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How Do Bonus Payments Affect the Demand for Auto Loans and Their Delinquency?

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Abstract

This article studies how receiving a bonus changes consumers' demand for auto loans and their risk of future delinquency. Unlike traditional consumer products, auto loans have a long-term impact on consumers' financial state because of the monthly payment obligation. Using a large consumer panel data set of credit and employment information, the authors find that receiving a bonus increases auto loan demand by 21%. These loans, however, are associated with higher risk, as the delinquency rate increases by 18.5%–31.4% depending on different measures. In contrast, an increase in consumers' base salary will increase their demand for auto loans but not their delinquency. By comparing consumers with bonuses with those without bonuses, the authors find that bonus payments lead to both demand expansion and demand shifting on auto loans. The empirical findings help shed light on how consumers make financial decisions and have important implications for financial institutions on when demand for auto loans and the associated risk arise.

Keywords

auto loan demand, bonus, consumer financial decision making, delinquency risk

Bonuses are a common component of employee compensation in the United States. It is estimated that 63% of firms offer annual bonuses to recognize their employees' contributions (Society for Human Resource Management 2018). The sizes of these annual bonuses are often significant. Our data from Equifax show that the average bonus payment was close to $5,000 in 2015, which is equivalent to 6.5% of an employee's annual income. Unlike salaries or commissions, which usually are paid biweekly or monthly, a bonus is typically a lump-sum payment paid once a year.

How do bonus payments affect consumers' purchasing behaviors, and what are the long-term consequences? We study these questions in the context of auto loans by empirically investigating the impact of bonuses on the demand for auto loans and the future delinquency. Auto loans offer an interesting context to study the impact of bonuses. In the United States, car purchases are often financed by an auto loan.[1] More importantly, the demand for auto loans, which are economically important and understudied, has different characteristics from the demand for traditional goods or services. Whereas transactions for traditional goods or services are completed after consumers pay for the product or service, transactions for auto loans consist of future loan repayments that last for more than five years, on average. The commitment of loan repayments can impose a substantial financial burden on consumers, especially those with limited resources. Therefore, the demand for an auto loan induced by a current bonus payment can lead to future financial burden and even loan delinquency, which may have a significant negative consequence for the consumer as well as for the financing institution that provides the auto loan.

Given the importance and uniqueness of bonuses and auto loan decisions, this article aims to answer the following two research questions: How does receiving a bonus payment affect consumers' demand for auto loans, and what is the delinquency risk for auto loans that are induced by bonus payments?

To answer these research questions, we use a large-scale panel data set provided by Equifax, with consumers from over 1,500 employers in the United States. This novel data set contains individual-level information on the time an auto loan

[1] A report found that cash buyers—defined as those with "no lender on title"—made up only 15.2% of new car buyers in the third quarter of 2013. In other words, 85% of car purchases are associated with a loan (Henry 2013).

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originates as well as the monthly loan repayments after the origination. In addition, it provides payroll information, including when a bonus is received and how much it is. The variation in the bonus pay dates across consumers enables us to investigate how receiving a bonus influences the propensity to take out an auto loan while controlling for other factors, such as the seasonality of car sales. The difference in the delinquency rates for loans originated when a bonus is received versus those originated at a different time (without receiving a bonus) helps identify the correlation between loan types (bonus-induced or not) and the delinquency rate. It is worth noting this correlation is usually difficult to measure because the delinquency rate is typically small. One benefit of using big data involving millions of consumers in this study is that we can identify such a rare but impactful event.

Our results show that receiving a bonus increases auto loan demand significantly. Compared with the demand in other months, the auto loan origination rate is 21% higher after receiving a bonus. However, bonus-induced auto loans are associated with a higher risk. We find that, after one year of loan origination, the 90-day delinquency rate (i.e., loans that have been three months overdue) of loans induced by bonus payments is 31.4% higher than loans originated in other months, and the 60-day delinquency rate is 18.5% higher. The delinquency rate is significantly higher for consumers with low and medium income (i.e., annual income below $100,000) and credit scores (i.e., lower than 760). In contrast, although an increase in the base salary also increases the demand for auto loans, these loans are not associated with a higher delinquency rate.

Multiple mechanisms can explain our empirical findings. One explanation is that bonus payments lead to demand expansion on auto loans, which further leads to a higher delinquency rate in the future. Demand expansion can be due to consumers' belief that they will have higher future income after they receive bonus payments. It can also arise from behavioral anomalies, such as mental accounting (e.g., Thaler 1985) and windfall (Arkes et al. 1994), which predict that when bonus payments come as a surprise, consumers may respond by spontaneous overspending. Another explanation, however, focuses on demand shifting: the need of an automobile already existed before the bonus, and receiving the bonus helps realize this need by relaxing the liquidity constraints of consumers. The demand-shifting explanation naturally implies that consumers who purchase automobiles with bonuses are more likely to face liquidity constraints and, in turn, have a higher risk of delinquency in the future.

To explore the potential mechanisms, we utilize a matching analysis that compares the behaviors of consumers who receive a bonus with consumers without bonuses but who have comparable total income and credit score. Demand analysis using this matched sample shows that consumers who receive a bonus have higher auto loan demand during bonus months and lower auto loan demand during non–bonus months compared with matched consumers who do not receive bonuses. We find evidence of bonuses leading to demand expansion because the increase during bonus months far exceeds the decrease during non–bonus months. This also suggests that some consumers shift the demand of loan origination to when they receive the bonus because customers who receive bonuses have lower demand during non–bonus months compared with their counterparts without bonuses. Therefore, both demand expansion and demand shifting likely jointly contribute to our observed effect.

We conduct a similar matching analysis to study the delinquency effect of bonus-induced loans. We match each loan from consumers who receive a bonus with one originated in the same month from consumers without bonuses but are otherwise very similar. This helps rule out an alternative explanation from the main analysis that the higher delinquency rate for bonus-induced loans could be driven by the lack of a bonus for the rest of the year when compared with consumers who originate a loan in non–bonus months. This concern is eliminated by matching with consumers without bonuses because neither group receives a bonus after the loan is originated. Consistent with results from the main analysis, we find a higher delinquency rate for bonus-induced loans than matched loans from consumers without bonuses. Loans that are originated during the non–bonus months from consumers with bonuses, however, do not have a higher delinquency rate than those from consumers without bonuses. Results suggest that consumers who receive a bonus payment are not riskier in general, but the loans that are likely influenced by receiving a bonus tend to have a higher risk.

