility of saving will drive the consumer to consume less and save more now.

The policy we study in this paper is unique in that it introduces soft liquidity constraints. Namely, it does not eliminate borrowing but makes it costlier to borrow. This cost is manifested in a higher minimum payment ratio, implying a higher effective interest rate unless a consumer can meet the new minimum payment. Since BRSA's policy implements higher borrowing costs only when the minimum payment is not met, it is akin to the discontinuous case in Fernandez-Corugedo (2002). This higher cost of borrowing, i.e., a soft liquidity constraint, based on models in Carroll and Kimball (1996, 2021) and Fernandez-Corugedo (2002), should reduce consumption and increase precautionary savings (reduce debt) at the time of the policy to prevent the policy-induced soft constraints from binding.

In the simulations below, we show three cases: consumption under a hard liquidity constraint, consumption under a soft liquidity constraint (akin to a pre-policy scenario), and consumption under a more restrictive soft liquidity constraint (akin to a post-policy scenario). In all three cases, we keep all parameters the same except for the borrowing constraint and the cost of borrowing. There is no borrowing in the first scenario, and the cost of borrowing is higher in the third relative to the second scenario.

The total monthly cost of borrowing in the case of Turkish credit cards has several components as shown in Table A.2 and replicated below:

	Calculation
Statement Balance	
Minimum Payment	Balance * Minimum Payment Ratio
Actual Payment	
Unpaid Statement Balance	Balance-Actual Payment
Unpaid Minimum Payment	max(0, Minimum Payment - Actual Payment)
Days Between Statement Date and Due Date	(September 3 - August 24)
Days Between Due Date and Next Statement Date (Days Late)	(September 23 - September 3)
Interest Charge 1	If Actual Payment≥Minimum Payment: (Unpaid Balance * Interest Rate) If Actual Payment<Minimum Payment: (Unpaid Balance * Interest Rate)*10/30
Interest Charge 2	If Actual Payment≥Minimum Payment: 0 If Actual Payment<Minimum Payment: (Statement Balance - Minimum Payment)* Interest Rate *20/30
Penalty Charge	(Unpaid Minimum Payment * Penalty Rate*Days Late/30)

If the actual payment is greater than or equal to the minimum, the borrowing cost is:

$$(Debt_{t-1} - Paid_t) \times r_t = ((w_{t-1} - c_{t-1}) - Paid_t) \times r_t$$

If the actual payment is lower than the minimum the borrowing cost, ignoring taxes, is:

$$(Debt_{t-1} - Paid_t) \times r_t \times \frac{Days\ from\ statement\ to\ payment_t}{30}$$

$$+ Debt_{t-1} \times (1 - ReqMinPay) \times r_t \times \frac{Days\ from\ payment\ to\ next\ statement_t}{30}$$

$$+ (Debt_{t-1} \times ReqMinPay - Paid_t) \times (r_t + 0.5\%) \times \frac{Days\ from\ payment\ to\ next\ statement_t}{30}$$

The extra charge is 0.5% a month (6.17% effective annual rate) on the difference between the minimum payment before and after the policy. The 0.5% is the fixed difference between the regular and penalty borrowing rates in Turkey, at least during our sample.

Let us consider the example shown in Table A.2. Panel A shows the formulae used to calculate the cost of borrowing. Panel B shows the assumptions for the statement balance, interest and penalty rates, and minimum payment ratios. Panel C shows the resulting interest and penalty charges for three cases: payment below the policy minimum (Columns 1-2), payment between the pre-policy and post-policy minimum (Columns 3-4), and payment above the policy minimum (Columns 5-6). When payment is below the minimum we have the two separate interest rate charges and the penalty, resulting in roughly 7% higher total interest and penalty charges post-policy. That is the net jump in the cost of borrowing assuming no change in payment behavior after the policy. Columns 3-4 show what happens if the pre-policy payment is above the minimum pre-policy, but fails to meet the new minimum after the policy. In Column 3 we only have a regular interest charge for the unpaid balance, for 30 days between the previous and current statement dates. Column 4 shows that no change in the payment behavior results in a roughly 4.75% increase in interest charges. Finally, Columns 5-6 show that interest charges remain fixed if the actual payment is above the minimum, ceteris paribus. This example shows how BRSA's policy would impact credit card holders if there was no change in payment behavior before and after the policy.

As per Fernandez-Corrugedo (2002), soft liquidity constraint needs to interact with (labor or rate of return) risk to induce precautionary savings. As such, our model incorporates labor risk through imposition of permanent and transitory income shocks. Introduction of such non-trivial risk requires numerical solution. We employ the method of endogenous grid points (Carroll, 2006). To explain briefly, this method starts with choosing an exogenous grid of asset values that spans the range of values that could plausibly be achieved, compute the marginal value of assets at each of these points, calculate the value of consumption whose marginal utility is consistent with the marginal value of assets, and finally, find the endogenous grid point of market resources as the sum of assets and consumption for each period. The set of these grid points is then interpolated to construct the consumption function.

Below we show the graphs for life-cycle consumption and debt paths under the three scenarios: hard constraint, soft constraint, and a stricter soft constraint. Essentially, a soft constraint implies a higher cost of borrowing. We run the simulation using annual frequency. Here are the primary parameters we utilize in the simulations:

Parameter	Value
β	0.95
ρ	1.8
$R_{free} = R_{save}$	1.03
R_{borrow}	1.06
Retirement age	65

The graph shows three soft constraint cases jointly: baseline, single policy change, and four policy changes, six months apart. In each case, the policy announcement for all future policy changes is made at a single point in time. Hence, consumers are aware of any current and future soft liquidity constraints at the time of the announcement.

Our empirical results show that consumers reduce consumption and debt, consistent with the theoretical work of Carroll and Kimball (1996, 2021) and Fernandez-Corugedo (2002). This exercise is similar to that in Alonso (2018), which shows the impact of unexpected credit tightening policy on hard and soft-constrained consumers. As the graphs below show, when the policy is announced (6 months before the policy is implemented), we see a significant drop in consumption relative to the pre-policy scenario. For comparison, in Figure A.5, we also show both soft-constrained and hard-constrained consumers' consumption side by side. Both consumers have the same parameters in the calibration except for the borrowing-related parameters.

In our simulated model, the consumption falls by 16.4% following the policy announcement at age 45 with multiple policy changes. This is the magnitude of a consumption drop we observe in Figure A.6.

Debt behavior following the policy announcement shows a consistent decrease over time. Following our empirical results, we report the change in debt two years after the policy announcement compared to the baseline scenario. In the simulation, debt is 35.5% lower than debt in base case two years after the announcement. These results are shown in Figure A.7 below. Overall, our simulations are consistent with theoretical expectations and our empirical results.

Table A.1: BRSA's schedule and minimum payment ratios for the first rule

This table reports the required minimum payment ratio increases based on consumers' credit card limits, as mandated by the policy. The first column shows the brackets for the credit card limit, while the second column shows the corresponding consecutive changes in the minimum payment ratio. The last column shows the range of months during which those consecutive changes are implemented and enforced.