The intended contribution of this study is to report new substantive empirical findings as well as their implications. To the best of our knowledge, our study is the first to use such large data sets on individual income and auto loan records to document how consumers respond to a lump-sum bonus with demand for a big-ticket consumer financial product. This provides firsthand evidence on how consumers may react to unexpected lump-sum payments, which are especially important when designing fiscal policies with respect to natural disasters such as the COVID-19 pandemic. Given that demand expansion plays an important role in our results, a program that helps reduce the purchase trigger of unexpected lump-sum payments can be beneficial for consumers by avoiding taking on long-term financial debt that they cannot afford. For example, when consumers receive a bonus payment, it may be useful to provide financial education or a nudge to assist them with better financial decision making if it can be offered "just in time" (Fernandes, Lynch, and Netemeyer 2014).

Moreover, we identify the long-term risk of such a consumption decision by documenting a higher delinquency rate for bonus-induced loans. With a $1.28 trillion balance in the first quarter of 2019, auto loans represent the third-largest consumer credit market after mortgages and student loans (Federal Reserve Bank of New York 2019). In the same quarter, however, $39 billion in auto loan balances is at least 90 days past due (DPD).[2] Given the economic significance of the auto loan

[2] See https://www.newyorkfed.org/microeconomics/hhdc/background.html (accessed March 29, 2021).

market, it is important for financial institutions to understand how bonuses could impact auto loan demand and delinquency. In fact, our results suggest that financial institutions have not taken into account this additional risk induced by bonuses when designing loan contracts and provisions: in our data, we find that the interest rate is actually slightly lower for bonus-induced auto loans, which indicates that the financial institutions currently do not treat bonus-induced loans as riskier. With lenders increasingly having digital access to income and employment information (Chan et al. 2020), financial institutions can target consumers with high need for auto loans and accordingly adjust the interest rate charged on the basis of consumers' delinquency risk. For policy makers, it may be worthwhile to consider ensuring the "ability to pay" when auto lenders extend credit to borrowers, similar to the mortgage industry. Such efforts could reduce the amount of predatory loans taken on by consumers, who will lose both their down payment and the car (through repossession) months after purchase if they cannot afford the loan.

Our article proceeds as follows: First, we review the relevant literature. We then describe the data set and present some summary statistics. Next, we present the main findings of how receiving a bonus affects auto loan demand and the delinquency rate. We explore potential mechanisms that can explain the findings with matching analyses. Finally, we conclude with a general discussion of our findings.

Literature Review

Because most consumers finance their car purchases, our study of auto loans is related to the empirical work in the marketing literature on factors influencing the demand for automobiles, such as brand names (Sullivan 1998), household characteristics (De Janosi 1959), and prices of own and competitors' products (Sudhir 2001). Our focus is on how the demand is influenced by bonus payments as a form of compensation; therefore, this research is also related to marketing and economics studies that examine how consumption responds to income changes. Several studies have shown an excess sensitivity of consumption to change in current income, which is inconsistent with predictions from the permanent income hypothesis (e.g., Flavin 1981; Parker 1999; Shapiro and Slemrod 2003; for a review, see Jappelli and Pistaferri [2010]). The excess sensitivity can be explained by borrowing frictions that occur when consumers face liquidity constraints; however, the excess sensitivity exists for consumers who are unlikely to be subject to such constraints (e.g., Stephens and Unayama 2011). Alternative explanations have been provided, including that consumption is determined by cultural norms—for example, consumers may feel an obligation to spend when they attain certain income levels (Akerlof 2007), that consumers are present-biased or myopic (Ganong and Noel 2019), and that consumption decisions are made on the basis of heuristic rules (Olafsson and Pagel 2018). We add to this literature by showing that when employees receive a bonus payment, there is a significant increase in the demand for auto loans. The key difference of this research from the aforementioned literature is that we study not only the demand for auto loans but also the repayment behavior after transactions. Most existing literature has focused on the consumption decisions only and ignores the long-term consequences, which we are able to directly quantify because auto loans entail long-term financial obligations. The only study similar to ours is Hankins, Hoekstra, and Skiba (2011), who show that winning the lottery only postpones, rather than prevents, bankruptcy filing.

This article is also related to the large body of literature on consumer financial decision making (e.g., Agarwal et al. 2009; Arrow 1965; Friedman 1974). Classical economic models assume that consumers maximize expected utility over a lifetime by making borrowing and saving decisions to smooth the consumption flow. Because financing decisions typically are complex, a new stream of literature in marketing and economics examines how customers may make suboptimal decisions. For instance, consumers tend to underestimate the exponential growth of savings (McKenzie and Liersch 2011), demonstrate inertial behavior in investment decisions (Madrian and Shea 2001), become overly optimistic about future usage of credit cards at adoption (Yang, Markoczy, and Qi 2007), and underestimate and overspend on exceptional expenses (Sussman and Alter 2012). In this article, we study the financial decision of obtaining loans for big-ticket durable goods consumption. We document that the decision is associated with receiving a bonus as well as a higher delinquency rate for the bonus-induced loans.

Various behavioral factors may influence consumer financial decision making. In particular, the mental accounting literature provides a conceptual framework by predicting a different marginal propensity to consume over different mental accounts (Thaler 1985). Such mental accounts will affect households' spending and investing decisions (Zhang and Sussman 2017). Consumers are more likely to spend income framed as a gain from the current wealth state, such as a bonus, than income framed as a return to the prior state, such as a rebate (Epley, Mak, and Idson 2006). Different mental accounts are also shown to affect consumers' preferences between hedonic and utilitarian products (O'Curry and Strahilevitz 2001). The windfall theory (Arkes et al. 1994), as a special case of mental accounting, focuses on the unexpected nature of the income and shows that unexpected gains are spent more readily than expected gains. These psychological explanations can contribute to the overall effect we find in this research. We also demonstrate how the loan decision can have a significant impact on a consumer's future financial state. Finally, related to our context, Thaler and Shefrin (1981) suggest that receiving a portion of salary via a bonus will promote savings because, by distributing a lump-sum payment instead of increasing each paycheck, it acts as an external self-control device. Our empirical results, however, show that this may not always be the case.

Data Description

Our empirical analysis leverages anonymized data on individual credit profiles and employment information, combining

Table 1. Descriptive Statistics on Auto Loan Origination.

	Number of Individuals (Millions)	Percentage	Monthly Auto Loan Origination Rate		
			Average	Bonus Month	Non–Bonus Month
	(1)	(2)	(3)	(4)	(5)
Overall	2.5	100%	1.72%	1.81%	1.71%
Credit Score Groups					
300−620	.6	23%	1.71%	1.83%	1.70%
621−760	1.1	43%	2.01%	2.11%	2.00%
761−850	.8	33%	1.35%	1.40%	1.35%
Annual Income Groups					
$10,000–$50,000	.9	37%	1.60%	1.64%	1.59%
$50,000–$100,000	1.0	38%	1.81%	1.90%	1.80%
>$100,000	.6	25%	1.76%	1.90%	1.75%

different databases operated by multiple business units of Equifax. Equifax is one of the three major credit bureaus, and it provides the largest consumer-reporting database of employment and income in the United States. The employment data in our study come from the voluntary participation of approximately 1,500 employers in the United States. The data are reported to Equifax on a payroll-to-payroll basis. They are in the form of anonymous information on each employee's monthly compensation that is broken down into different components, including base salary, bonus, commission, and overtime pay. The detailed compensation data enable us to know the timing and size of bonuses as well as changes in the base salary. The credit data contain information on all individuals with a credit history, as all banks are required to report the credit information to the three major credit bureaus. We observe whether these individuals have an auto loan and, if so, the time of the loan origination as well as subsequent monthly repayments. We merge the credit and employment data for individuals for whom we have both employment and credit data in 2015, then use the credit data of those individuals to assess their auto loan repayment behavior. This rich data set allows us to examine the impact of receiving a bonus on auto loan demand as well as the repayment behavior for those loans. Note that we measure the impact of bonuses on auto loan demand instead of the underlying vehicle demand. This is because we cannot directly estimate the impact on vehicle demand because we do not observe the vehicle purchase without an auto loan.

The sample for the main analysis consists of 2.5 million individuals who received one bonus payment in 2015.[3] Note that these individuals may or may not take out an auto loan during our sample period. The average consumer in our sample has a credit score of 697 (in a range of 300–850; median: 716) and makes $73,000 in annual income (median: $64,000).[4] About one-fifth of these individuals originated an auto loan in 2015. The average auto loan origination rate in a month is 1.72%, which is higher than the 1.1% average origination rate for the general U.S. population.[5] The difference could be due to the auto loan origination rate being higher for individuals in the workforce than the general population. Column 3 of Table 1 shows the auto loan origination rate by credit score and income groups. Columns 4 and 5 further compare the origination rate in the month when a bonus is received and that in other months. Consistently across all groups, the loan origination rates are higher in the bonus month.

The main analysis focuses on individuals who have received a bonus payment. We compare auto loan demand when consumers receive a bonus with that during non–bonus months, and the delinquency rates of loans originated during bonus month vs. other months. In the "Mechanisms" section, we further leverage information from consumers who do not receive a bonus. Because there may be systematic differences between people who do and do not receive bonus payments, we use a matching approach to compare with consumers (loans) with similar observed characteristics.

The average amount of bonus payments is about $4,700, which is about 6.5% of the annual income. The distribution of bonus size is heavily right-skewed, with a quarter of individuals receiving an amount smaller than $500. In our sample, 70% of individuals also receive an increase in the base salary. The average annualized salary increase is about $5,800. Figure 1 shows the density distributions of bonus payments

[3] To identify the effect of receiving a bonus, we exclude individuals who received multiple bonuses in the year. It is difficult to pin down which bonus has the direct effect on the loan origination, because some of the bonuses were paid out in consecutive months in the year.

[4] The average credit score of 697 is very close to the average 703 in the U.S. population. For income, the median income in the sample is $64,123, which is very close to the median household income reported by the Census Bureau ($63,179). Because our research question only pertains to individuals who have received a bonus, it is conceivable that the average income is higher than that in the general population. We thank an anonymous reviewer for the suggestion on sampling consideration.

[5] To calculate the national origination rate, we use a report (Federal Reserve Bank of New York 2019) showing that the total auto loan origination was $612 billion in 2019. Assuming the average loan size is $20,000, there were 30.6 million loans originated in the year. Dividing the number of loans by the U.S. adult population (at least 20 years old) at 240 million, we obtain a 12.8% annual origination rate, or 1.1% monthly origination.

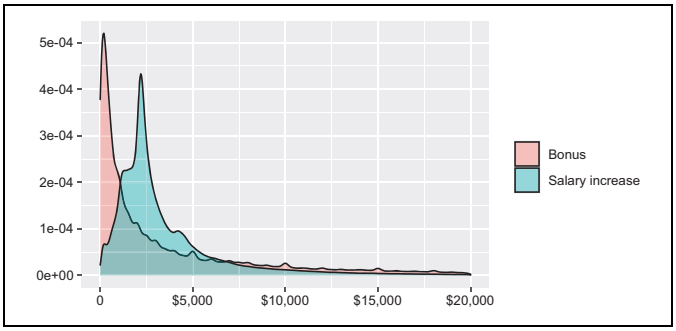

Figure 1. Distribution of bonus and salary increase.

and salary increases. It indicates a more dispersed distribution of bonus payments, which has a larger proportion of very small and large amounts.

For individuals who originate an auto loan in the year, Table 2 presents some summary statistics for the loan characteristics. The average auto loan amount in our sample is \$22,200, with a 5.1% interest rate for five years. The average monthly loan repayment of low-income individuals (those with an annual income of \$10,000–\$50,000) is \$374. The amount is lower than that of individuals with higher income, but it represents a much larger financial burden because the repayment takes from 9% to 45% of their monthly income. Table 2 also reports the delinquency rate one year after the loan origination. Following industry practice, we define "delinquency rate" as the percentage of loans that are 90 DPD. We also use another measure, 60 DPD, for a robustness check. The last two columns show that delinquency rates are significantly higher for individuals with low credit scores and low incomes.