Credit Card Limit	Minimum Payment	Date effective
Less than 5,000	20%	0-12 months after policy
	22%	12-24 months after policy
	25%	After 24 months
5,000 – 15,000	20%	0-6 months after policy
	22%	6-12 months after policy
	25%	After 12 months
15,000 – 20,000	20%	0-6 months after policy
	22%	6-12 months after policy
	25%	12-18 months after policy
	28%	18-24 months after policy
	30%	After 24 months
Greater than 20,000	20%	0-6 months after policy
	22%	6-12 months after policy
	25%	12-18 months after policy
	28%	18-24 months after policy
	30%	24-30 months after policy
	35%	30-36 months after policy
	40%	After 36 months

Table A.2: Examples of interest and late payment charges before and after the BRSA's policy implementation

Panel A: Cost of Borrowing Calculation

	Calculation
Statement Balance	
Minimum Payment	Balance * Minimum Payment Ratio
Actual Payment	
Unpaid Statement Balance	Balance-Actual Payment
Unpaid Minimum Payment	max(0, Minimum Payment - Actual Payment)
Days Between Statement Date and Due Date	(September 3 - August 24)
Days Between Due Date and Next Statement Date (Days Late)	(September 23 - September 3)
Interest Charge 1	If Actual Payment≥Minimum Payment: (Unpaid Balance * Interest Rate) If Actual Payment<Minimum Payment: (Unpaid Balance * Interest Rate)*10/30
Interest Charge 2	If Actual Payment≥Minimum Payment: 0 If Actual Payment<Minimum Payment: (Statement Balance - Minimum Payment)* Interest Rate *20/30
Penalty Charge	(Unpaid Minimum Payment * Penalty Rate*Days Late/30)

Panel B: Assumptions for Cost of Borrowing Scenarios

Assumptions	Pre-Policy	Post-Policy
Statement Balance	5000	5000
Minimum Payment Ratio	20%	40%
Interest rate (monthly)	2%	2%
Penalty rate (monthly)	3%	3%
Days Between Statement Date and Due Date	10	10
Days Between Due Date and Next Statement Date (Days Late)	20	20

Panel C: Calculations for Cost of Borrowing Scenarios

	Pre-Policy (1)	Post-Policy (2)	Pre-Policy (3)	Post-Policy (4)	Pre-Policy (5)	Post-Policy (6)
Statement Balance	5000	5000	5000	5000	5000	5000
Minimum Payment	1000	2000	1000	2000	1000	2000
Actual Payment	500	500	1500	1500	3000	3000
Unpaid Statement Balance	4500	4500	3500	3500	2000	2000
Unpaid Minimum Payment	500	1500	0	500	0	0
Days Between Statement Date and Due Date	10	10	10	10	10	10
Days Between Due Date and Next Statement Date (Days Late)	20	20	20	20	20	20
Interest Charge 1	30	30	70	23.33333333	40	40
Interest Charge 2	53.3333333	40	0	40	0	0
Penalty Charge	10	30	0	10	0	0
Total Interest + Penalty	93.3333333	100	70	73.33333333	40	40

Table A.3: Spending and debt response to policy implementation

This table reports the difference-in-difference regression estimating the policy effect on credit card spending and debt. We report the estimates for spending, total debt, the proportion of debt paid, interest charges, and penalty, respectively. Panel A reports the average impact of the two policy rules, the CA treatment and the combined CA+MP treatment. Panel B shows the impact at each policy date for the combined MP+CA treatment. All treatment variables are defined in the period between January 2011 and June 2011 based on the credit card limits. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

Panel A

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(4)	(5)
CA * post	-106.3103***	-110.7679***	0.0401***	-0.9838***	-0.4199**
	(9.5115)	(10.6269)	(0.0012)	(0.0448)	(0.1663)
(MP + CA) * post	-124.3417***	-174.9723***	0.0624***	-2.7465***	-7.5367***
	(13.9998)	(17.9677)	(0.0021)	(0.1508)	(0.4923)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	13440334	13440334	13440334	13440334	13440334
Adjusted R-squared	0.500	0.637	0.424	0.483	0.567

Panel B

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(4)	(5)
CA * post	-106.3103***	-110.7679***	0.0401***	-0.9838***	-0.4199**
	(9.5115)	(10.6269)	(0.0012)	(0.0448)	(0.1663)
(MP + CA) * post-6m	-106.3754***	-49.2398***	-0.0071***	-1.5051***	2.3841***
	(10.5688)	(7.8383)	(0.0025)	(0.0899)	(0.2616)
(MP + CA) * post-12m	-111.2697***	-181.0990***	0.0697***	-2.6874***	-9.2083***
	(13.6377)	(18.5330)	(0.0023)	(0.1507)	(0.5802)
(MP + CA) * post-18m	-145.7578***	-252.4972***	0.1053***	-3.6061***	-13.2643***
	(16.5431)	(24.7365)	(0.0022)	(0.2103)	(0.7923)
(MP + CA) * post-24m	-153.2081***	-301.2152***	0.1202***	-4.0686***	-15.1015***
	(18.8485)	(28.9156)	(0.0026)	(0.2148)	(0.8064)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	13440334	13440334	13440334	13440334	13440334
Adjusted R-squared	0.500	0.637	0.425	0.483	0.567

Table A.4: Alternative MP-treatment definition

This table reports the difference-in-difference regressions estimating the policy effect on credit card spending and debt, using an alternative definition of the MP treatment. We report the estimates for spending, total debt, the proportion of debt paid, interest charges, and penalty, respectively. The table reports the average impact of the two policy rules, the CA treatment and the combined MP+CA treatment. MP treatment variable is equal to 1 if a consumer pays below the minimum more than three times between January 2010 and December 2010. The required minimum payment is defined in the policy text based on the credit card limits. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(4)	(5)
CA * post	-99.7927***	-104.3608***	0.0778***	-2.2088***	-0.5172***
	(5.7098)	(5.3134)	(0.0022)	(0.0592)	(0.1880)
(MP + CA) * post	-117.9596***	-244.9960***	0.1779***	-5.9102***	-19.2715***
	(10.8811)	(14.7120)	(0.0024)	(0.2508)	(0.8951)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	13440334	13440334	13440334	13440334	13440334
Adjusted R-squared	0.569	0.638	0.431	0.486	0.571

Table A.5: Treatment assignment using propensity score matching

This table reports the difference-in-difference regressions estimating the policy effect on credit card spending and debt when treatment is assigned using propensity score matching (PSM-treatment). We report the estimates for spending, total debt, the proportion of debt paid, interest charges, and penalty, respectively. Panel A reports the average impact of the PSM treatment. Panel B shows the impact at each policy date for the PSM treatment. We use cardholders' gender, age, education, marital status, city, job type, credit limit, card type, and card issuance month to predict participation in the treatment or control group. The independent variables are the interactions between a PSM-treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

Panel A

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(4)	(5)
Treatment * post	-111.4649***	-195.2607***	0.1173***	-3.5957***	-10.1178***
	(7.1541)	(6.5519)	(0.0021)	(0.0865)	(0.2664)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	7801514	7801514	7801514	7801514	7801514
Adjusted R-squared	0.572	0.642	0.426	0.488	0.566

Panel B

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(4)	(5)
Treatment * post-6m	-59.8292***	-117.5081***	0.0932***	-3.5497***	-8.9784***
	(4.5333)	(3.9293)	(0.0020)	(0.1133)	(0.2827)
Treatment * post-12m	-97.1094***	-184.9470***	0.1181***	-3.3427***	-10.2315***
	(6.1815)	(6.1678)	(0.0024)	(0.0834)	(0.2926)
Treatment * post-18m	-152.9072***	-250.3628***	0.1331***	-3.7760***	-10.7506***
	(10.8292)	(9.5499)	(0.0020)	(0.1027)	(0.3118)
Treatment * post-24m	-185.1120***	-294.1531***	0.1394***	-3.9522***	-11.2963***
	(12.2629)	(12.4853)	(0.0023)	(0.1036)	(0.3094)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	7801514	7801514	7801514	7801514	7801514
Adjusted R-squared	0.572	0.642	0.426	0.488	0.566

Table A.6: Falsification test: random treatment assignment

This table reports the difference-in-difference regressions estimating the policy effect on credit card spending and debt when CA and combined MP + CA treatments are randomly assigned. We report the estimates for spending, total debt, the proportion of debt paid, interest charges, and penalty, respectively. Panel A reports the average impact of the two random treatment assignments, respectively. Panel B shows the impact at each policy date for the randomly assigned combined MP + CA treatment. All random treatment variables are defined between January 2010 and December 2010 based on credit card limits and maintaining the sample proportions of the CA and combined MP + CA treatments, respectively. The independent variables are the interactions between a random treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(4)	(5)
CA * post	0.3374	-0.1150	-0.0000	0.0116	0.1337
	(2.3724)	(2.7230)	(0.0007)	(0.0413)	(0.1256)
(MP + CA) * post	-4.9528	-1.2590	0.0006	0.0537	0.1820
	(5.1644)	(6.2773)	(0.0013)	(0.0727)	(0.2558)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	13440334	13440334	13440334	13440334	13440334
Adjusted R-squared	0.569	0.637	0.423	0.482	0.566

Table A.7: MP Treatment categories – different minimum payment ratios

This table reports the difference-in-difference regressions estimating the policy effect on credit card spending, separating the MP-treatment into three categories. The categories are based on the minimum payment ratios, namely less than 20%, 20-25%, and 25-30%. We report the estimates for spending, total debt, the proportion of debt paid, interest charges, and penalty, respectively. All treatment variables are defined in the period between January 2010 and December 2010 based on the credit card limits. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(4)	(5)
MP_20%*post	-45.3517***	-148.5143***	0.2792***	-5.4769***	-28.6736***
	(14.5748)	(20.0951)	(0.0053)	(0.3605)	(1.7973)
MP_25%*post	-77.8543***	-247.3106***	0.1800***	-8.0928***	-36.3096***
	(12.1141)	(18.0506)	(0.0023)	(0.3993)	(1.6277)
MP_30%*post	-83.4142***	-221.4570***	0.1768***	-6.5108***	-22.3313***
	(10.8427)	(15.9823)	(0.0017)	(0.3311)	(1.1567)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	13440334	13440334	13440334	13440334	13440334
Adjusted R-squared	0.569	0.637	0.428	0.485	0.572

Table A.8: Consumption response and descriptive statistics including full payers

This table reports the difference-in-difference regressions estimating the policy effect on credit card spending and debt including full payers. We report the estimates for spending, total debt, the proportion of debt paid, interest charges, and penalty, respectively. Panel A reports the average impact of the two policy rules, the CA treatment and the combined MP+CA treatment. Panel B shows the impact at each policy date for the combined MP+CA treatment. All treatment variables are defined in the period between January 2010 and December 2010 based on the credit card limits. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013. Panel C shows descriptive statistics for the full sample including full payers. Panel D shows descriptive statistics for only the control group including full payers

Panel A

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(6)	(7)
CA * post	-118.3714***	-159.0099***	0.1079***	-3.0073***	-5.0133***
	(6.5584)	(5.9679)	(0.0025)	(0.0758)	(0.1294)
(MP + CA) * post	-116.7001***	-283.1315***	0.2418***	-8.5008***	-35.9663***
	(11.3071)	(15.7288)	(0.0051)	(0.3666)	(1.5720)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	19082118	19082118	19082118	19082118	19082118
Adjusted R-squared	0.560	0.620	0.471	0.480	0.568

Panel B

Dep.Var.	Spending	Debt	% Paid	Interest	Penalty
	(1)	(2)	(3)	(6)	(7)
CA * post	-118.3714***	-159.0099***	0.1079***	-3.0073***	-5.0133***
	(6.5584)	(5.9679)	(0.0025)	(0.0758)	(0.1294)
(MP + CA) * post-0m	-64.7785***	-138.6609***	0.1621***	-6.7982***	-20.6818***
	(4.8688)	(6.8393)	(0.0050)	(0.2861)	(0.8051)
(MP + CA) * post-6m	-83.8826***	-231.4465***	0.2278***	-8.6659***	-35.3343***
	(8.3078)	(11.8532)	(0.0055)	(0.3922)	(1.5941)
(MP + CA) * post-12m	-120.0569***	-321.2136***	0.2682***	-8.7920***	-41.3803***
	(12.6360)	(18.5248)	(0.0053)	(0.3891)	(1.8271)
(MP + CA) * post-18m	-171.5454***	-392.9261***	0.2901***	-9.3924***	-43.6356***
	(17.9618)	(25.0820)	(0.0050)	(0.4127)	(2.0307)
(MP + CA) * post-24m	-196.3113***	-427.9676***	0.2993***	-9.5653***	-44.4661***
	(19.8613)	(24.8573)	(0.0051)	(0.3774)	(1.9215)
Individual FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	19082118	19082118	19082118	19082118	19082118
Adjusted R-squared	0.560	0.620	0.472	0.480	0.569

Panel C: Descriptive Statistics - including full payers

Variable	Mean	StDev	Min	Max
Spending Total	575.18	1460.25	0	310765
No. of Transactions	6.11	10.93	0	2335
Debt	724.58	1564.08	0	311524
Amount Paid	536.67	1364.36	0	293392
Interest	4.58	15.80	0	6117
Penalty	13.33	49.17	0	9699
Percentage Paid	0.79	0.34	0	1
Paid Below Minimum	0.14	0.35	0	1
Paid Below 50%	0.23	0.42	0	1
Utilization	0.25	13.87	0	14925
Credit Limit	4849.04	6935.28	0	500000
Age	41.06	9.81	17	91
Male	0.87	0.34	0	1
Married	0.83	0.38	0	1
Education Level	3.14	1.27	1	8
Investment	0.19	0.39	0	1
Personal Loan	0.03	0.18	0	1

Panel D: Control group - including full payers

Variable	Mean	StDev	Min	Max
Spending Total	652.17	1638.67	0	310765
No. of Transactions	6.58	11.82	0	2335
Debt	679.45	1633.58	0	311524
Amount Paid	608.82	1533.80	0	293392
Interest	1.76	10.99	0	6117
Penalty	3.87	26.37	0	9699
Percentage Paid	0.91	0.24	0	1
Paid Below Minimum	0.05	0.22	0	1
Paid Below 50%	0.09	0.28	0	1
Utilization	0.17	16.82	0	14925
Credit Limit	5782.79	7720.34	0	500000
Age	41.38	9.80	17	91
Male	0.87	0.34	0	1
Married	0.84	0.36	0	1
Education Level	3.22	1.27	1	8
Investment	0.22	0.41	0	1
Personal Loan	0.05	0.21	0	1

Table A.9 – Policy impact on payments at or below the minimum

This table reports the regressions estimating the policy effect on credit card payment behavior. Specifically, we show the estimates for changes in the proportion of consumers that pay at or below minimum payment amount (P), respectively. Column 1 is based on a difference-in-difference regression and reports the average impact of the two policy rules, the CA treatment and the combined MP+CA treatment. Column 2 also uses difference-in-difference regressions to show the impact at each policy date for combined MP+CA treatment. Column 3 employs a panel data regression to estimate the average change in the *P* measure for all new credit cards that experience a decrease in the minimum payment from 40% to 25%. All treatment variables are defined in the period between January 2010 and December 2010 based on the credit card limits. The independent variables in the first two columns are the interactions between a treatment variable and a corresponding post-policy variable. The independent variable in Column 3 is a dummy that takes a value of 1 in a month when the minimum payment ratio for a new credit card falls from 40% to 25%. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions in Columns 1 and 2 runs from January 2010 to February 2013. The sample in Column 3 uses the six months before and the six months after each new card's minimum payment decrease.

Dep.Var.	*P*	*P*	*P*
	(1)	(2)	(3)
CA * post	-0.0698***	-0.0698***	
	(0.0031)	(0.0031)	
(MP + CA) * post	-0.3074***		
	(0.0046)		
(MP + CA) * post-0m		-0.2115***	
		(0.0067)	
(MP + CA) * post-6m		-0.2740***	
		(0.0056)	
(MP + CA) * post-12m		-0.3269***	
		(0.0049)	
(MP + CA) * post-18m		-0.3594***	
		(0.0038)	
(MP + CA) * post-24m		-0.4804***	
		(0.0048)	
New Card - MP decrease			0.1060***
(panel regression)			(0.0078)
Individual FE	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes
Observations	13440334	13440334	118786
Adjusted R-squared	0.324	0.325	0.347

Table A.10: Response to policy across education and income volatility categories

This table reports the difference-in-difference regressions estimating the policy effects. Panels A reports the estimates for credit card spending and total debt across different consumer groups separated based on education. Panel B reports the results for groups based on income volatility. Both panels report the average impact of the two policy rules, the CA treatment and the combined MP+CA treatment. All treatment variables are defined in the period between January 2010 and December 2010 based on credit card limits. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