When identifying the effect of receiving a bonus on auto loan origination, it is important to note that the individuals in our data receive bonuses at different times of the year. Figure 2 shows the distribution of when bonuses are paid out. There is a wide distribution, with higher percentages falling in March and April, when many employers end their fiscal year for accounting purposes, as well as in December, the end of the calendar year. The identification of the effects of receiving a bonus comes from the likelihood of taking out an auto loan among individuals who receive a bonus in the month compared with those who do not. Without the variation in the timing of bonuses, we cannot separate the bonus effect from the seasonality of car sales.

Effects of Bonus on Auto Loans

In this section, we document the main effect that receiving bonus payments increases the demand for auto loans. Furthermore, loans originated in the month of receiving a bonus have a higher delinquency risk.

Demand for Auto Loans

To quantify the effect of bonuses on demand, we use a linear probability model to evaluate how the likelihood of auto loan origination for each consumer in a month correlates with whether the consumer receives a bonus payment. Let Loan_{im} equal 1 if consumer i originates an auto loan in month m and 0 otherwise. Let B_{im} equal 1 if consumer i receives a bonus in month m and 0 otherwise. Because the consumer may take some time to research and shop around, the effect of receiving a bonus can impact the auto loan decision in the months after. We therefore also include variables $B_{i,m-1}$, $B_{i,m-2}$, $B_{i,m-3}$ to denote whether the consumer receives a bonus in months $m-1$ to $m-3$ in the regression analysis. Moreover, because the customer may know about the bonus before it arrives in her paycheck, we use $B_{i,m+1}$ to represent that the consumer receives a bonus in month $m+1$.[6] In addition, because having an auto loan represents the purchase of a durable good, the probability of originating an auto loan is likely to be different from consumers who have taken an auto loan recently. To account for this, we include a dummy variable A_{im} that equals 1 if consumer i recently has an auto loan prior to month m, as well as an interaction effect of this dummy with the bonus month B_{im}.[7] Doing so allows us to study the impact of receiving a bonus on auto loan demand while also accounting for the influence of a prior auto loan.

The linear probability model is specified as follows:

$$\begin{aligned}\text{Loan}_{im} = {} & \gamma_1 B_{im} + \gamma_2 B_{i,m-1} + \gamma_3 B_{i,m-2} + \gamma_4 B_{i,m-3} \\ & + \gamma_5 B_{i,m+1} + \alpha A_{im} + \eta B_{im} A_{im} + \beta X_{im} + \varepsilon_{im}. \end{aligned} \quad (1)$$

The main parameters of interest are γ_1, γ_5, which measure the increase in auto loan origination during the months around receiving a bonus. In the equation, X_{im} represents other observed factors that may affect the demand: The first one is the annual income (including the bonus payment) to proxy for a consumer's financial resources. We also include credit score to control for the impact of credit access on auto loan demand. Furthermore, month fixed effects are used to control for the seasonality in car sales, and state fixed effects are used to account for the geographic differentiation. Finally, ε_{im} is a stochastic component that is assumed to be exogenous to the time of receiving a bonus. Given that the need for buying cars is likely to continue as long as the loan origination has not occurred, within-individual εs may be positively correlated across months. To account for the serial correlation, standard errors of our estimates are clustered at the individual level. This holds true for all other regression analyses that involve multi-month observations.

[6] We used more lag months in the preliminary analysis, but the coefficients turn out to be insignificant; thus, we focus on the results that only include three lagged months. As we present next, the coefficient for $B_{i,m+1}$ is statistically insignificant; therefore, we do not include more months prior to month m. We use data from late 2014 and early 2016 to calculate the appropriate lead and lag variables.

[7] For example, if a consumer originates an auto loan in March 2015, then the dummy variable A equals 1 since April 2015. Because the auto loan origination is tracked since November 2014, the dummy variable is more likely to be turned on for later months in the data.We thank the anonymous review team for the suggestion.

Table 2. Auto Loan Characteristics.

	Number of Loans (Millions)	Loan Amount ($10,000)	Loan Length (Years)	Interest Rate	Monthly Payment	Delinquency Rate	
						90 DPD	60 DPD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Overall	.53	2.22	5.08	5.4%	$410	.70%	1.31%
Credit Score Groups							
300−620	.12	2.03	5.22	11.3%	$415	2.51%	4.61%
621−760	.27	2.29	5.15	4.2%	$407	.24%	.48%
761−850	.14	2.26	4.83	2.4%	$414	.02%	.05%
Annual Income Groups							
$10,000–$50,000	.18	1.96	5.18	7.7%	$374	1.56%	2.72%
$50,000–$100,000	.21	2.27	5.14	4.8%	$411	.35%	.79%
>$100,000	.13	2.49	4.87	3.1%	$459	.09%	.25%

Notes: 90 DPD refers to the 90-day delinquency rate. A loan is considered 90 days delinquent when it has missed payments for at least 90 days. Similarly, 60 DPD refers to the 60-day delinquency rate.

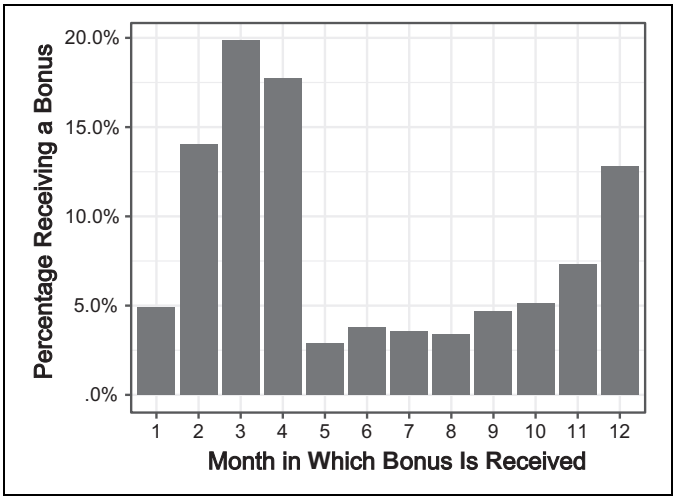

Figure 2. Distribution of the percentage of people who receive a bonus each month.