Panel A: Education	Low Education			High education		
Dep.Var.	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency
	(1)	(2)	(3)	(4)	(5)	(6)
CA * post	-112.0676***	-168.8486***	-0.0223***	-106.0531***	-158.1463***	-0.0229***
	(6.8927)	(6.9160)	(0.0014)	(6.7849)	(6.8527)	(0.0012)
(MP + CA) * post	-113.0875***	-287.5756***	-0.0741***	-91.1997***	-342.7974***	-0.0855***
	(10.3995)	(14.8332)	(0.0045)	(13.4333)	(27.9983)	(0.0066)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6555608	6555608	6555608	2931700	2931700	2931700
Adjusted R-squared	0.583	0.649	0.237	0.546	0.610	0.252

Panel B: Income Volatility	Low Income Volatility			High Income Volatility		
Dep.Var.	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency
	(1)	(2)	(3)	(4)	(5)	(6)
CA * post	-104.9056***	-140.4980***	-0.0268***	-147.8267***	-208.4895***	-0.0263***
	(6.084)	(6.168)	(0.002)	(12.898)	(13.422)	(0.002)
(MP + CA) * post	-108.7402***	-309.5964***	-0.0909***	-149.3802***	-337.9013***	-0.0742***
	(11.485)	(18.788)	(0.005)	(17.828)	(25.226)	(0.005)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2556336	2556336	2556336	3001202	3001202	3001202
Adjusted R-squared	0.519	0.578	0.249	0.59	0.647	0.226

Table A.11: Discretionary vs. non-discretionary consumption

This table reports the difference-in-difference regressions estimating the policy effect on credit card spending separated into discretionary and non-discretionary consumption. Non-discretionary consumption includes spending on food, hygiene, and cosmetic products, healthcare products, and general groceries, and spending in supermarkets. Discretionary spending includes travel, jewelry, entertainment, car rentals, hotel lodging, direct marketing sales, and miscellaneous expenses. This table reports the average impact of the two policy rules, the CA treatment and the combined MP+CA treatment. All treatment variables are defined between January 2010 and December 2010 based on the credit card limits. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

Dep.Var.	Discretionary	Non-Discretionary	Discretionary	Non-Discretionary
	(1)	(2)	(3)	(4)
CA * post	-91.1159***	-16.4859***	-91.1159***	-16.4859***
	(6.1245)	(1.6940)	(6.1245)	(1.6940)
(MP + CA) * post	-87.3909***	-16.1149***		
	(10.1245)	(2.1797)		
(MP + CA) * post-0m			-44.6833***	-10.1284***
			(5.1009)	(1.4845)
(MP + CA) * post-6m			-38.3399***	-6.5253***
			(5.6419)	(1.6639)
(MP + CA) * post-12m			-116.6352***	-19.4420***
			(13.9664)	(3.0267)
(MP + CA) * post-18m			-134.0831***	-24.3757***
			(15.4515)	(3.4661)
(MP + CA) * post-24m			-134.8571***	-28.0796***
			(17.7647)	(3.4523)
Individual FE	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
Observations	13440334	13440334	13440334	13440334
Adjusted R-squared	0.392	0.277	0.392	0.277

Table A.12: Response to policy based on investment account and car ownership

This table reports the difference-in-difference regressions estimating the policy effects. Panels A reports the estimates for credit card spending, debt, and delinquency across different consumer groups separated based on investment account ownership. Panel B reports the results for groups based on car ownership. Both panels report the average impact of the two policy rules, the CA treatment and the combined MP+CA treatment. All treatment variables are defined in the period between January 2010 and December 2010 based on credit card limits. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

Panel A: Investment Account	No Investment Account			Investment Account		
Dep.Var.	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency
	(1)	(2)	(3)	(4)	(5)	(6)
CA * post	-111.4728***	-160.2977***	-0.0244***	-84.2707***	-135.9078***	-0.0253***
	(11.0960)	(11.2042)	(0.0023)	(6.9930)	(7.4274)	(0.0018)
(MP + CA) * post	-107.5165***	-272.2916***	-0.0772***	-85.4156***	-328.3670***	-0.0674***
	(16.5183)	(19.6047)	(0.0054)	(11.9025)	(14.5108)	(0.0037)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10908394	10908394	10908394	2531940	2531940	2531940
Adjusted R-squared	0.576	0.642	0.244	0.538	0.618	0.189

Panel B: Car Ownership	No Car Owned			Car Owned		
Dep.Var.	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency
	(1)	(2)	(3)	(4)	(5)	(6)
CA * post	-105.2263***	-153.7110***	-0.0251***	-150.1535***	-172.3071***	0.0103***
	(7.2920)	(7.7715)	(0.0017)	(19.7297)	(27.7821)	(0.0019)
(MP + CA) * post	-103.3039***	-270.4302***	-0.0769***	-160.3070***	-680.9976***	0.0120***
	(12.1913)	(16.1635)	(0.0048)	(37.7471)	(80.4671)	(0.0035)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12820706	12820706	12820706	619628	619628	619628
Adjusted R-squared	0.552	0.627	0.238	0.650	0.683	0.129

Table A.13: Consumption response: revolvers vs. non-revolvers

This table reports the difference-in-difference regressions estimating the policy effect on credit card spending for revolvers and non-revolvers. Revolvers are defined as consumers that roll over their debt at least once between January 2010 and December 2010 (12 months) or between January 2011 and June 2011 (6 months). Non-revolvers pay in full in the same periods, respectively. We report the average policy impact of the CA treatment and dynamic impact for the combined MP+CA treatment. All treatment variables are defined between January 2010 and December 2010 based on credit card limits. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

	12 months before policy		6 months before policy	
Panel A	Non-revolver	Revolver	Non-revolver	Revolver
Dep.Var.	Spending	Spending	Spending	Spending
	(1)	(2)	(3)	(4)
CA * post	-103.4959***	-168.4234***	-86.7494***	-113.8167***
	(6.9666)	(14.8635)	(5.8132)	(10.4560)
(MP + CA) * post	-62.9339***	-149.0823***	-51.0765***	-81.2861***
	(14.0745)	(14.9994)	(18.5219)	(11.8580)
Individual FE	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
Observations	11568340	1871994	8648534	3135304
Adjusted R-squared	0.569	0.543	0.568	0.549

	12 months before policy		6 months before policy	
Panel B	Non-revolver	Revolver	Non-revolver	Revolver
Dep.Var.	Spending	Spending	Spending	Spending
	(1)	(2)	(3)	(4)
CA * post	-103.4959***	-168.4234***	-86.7494***	-113.8167***
	(6.9666)	(14.8635)	(5.8132)	(10.4560)
(MP + CA) * post-0m	-38.0504***	-141.7859***	-19.1625**	-72.9439***
	(8.7068)	(14.4195)	(9.4986)	(10.4105)
(MP + CA) * post-6m	-32.6003***	-146.3931***	-22.6670	-76.2905***
	(12.2185)	(15.1218)	(15.8153)	(11.7346)
(MP + CA) * post-12m	-61.8210***	-156.5158***	-46.0708**	-86.0679***
	(17.0283)	(15.6823)	(21.2122)	(12.6570)
(MP + CA) * post-18m	-101.0685***	-151.4467***	-94.2379***	-86.8555***
	(22.7634)	(15.8696)	(29.3959)	(13.2433)
(MP + CA) * post-24m	-117.5196***	-149.6456***	-117.5801***	-90.2461***
	(28.7192)	(15.8182)	(39.0952)	(13.6020)
Individual FE	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
Observations	11568340	1871994	8648534	3135304
Adjusted R-squared	0.569	0.543	0.568	0.549

Table A.14: Heterogeneity in consumption response across demographic traits

This table reports the difference-in-difference regressions estimating the policy effects. Panels A-C reports the estimates for credit card spending and total debt across different consumer groups separated based on gender, age, marital status, occupation, presence of personal loan, and the number of cards held, respectively. All panels report the average impact of the two policy rules, the CA treatment and the combined MP+CA treatment. All treatment variables are defined in the period between January 2010 and December 2010 based on credit card limits. The independent variables are the interactions between a treatment variable and a corresponding post-policy variable. All regressions control for consumer fixed effects and monthly time effects. The standard errors are clustered at the city×product level. The sample used in the regressions runs from January 2010 to February 2013.

Panel A: Gender and Age	Female			Male			Age <40			Age ≥40		
Dep.Var.	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
CA * post	-48.7542***	-86.1924***	-0.0323***	-116.0569***	-167.5213***	-0.0221***	-114.7316***	-157.6259***	-0.0273***	-103.6569***	-160.4517***	-0.0188***
	(5.7471)	(5.9143)	(0.0028)	(7.3651)	(7.3608)	(0.0016)	(8.6498)	(8.1190)	(0.0018)	(7.3065)	(8.0698)	(0.0019)
(MP + CA) * post	-32.1405***	-149.3193***	-0.0879***	-116.8276***	-301.5619***	-0.0723***	-115.9834***	-246.1361***	-0.0914***	-99.8750***	-310.5477***	-0.0609***
	(8.6803)	(10.2752)	(0.0062)	(12.2630)	(17.7923)	(0.0047)	(14.4120)	(18.3256)	(0.0058)	(11.3096)	(16.8082)	(0.0042)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1684996	1684996	1684996	11724596	11724596	11724596	6785546	6785546	6785546	6654788	6654788	6654788
Adjusted R-squared	0.577	0.657	0.232	0.567	0.635	0.240	0.558	0.621	0.224	0.573	0.642	0.257
Panel B: Marital Status and Occupation	Single			Married			Public Sector			Private Sector		
Dep.Var.	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
CA * post	-93.3657***	-141.6361***	-0.0328***	-112.0803***	-162.0149***	-0.0214***	-61.4373***	-118.9354***	-0.0321***	-147.8459***	-202.1096***	-0.0258***
	(10.0654)	(10.2886)	(0.0020)	(7.2427)	(7.2742)	(0.0017)	(9.8102)	(12.2186)	(0.0041)	(10.9688)	(9.4321)	(0.0020)
(MP + CA) * post	-90.0168***	-217.3468***	-0.0994***	-110.7338***	-297.6125***	-0.0693***	-51.2070***	-208.5524***	-0.1400***	-150.8048***	-350.8622***	-0.0749***
	(15.4700)	(18.9894)	(0.0043)	(11.9558)	(16.8147)	(0.0051)	(16.0995)	(30.9372)	(0.0168)	(16.4802)	(23.3699)	(0.0063)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2336468	2336468	2336468	10937540	10937540	10937540	314222	314222	314222	3731410	3731410	3731410
Adjusted R-squared	0.555	0.639	0.218	0.570	0.637	0.244	0.513	0.583	0.262	0.574	0.632	0.229
Panel C: Persoal Loan and No. of Cards	Personal Loan			No Personal Loan			Single-card Holders			Multiple-card Holders		
Dep.Var.	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency	Spending	Debt	30-day delinquency
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
CA * post	-72.4966***	-134.5250***	-0.0221***	-103.8434***	-153.7535***	-0.0242***	-104.6600***	-153.0598***	-0.0236***	-37.7227	-125.7196	-0.0306***
	(12.5508)	(12.5038)	(0.0010)	(1.1597)	(1.1697)	(0.0003)	(6.4806)	(6.4409)	(0.0017)	(113.9675)	(156.1078)	(0.0044)
(MP + CA) * post	-75.3469**	-512.4636***	-0.0734***	-100.1952***	-273.0968***	-0.0752***	-103.7095***	-275.7427***	-0.0737***	63.9154	-709.0359***	-0.1094***
	(37.5531)	(37.4127)	(0.0029)	(2.3780)	(2.3985)	(0.0006)	(11.6606)	(16.3107)	(0.0050)	(232.3892)	(270.7372)	(0.0283)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	462916	462916	462916	12989236	12989236	12989236	12946866	12946866	12946866	152798	152798	152798
Adjusted R-squared	0.536	0.594	0.167	0.569	0.639	0.239	0.562	0.640	0.239	0.537	0.571	0.222

Figure A.1: Sample credit card statement (personal and other information excluded)

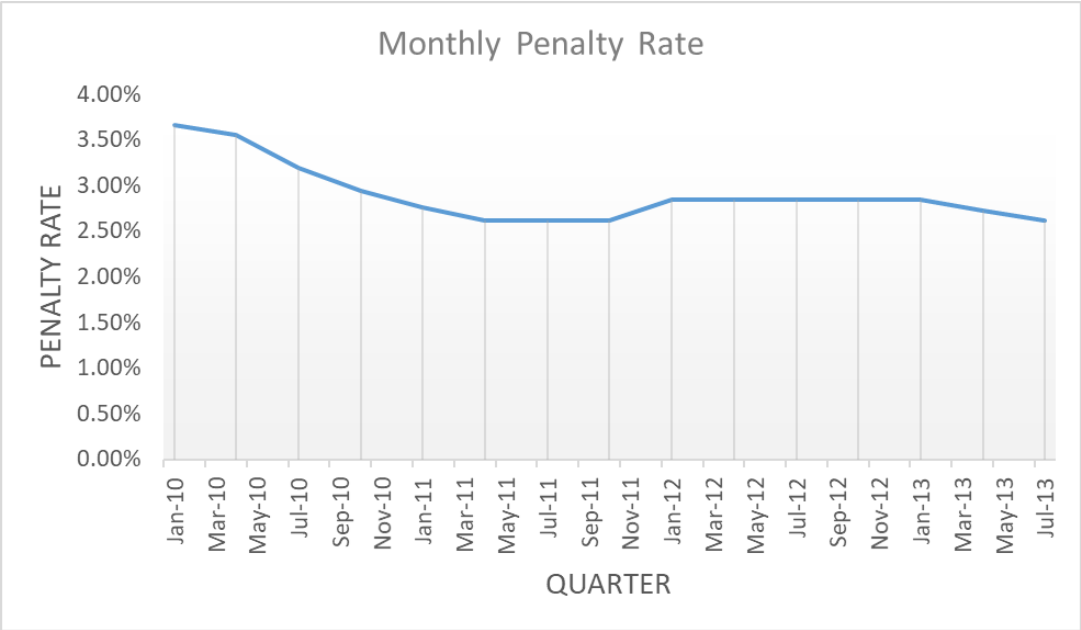
HESAP BİLGİLERİ	
Hesap Kesim Tarihi	:27 Kasım 2013
Son Ödeme Tarihi	**:9 Aralık 2013**
Dönem Borcu	**:1.322,45 TL**
Ödenmesi Gereken Asgari Tutar/Oran	:330,61TL / 25%
Önceki Dönem Hesap Özeti Borcu	:1.357,15 TL
Dönem İçi Harcamalar	:1.322,45 TL
Dönem İçi Ödemeler	:+1.357,15 TL
Kalan Toplam Taksit Tutarı	:0,00 TL
Bir Sonraki Ay Hesap Kesim Tarihi	:27 Aralık 2013
Bir Sonraki Ay Son Ödeme Tarihi	:6 Ocak 2014
Müşteri Limiti	:13.000,00 TL
Kart Limiti	:3.000,00 TL
Nakit Çekim Limiti	:3.000,00 TL
Alışveriş Faiz Oranı	:2,02%
Nakit Çekim Faiz Oranı	:2,02%
Gecikme Faiz Oranı	:2,52%

ACCOUNT INFORMATION	
Statement Date	:27 November 2013
Payment Due Date	**:9 December 2013**
Total Debt	**:1,322.45 TL**
Minimum Payment	:330.61 TL /25%
Total Debt on the Previous Statement	:1,357.15 TL
Total Spending	:1,322.45 TL
Total Payments	:+1,357.15 TL
Remaining Installments	:0.00 TL
Next Statement Date	:27 December 2013
Next Payment Due Date	:6 January 2014
Customer's Total Credit Card Limit	:13,000.00 TL
Credit Card Limit (Card on the Statement)	:3,000.00 TL
Cash Advance Limit	:3,000.00 TL
Interest charged on purchases	:2.02%
Interest charged for cash advances	:2.02%
Penalty rate	:2.52%