Regression results are in Column 1 of Table 3. Auto loan demand significantly increases in the month of receiving a bonus by .14 percentage points. Using the baseline of 1.71% origination during non–bonus months (see Table 1), this represents an 8.4% increase from the average monthly origination rate. There are also increases of 6.7%, 3.7%, and 1.6% one month, two months, and three months after receiving the bonus, respectively. Adding the impact of bonuses across the four-month period, the total auto loan demand increases by 20.3%. The effect on the demand for auto loans in the month before receiving a bonus is not significant.

To understand the economic significance of this increase, we use a study from McCarthy (1996) as a reference. The article reports that the estimated price elasticity of new vehicle demand is −.87. This suggests that if an auto company wants to achieve a demand increase of 20.3%, it has to run a 23.3% price promotion for its vehicles. Furthermore, McCarthy finds that the income elasticity of new vehicle demand is 1.70. Thus, there has to be an 11.9% income increase for consumers to increase demand by 20.3%. These results show that the effect identified here is economically meaningful.

Results for the control variables included in the regression are reasonable. The effect of the recent auto loan dummy variable is negative, suggesting that consumers are much less likely to take out another auto loan after having done so recently. With a positive main effect of a bonus payment (.143%), and a negative interaction effect with the recent auto loan dummy (−.12%), it means that receiving a bonus leads to a significant increase in auto loan origination, but the effect will be attenuated for consumers who have recently originated an auto loan. In addition, both annual income and credit score are important in determining the level of auto loan origination.

Robustness Checks

To check the robustness of the result, we conduct several tests. First, one may be concerned that car sales are higher in months when most consumers receive bonuses. Figure 2 shows that many consumers receive bonuses in February, March, April, and December. Many consumers also receive tax refunds between February and April. Car manufacturers may run price and nonprice promotions during those months, which can influence the auto loan demand. Such omitted-variable bias has been taken care of by the month fixed effects in the regression. We further rule out this alternative explanation by measuring the effect for consumers who received a bonus in the months when there are few bonuses observed in the data (i.e., in January and May–November). The results are in Column 2 of Table 3. The estimated coefficients are very close to those in Column 1.

Table 3. Auto Loan Origination and Timing of Bonus.

	Dependent Variable: Originate Auto Loan					
	Linear Probability Model				Logit Model	Linear Placebo
	(1)	(2)	(3)	(4)	(5)	(6)
1 month before bonus	.00003	.00008	.00007	−.00006	.00230	−.00012
	(.00009)	(.00012)	(.00009)	(.00009)	(.00546)	(.00009)
Bonus month	.00143***	.00138***	.00144***	.00104***	.08302***	.00006
	(.00010)	(.00014)	(.00010)	(.00009)	(.00558)	(.00009)
1 month after bonus	.00115***	.00093***	.00116***	.00057***	.06623***	−.00008
	(.00010)	(.00011)	(.00009)	(.00009)	(.00550)	(.00009)
2 months after bonus	.00063***	.00054***	.00066***	.00045***	.03709***	.00007
	(.00009)	(.00010)	(.00009)	(.00009)	(.00527)	(.00010)
3 months after bonus	.00027***	.00039***	.00028***	.00032***	.01529***	−.00002
	(.00010)	(.00011)	(.00010)	(.00009)	(.00556)	(.00010)
Recent auto loan	−.00495***	−.00510***	−.00489***		−.32193***	−.00500***
	(.00007)	(.00009)	(.00008)		(.00494)	(.00008)
Bonus month and recent auto loan	−.00120***	−.00131***	−.00121***		−.07405***	−.00042
	(.00026)	(.00040)	(.00028)		(.01852)	(.00026)
Annual income ($10,000)	.00109***	.00113***	.00106***		.00621***	.00011***
	(.00002)	(.00002)	(.00002)		(.00010)	(.000002)
Annual income squared	−.00003***	−.00004***	−.00003***		−.00002***	−.0000003***
	(.000001)	(.000001)	(.000001)		(.000001)	(.00000)
Credit score (100)	.02582***	.02701***	.02573***		.02382***	.02582***
	(.00035)	(.00028)	(.00024)		(.00020)	(.00024)
Credit score squared	−.00211***	−.00219***	−.00210***		−.00002***	−.00211***
	(.00003)	(.00002)	(.00002)		(.0000002)	(.00002)
Month FEs	Yes	Yes	No	Yes	Yes	Yes
State FEs	Yes	Yes	No	No	Yes	Yes
County-month FEs	No	No	Yes	No	No	No
Individual FEs	No	No	No	Yes	No	No
Observations	30,343,500	22,757,625	30,343,500	30,343,500	30,343,500	30,343,500
R^2 (pseudo R^2)	.00129	.00130	.00140	.17555	.0083	.00128

*$p < .1$.
**$p < .05$.
***$p < .01$.
Notes: The sample used in this analysis has a panel structure of individual by month. Each individual is observed 12 months in the data. FEs = fixed effects.

One may also be concerned that there are location- and time-specific unobserved factors that drive the correlation between the timing of the bonus and auto loan demand. To control for those factors, we replace the month and state fixed effects in Equation 1 with county and month interaction fixed effects to allow for a unique time trend in each county. Column 3 in Table 3 reports the results, which are essentially the same as those in Column 1.

To further control for the unobserved heterogeneity across consumers, we include individual fixed effects in another regression. Once we control for individual fixed effects, any variation that is left to pin down the estimate is intertemporal. The identification of the main parameters of interest comes from whether consumers are more likely to originate a loan when receiving a bonus, after controlling for the general time trend of auto loan origination. Note that the individual fixed effects completely soak up the cross-sectional effects of income and credit score, which rules out alternative explanations that systematic differences across individuals may drive the result. Regression results are in Column 4 of Table 3. The estimated coefficients are slightly smaller than those in the main model but are still highly significant.