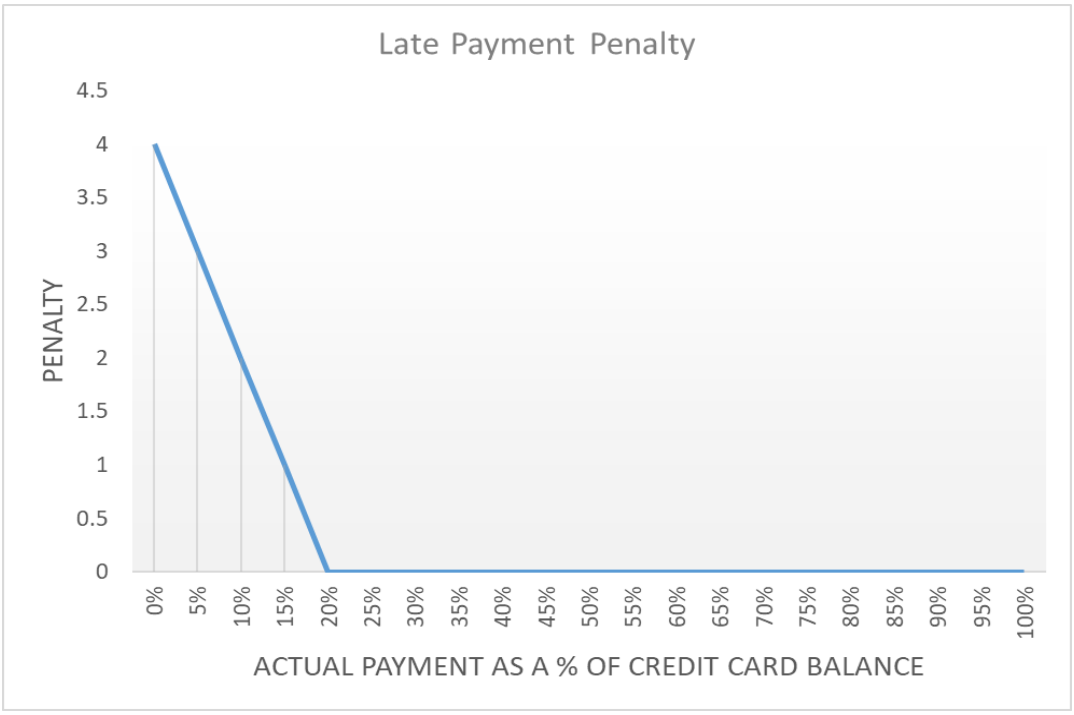
Notes: This figure presents an excerpt from a credit card statement from a major Turkish bank in Turkish and a translation in the accompanying table. It shows the current and the next statement dates, minimum payment amount, due date, total spending, total debt, credit card limit, and applicable interest rates and penalty rate. The minimum payment amount and date are shown in bold in the original statement to direct the account holder's attention to those two important pieces of information.

Figure A.2: Institutional setting: Penalty fees and monthly penalty rates

Panel A: Late payment penalty: changes in penalty rates over time



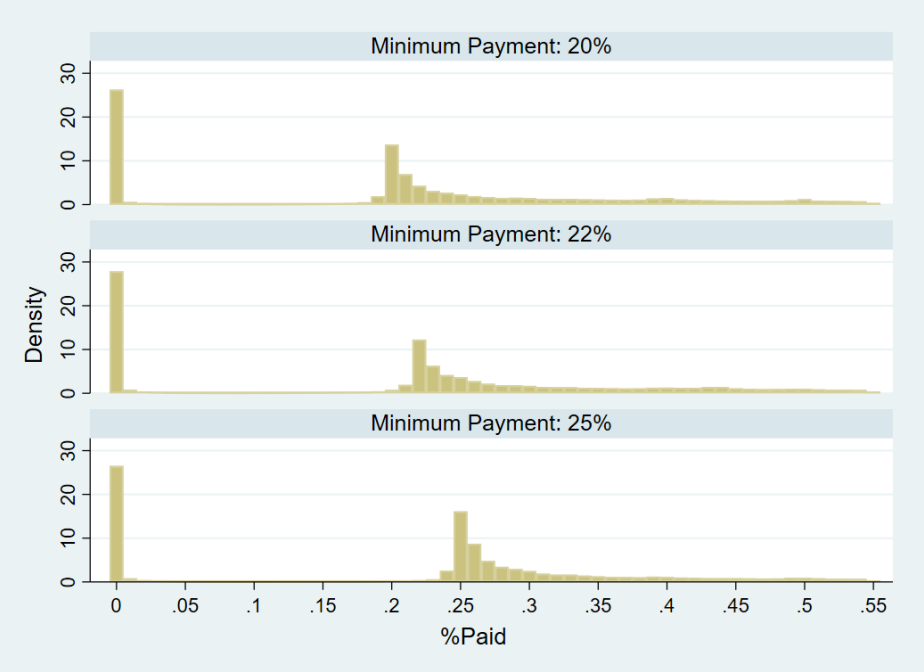
Panel B: Late payment penalty structure in Turkish credit cards



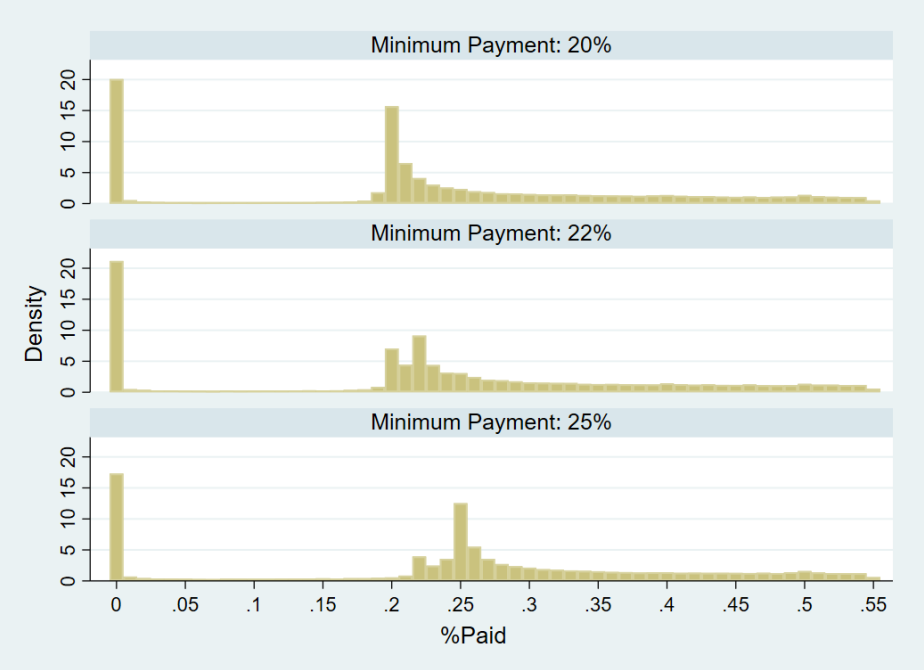
Notes: Panel A shows the time series of the monthly penalty rate for late credit card payments. The penalty rate is set by the Central Bank of Turkey every quarter. Panel B shows the amount the penalty charged before BRSA's policy for a given level of payment expressed as a proportion of outstanding credit card balance. The required minimum payment ratio before the policy was 20%. The penalty is charged only on the unpaid amount below the required minimum payment level. In this example the following assumptions were used: penalty rate = 3%; CC debt = 1000; actual payment = a range between TL0 and TL200.

Figure A.3: Bunching around required minimum payment ratios over time

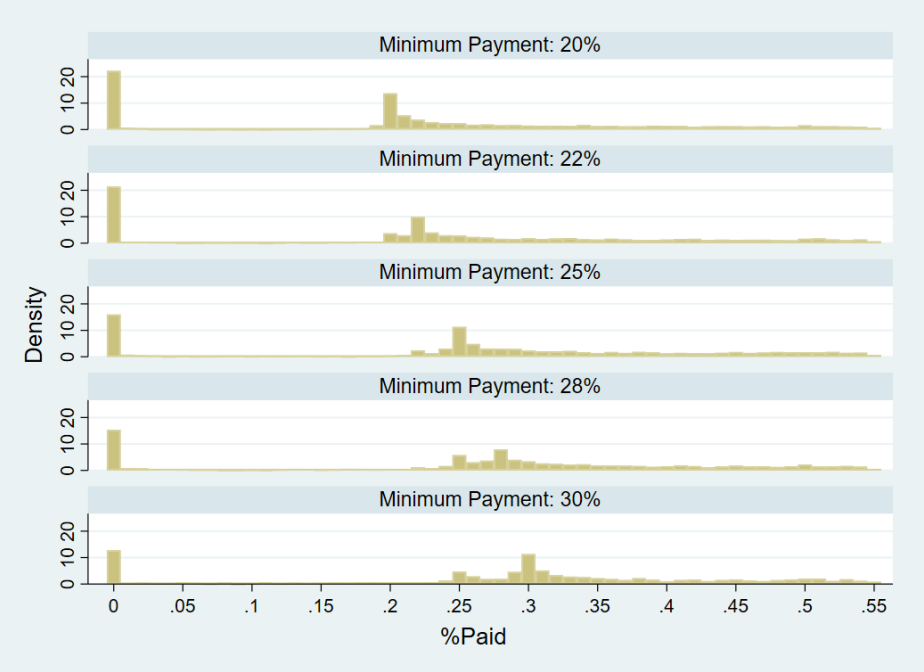
Panel A: Bunching - borrowers with limit (<5000)



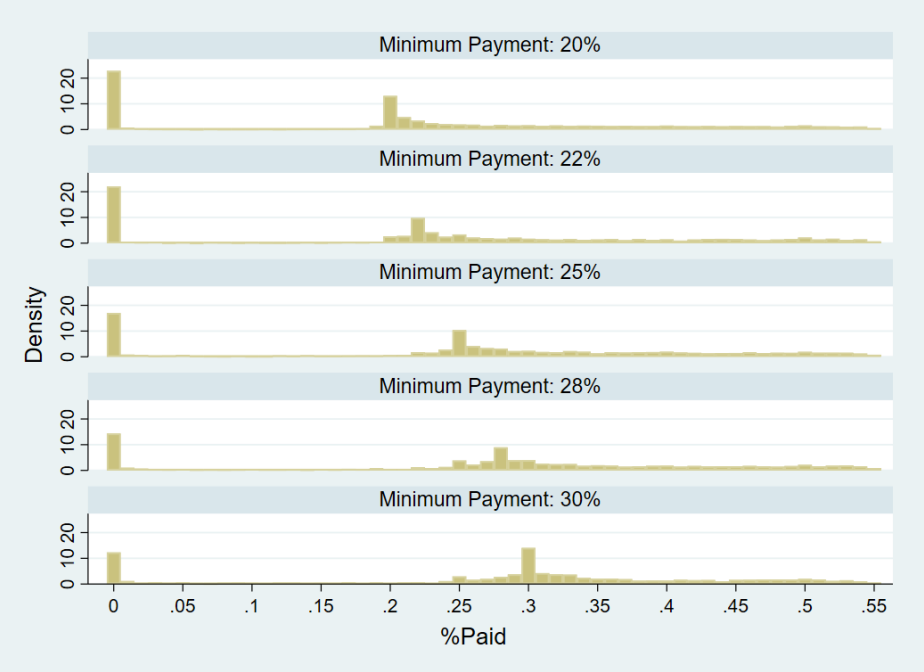
Panel B: Bunching - borrowers with limit (5000, 15,000)



Panel C: Bunching - borrowers with limit (15,000, 20,000)



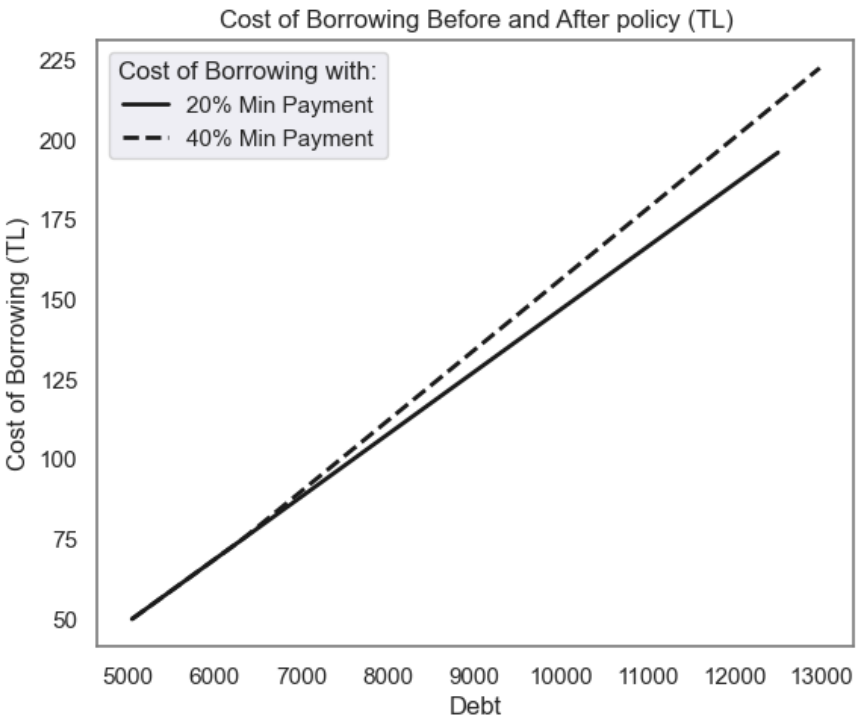
Panel D: Bunching - borrowers with limit (>20,000)



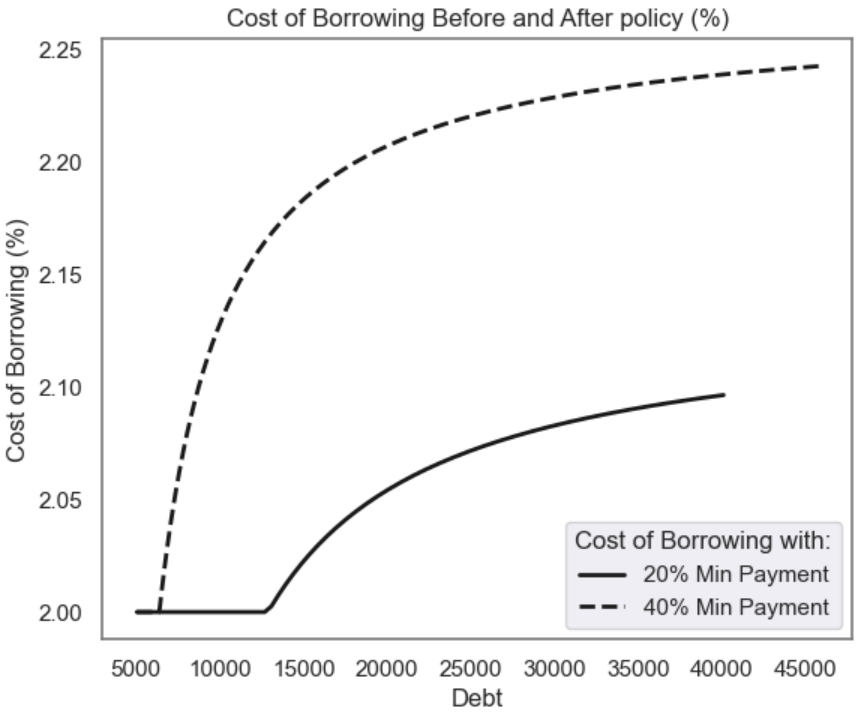
Notes: This figure shows the histograms of the percentage of monthly credit card balance paid at different required minimum payment ratios. Panels A shows these histograms for borrowers with credit card limit less than TL5000. Panels B-D show the same histograms for borrowers with credit card limits in the TL5,000-15,000, TL15,000-20,000, and TL 20,000+ ranges, respectively.