Given that auto loan origination is a binary variable, a logit regression could be a better specification to test the impact of bonuses on auto loan origination. Therefore, we report results from a logit specification with month and state fixed effects in Column 5 of Table 3. Using the averages of the control variables and the estimated coefficients, we translate the estimated coefficients into the percentage change in demand. The predicted average loan origination rate in months without bonus is 1.62%. Compared with the average, the percentage increase in auto loan demand is 8.5% in the bonus month, 6.7% one month after, 3.7% two months after, and 1.5% three months after. They add up to a 20.4% total increase, which is very close to the results using the linear probability model.

Finally, to further demonstrate the robustness of our results, we conduct a placebo test. In this placebo test, we randomly generate the timing of a bonus for each individual and use the

same model specification as Equation 1 but replace with indicators constructed from the randomly generated bonus months. Column 6 of Table 3 reports the results. As we expect, the coefficients for the month indicators are all statistically insignificant, and the magnitude of the estimates are close to zero.

Auto Loan Delinquency

In this section, we compare the delinquency rate between bonus-induced loans (i.e., loans originated in the months around receiving a bonus) and loans originated in other months. Note that the analysis only includes individuals who are used in the previous analysis (i.e., those who received bonus payments) and originate an auto loan in the data. Each unit of observation in the delinquency analysis is an auto loan. Because the analysis is cross-sectional, results in this section only show the correlation between bonus-induced loans and delinquencies. We further scrutinize the causal link in the next section.

Let Delinq_l equal 1 if loan l is delinquent and 0 otherwise (we define this next). Similar to Equation 1, let $B_{l,m}$ equal 1 if loan l is originated in the same month the consumer receives a bonus and 0 otherwise. We also use $B_{l,m-1}$, $B_{l,m-2}$, $B_{l,m-3}$ to denote if loan l is originated one to three months after receiving a bonus, and $B_{l,m+1}$ captures if loan l is originated one month before receiving a bonus. Together, these indicator variables denote loans that happen close to receiving a bonus. We again use a linear probability model to quantify the effect of receiving a bonus on the delinquency rate, specified as

$$\begin{aligned}\text{Delinq}_l = {} & \delta_1 B_{lm} + \delta_2 B_{l,m-1} + \delta_3 B_{l,m-2} + \delta_4 B_{l,m-3} \\ & + \delta_5 B_{l,m+1} + \beta X_l + \varepsilon_l. \end{aligned} \quad (2)$$

Our main parameters of interest, δ_1 to δ_5, represent the difference in the delinquency rate of bonus-induced loans compared with that of other loans. Covariate X_l includes an intercept and the consumer' s credit score and income. Furthermore, loan amount, loan length, and the interest rate are also used as controls. Month fixed effects (for the month in which the loan was originated) and state fixed effects are also used to control for the time and geographic differentiation across loans. Finally, the stochastic component ε_l is assumed to be i.i.d. across loans.

To measure loan delinquency, we follow the industry practice of characterizing loan delinquency by whether the loan has missed payments for over 90 days (i.e., 90 DPD). We measure loan delinquency 12 months after origination for each loan. Results are reported in Column 1 of Table 4. The 90-day delinquency rate is significantly higher by .22 percentage points for auto loans originated in the same month of receiving a bonus. Although the value may appear small, delinquent loans are very costly for lenders as the recovery value for delinquent loans tends to be small (Einav, Jenkins, and Levin 2012). To put the coefficients in perspective, we compare them with the average 90 DPD at .70%. The effect represents a 31.4% increase in delinquency for loans originated in the month of receiving the bonus, suggesting bonus-induced loans are associated with a significantly higher risk. For the other months around bonuses, the delinquency rates are also higher compared with loans not close to a bonus, but the estimates are not statistically significant.

Robustness Checks

Another commonly used measure for loan delinquency is the 60-day delinquency rate (60 DPD). We repeat the regression analysis using 60 DPD as the dependent variable. Results are in Column 2 of Table 4. Similar to the previous results, the coefficient for auto loans originated in the month of receiving a bonus is significantly positive (.24%). Relative to the average 60 DPD at 1.3%, this represents an 18.5% higher delinquency rate. Because 60 DPD is more common than 90 DPD in our data, we find the estimated coefficients for one month before bonus and two months after bonus are also significant.

We further run a logit regression for the loan delinquency to test the robustness of the results under alternative model specifications. Results are reported in Columns 3 and 4 of Table 4 for 90 DPD and 60 DPD, respectively. Estimation results are qualitatively similar to that in Columns 1 and 2. We translate the estimated coefficients into percentage changes to better interpret the results. Compared with the baseline average, the percentage increase in 90 DPD is 21.3% loans originated at bonus month, and the increase in 60 DPD is 16.4%. They are reasonably close to the results using the linear probability model. We use two additional measures for the delinquency analysis. First, to measure severe delinquencies, we define a loan as truly delinquent when the consumer stops making any additional payments which lasts for at least six months in our data. Second, we use the number of monthly payments overdue, which complements the delinquency rate in representing potential loss for financing institutions. We find that bonus-induced loans have a significantly higher true delinquency rate and number of monthly payments overdue. We further collect additional loan performance data three years after loan origination. The results of a higher delinquency risk for bonus-induced loans are robust with the longer time horizon. Appendix A presents details of the results.

Heterogeneous Effects of Bonus

Next, we present how our estimated effects may be different across individuals with different income and credit scores, as well as the size of the bonus. The potential heterogeneous effects of bonuses have important managerial implications: Results allow financial institutions to more effectively target borrowers depending on how they respond to receiving bonus payments, as well as to assess the extent of the increased risk among different types of borrowers. In the "Mechanisms" section, we discuss how these heterogeneous effects could also help provide suggestive evidence on the underlying mechanisms.

We start with the demand analysis for consumers from different income brackets by running separate regressions for each

Table 4. Delinquency for Bonus-Induced Auto Loans.