Figure A.4: Cost of borrowing before and after the policy

Panel A

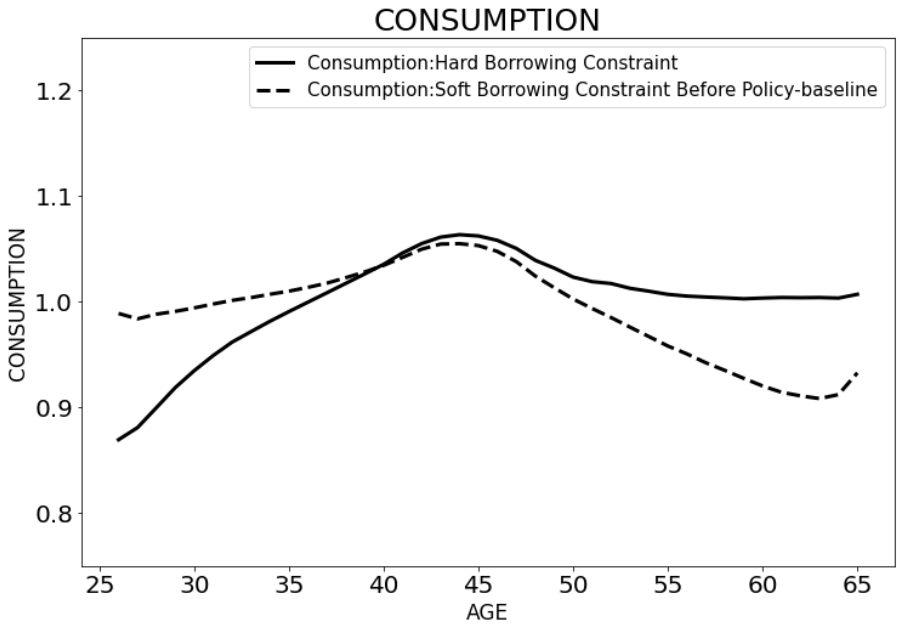


Panel B



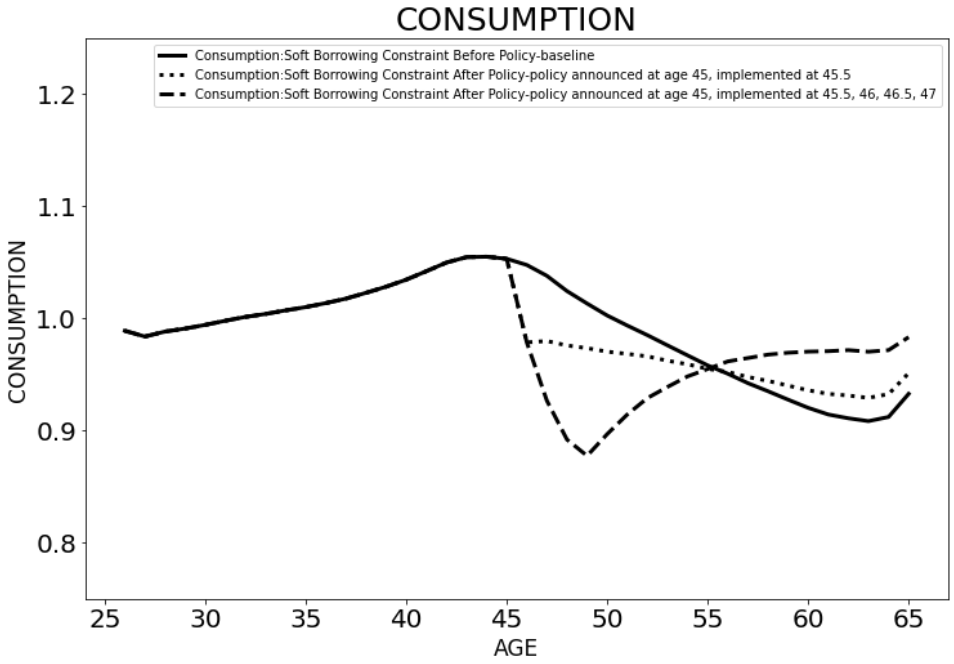
Notes: This figure shows the cost of borrowing before and after the policy, i.e. with 20% and 40% minimum payment. Panel A shows the cost of borrowing in Turkish Liras at different levels of debt. Panel B shows he cost of borrowing in % terms at different levels of debt. The graphs were created with the assumption of TL5,000 initial debt, 2% interest rate, 3% penalty rate, minimum payment ratio of 20% and 40% before and after policy, and fixed monthly spending and payment of TL2,500 to isolate the cost of borrowing evolution at different levels of debt.

Figure A.5: Simulated Consumption for Hard and Soft Constrained Consumers



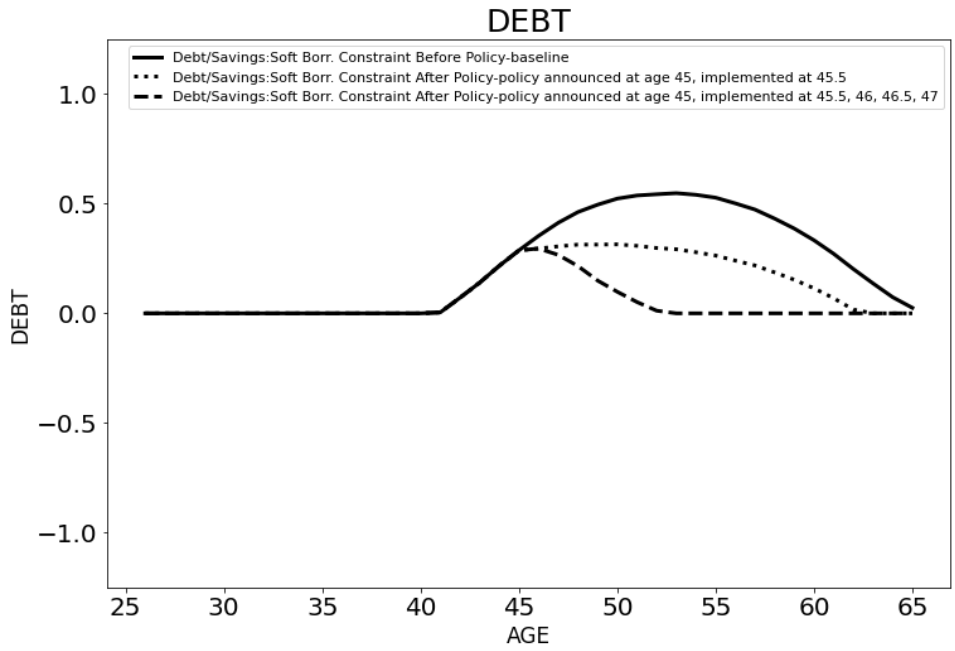
Notes: This figure shows consumption normalized by income over the life cycle. Solid line shows consumption for hard-constrained consumer, while the dashed line show consumption for a consumer that can borrow but faces a borrowing cost.

Figure A.6: Simulated Consumption Before and After Policy Shock



Notes: This figure shows consumption normalized by income over the life cycle. Solid line shows consumption for a consumer that can borrow but faces a borrowing cost; this is the baseline case. Dotted line shows consumption for a consumer facing a higher borrowing cost relative to the baseline imposed by a single policy shock announced at age 45 and implemented six months later. Dashed line shows consumption for a consumer with a higher borrowing cost relative to the baseline imposed by multiple policy shocks all announced at age 45 and implemented over the next four consecutive six-month periods.

Figure A.7: Simulated Debt Before and After Policy Shock



Notes: This figure shows debt normalized by income over the life cycle. The solid line shows debt for a consumer that can borrow but faces a borrowing cost; this is the baseline case. The dotted line shows debt for a consumer facing a higher borrowing cost relative to the baseline imposed by a single policy shock announced at age 45 and implemented six months later. Finally, the dashed line shows debt for a consumer with a higher borrowing cost relative to the baseline imposed by multiple policy shocks announced at age 45 and implemented over the subsequent four consecutive six-month periods. If consumer saves, i.e. there is no debt, we record that as debt = 0.