	Dependent Variable:			
	90 DPD	60 DPD	90 DPD	60 DPD
	Linear Probability Model		Logit Model	
	(1)	(2)	(3)	(4)
1 month before bonus	.00064	.00165***	.00004	.09061*
	(.00044)	(.00059)	(.06473)	(.04683)
Bonus month	.00217***	.00240***	.19317***	.15227***
	(.00044)	(.00060)	(.06121)	(.04578)
1 month after bonus	.00052	.00098	−.01711	.07436
	(.00045)	(.00061)	(.06938)	(.04863)
2 months after bonus	.00049	.00121**	.01022	.08780*
	(.00043)	(.00059)	(.06934)	(.04860)
3 months after bonus	.00046	.00031	.04329	.02652
	(.00045)	(.00061)	(.06996)	(.05101)
Annual income ($10,000)	−.00149***	−.00194***	−.23614***	−.16883***
	(.00007)	(.00010)	(.01187)	(.00954)
Annual income squared	.00005***	.00007***	.00583***	.00425***
	(.000003)	(.000005)	(.00065)	(.00057)
Credit score (100)	−.06220***	−.11180***	1.42505***	1.87941***
	(.00168)	(.00228)	(.23040)	(.17899)
Credit score squared	.00434***	.00768***	−.18673***	−.22825***
	(.00012)	(.00017)	(.02044)	(.01569)
Loan amount ($10,000)	.00188***	.00333***	.40513***	.33498***
	(.00029)	(.00039)	(.06440)	(.04877)
Loan amount squared	−.00011***	−.00031***	−.02076**	−.02233***
	(.00004)	(.00005)	(.00977)	(.00757)
Loan length (year)	−.00145***	.00071	−.26876***	−.00107
	(.00033)	(.00045)	(.04460)	(.03480)
Loan length squared	.00004	−.00008**	.00798**	−.00024
	(.00003)	(.00004)	(.00407)	(.00295)
Interest	−.03774**	.08280***	19.23768***	21.30005***
	(.00686)	(.00930)	(.94956)	(.75170)
Interest squared	1.03656***	.92174***	−25.64674***	−37.49592***
	(.02756)	(.03733)	(2.79067)	(2.34426)
Month of origination FEs	Yes	Yes	Yes	Yes
State FEs	Yes	Yes	Yes	Yes
Observations	529,001	529,001	529,001	529,001
R^2 (pseudo R^2)	.03809	.05174	.25245	.24014

*$p < .1$.
**$p < .05$.
***$p < .01$.
Notes: The sample used in this analysis is conditional on having a loan originated. Each observation is an auto loan. 90 (60) DPD refers to the 90-day (60-day) delinquency rate. FEs = fixed effects.

income group. We separate consumers into three income buckets: annual incomes below $50,000 (low-income group), between $50,000 and $100,000 (medium-income group), and above $100,000 (high-income group). This classification places roughly one-third of the individuals in the data in each bucket. Columns 1–3 in Table 5 report the regression results. The effects of receiving a bonus on the demand for auto loans are significantly positive across all three income groups. Relative to the average monthly auto loan origination of each group during non–bonus months (see Table 1), the total percentage increase is 12.8%, 21.7%, and 33.0% for low-, medium-, and high-income consumers, respectively.

Credit scores also play an important role in facilitating access to credit and thus also represent an individual's financial resources. We run the analysis for consumers in three different brackets: subprime (less than 620), near prime (620–760), and prime (above 760). Columns 4–6 of Table 5 report the regression results. Using the same approach, we translate the numbers into a percentage increase for each group. The magnitude of the effects across different credit score groups is similar, with a 16.9% increase for subprime consumers, 22.6% increase for near-prime consumers, and 19.6% increase for prime consumers.

Next, we investigate how the effects of bonuses on the delinquency rate vary across consumers. Such results can help

Table 5. Auto Loan Origination by Income and Credit Score.

	Dependent Variable: Originate Auto Loan					
	By Income Groups			By Credit Score Groups		
	<$50,000	$50,000–$100,000	>$100,000	<620	620–760	>760
	(1)	(2)	(3)	(4)	(5)	(6)
1 month before bonus	.00038***	−.00004	−.00005	−.00009	.00025*	−.00016
	(.00014)	(.00015)	(.00018)	(.00018)	(.00015)	(.00014)
Bonus month	.00095***	.00167***	.00242***	.00149***	.00187***	.00099***
	(.00015)	(.00016)	(.00020)	(.00020)	(.00016)	(.00015)
1 month after bonus	.00072***	.00115***	.00205***	.00105***	.00143***	.00090***
	(.00015)	(.00016)	(.00020)	(.00019)	(.00015)	(.00015)
2 months after bonus	.00039***	.00074***	.00072***	.00034*	.00082***	.00047***
	(.00014)	(.00015)	(.00018)	(.00019)	(.00015)	(.00014)
3 months after bonus	−.00002	.00035**	.00058***	.0000003	.00039**	.00029**
	(.00015)	(.00016)	(.00020)	(.00020)	(.00015)	(.00015)
Recent auto loan	−.00524***	−.00565***	−.00392***	−.00505***	−.00604***	−.00403***
	(.00013)	(.00012)	(.00015)	(.00016)	(.00012)	(.00013)
Bonus month and recent auto loan	−.00113**	−.00103**	−.00130**	−.00174***	−.00160***	.00007
	(.00044)	(.00047)	(.00059)	(.00058)	(.00043)	(.00050)
Annual income ($10,000)	.00284***	.00091***	.00037***	.00151***	.00109***	.00055***
	(.00019)	(.00032)	(.00008)	(.00004)	(.00003)	(.00003)
Annual income squared	−.00022***	−.00003	−.00001**	−.00005***	−.00003***	−.00001***
	(.00003)	(.00002)	(.000003)	(.000003)	(.000001)	(.000001)
Credit score (100)	.01885***	.02724***	.02936***	−.00550***	.05351***	.01756
	(.00033)	(.00045)	(.00075)	(.00048)	(.00375)	(.01512)
Credit score squared	−.00152***	−.00223***	−.00246***	.00099***	−.00421***	−.00173*
	(.00003)	(.00003)	(.00005)	(.00005)	(.00027)	(.00095)
Month FEs	Yes	Yes	Yes	Yes	Yes	Yes
State FE s	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,179,248	11,607,120	7,557,132	7,045,200	13,167,336	10,130,964
R^2	.00096	.00139	.00189	.00140	.00116	.00083

*$p < .1$.
**$p < .05$.
***$p < .01$.
Notes: FEs = fixed effects.

financing institutions correctly evaluate the delinquency risk that comes from bonus-induced auto loans. We use the 90 DPD as the dependent variable in the regression.[8] Results are reported in Table 6. Columns 1–3 show that, for consumers with annual income less than $100,000, the delinquency rate is significantly higher for bonus-induced loans. The estimated coefficients represent a 22.6% increase in 90 DPD for the low-income group and a 30.5% increase for the medium-income group, relative to the baseline delinquency rate. For high-income consumers, however, the effect is not significant.

Similarly, Columns 4–6 of the table show that, for consumers whose credit scores are lower than 760, the delinquency risk is higher if a loan is induced by a bonus. Compared with the average delinquency rate, the 90 DPD increases by 23.6% for subprime consumers and 31.1% for near-prime consumers. The effect again is not significant for the prime group.

[8] Results from using 60 DPD are similar. For brevity, we do not report the results here.

Beyond the observed characteristics such as income and credit score, the size of the bonus may also play an important role in determining the demand impact. We analyze the heterogeneous effects by the size of the bonus. The size of bonuses has a wide-ranging distribution across consumers (see Figure 1). We first show the effects of bonuses across consumers who receive very small (<$500), small ($500–$2,000), medium ($2,000–$7,000), and large (>$7,000) bonuses. This classification gives us roughly one-fourth of consumers in the data in each group. We run separate regressions for consumers who receive a bonus of a certain size. Table 7 presents the results. The demand effects are significantly positive for all groups. Interestingly, even for a very small bonus (i.e., less than $500), demand for auto loans increases by 12.8% compared with the average in that group.

Overall, the results in this section suggest that the increase in demand is significant across consumers with different income bands and credit score segments. The increase in the delinquency rate, however, is significant only among consumers with low income and low credit scores. Such heterogeneous

Table 6. Delinquency for Bonus-Induced Auto Loans by Income and Credit Score.

	Dependent Variable: 90 DPD (90-Day Delinquency Rate)					
	By Income Groups			By Credit Score Groups		
	<$50,000	$50,000–$100,000	>$100,000	<620	620–760	>760
	(1)	(2)	(3)	(4)	(5)	(6)
Bonus month	.00354***	.00108**	−.00029	.00592***	.00074**	.00003
	(.00107)	(.00048)	(.00032)	(.00164)	(.00035)	(.00014)
Annual income ($10,000)	−.00950***	−.00071	−.00009	−.00591***	−.00072***	−.00012***
	(.00148)	(.00103)	(.00011)	(.00038)	(.00006)	(.00002)
Annual income squared	.00098***	.00003	.000002	.00025***	.00002***	.000004***
	(.00024)	(.00007)	(.000003)	(.00002)	(.000003)	(.000001)
Credit score (100)	−.07223***	−.03875***	−.03098***	−.09028***	−.02339**	.00364
	(.00370)	(.00218)	(.00187)	(.01523)	(.00917)	(.01560)
Credit score squared	.00503***	.00267***	.00212***	.00683***	.00159**	−.00022
	(.00028)	(.00016)	(.00013)	(.00142)	(.00066)	(.00098)
Loan amount ($10,000)	.000001***	.0000001***	.0000000	.000001***	.0000001***	.00000
	(.0000001)	(.0000000)	(.0000000)	(.0000002)	(.0000000)	(.00000)
Loan amount squared	−.00000***	−.00000	−.00000	−.00000***	−.00000***	−.00000
	(.00000)	(.00000)	(.00000)	(.00000)	(.00000)	(.00000)
Loan length (year)	−.00036***	−.00002	.00001	−.00072***	.00003	−.00001
	(.00007)	(.00003)	(.00002)	(.00011)	(.00002)	(.00001)
Loan length squared	.000001**	−.0000001	−.0000001	.000002**	−.0000003*	.0000001
	(.000001)	(.0000002)	(.0000001)	(.000001)	(.0000002)	(.0000001)
Interest	.00624	−.01111	−.00752	.05387**	.01110*	−.00380
	(.01560)	(.00817)	(.00619)	(.02202)	(.00629)	(.00339)
Interest squared	.99776***	.66544***	.48266***	.80845***	.52064***	.31778***
	(.05841)	(.03524)	(.03229)	(.07945)	(.03105)	(.02654)
Month of origination FEs	Yes	Yes	Yes	Yes	Yes	Yes
State FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	180,666	214,233	134,102	121,354	267,956	139,691
R^2	.04070	.02105	.01396	.03355	.00904	.00284

*$p < .1$.
**$p < .05$.
***$p < .01$.
Notes: FEs = fixed effects.

results have important managerial implications for financial institutions to predict the level of increased demand for different consumers. With lenders increasingly having digital access to income and employment information (Chan et al. 2020), financial institutions should take into account the additional risk associated with bonus-induced loans, especially for consumers with low income and low credit scores. Moreover, we also find that the impact of bonuses on demand is significant across different sizes of bonuses; in particular, consumers are more likely to start an auto loan even if they receive very small bonuses (<$500).

Effects from an Increase in Base Salary

Finally, to demonstrate the unique impact of bonuses on consumer auto loan demand and delinquency, we compare the impact of receiving bonuses with the impact of having a base salary increase. In our data, about 80% of consumers experienced an increase in the base salary, in addition to the bonus payment. We investigate whether their responses to the increase in base salary are different from when they receive a bonus. Intuitively, as the increase indicates higher income that will continue for the future, its effects on the auto loan demand and delinquency rate can be very different from that of one-time bonus payments.

To study the demand effect, we run a similar regression as Equation 1, with indicators for the months around consumers receiving a base salary increase. The results appear in Column 1 of Table 8. Similar to receiving a bonus, the demand for auto loans increases significantly. The total increase across the four months of receiving a base salary increase is .43 percentage points, representing a 24.9% increase compared with the average monthly auto loan origination during non-salary-increase months. The demand increase from salary increase is higher than that from a bonus at 20.3%. The larger demand impact may come from either a larger demand response to the salary increase or from the salary increase being higher on average than the bonus amount. We further compare the demand effect from a bonus with that from a salary increase of the same size. Results suggest that the demand increase is larger from a bonus

Table 7. Auto Loan Origination by Size of Bonus.

	Dependent Variable: Originate Auto Loan			
	By the Size of the Bonus			
	<$500	$500–$2000	$2000–$7000	>$7000
	(1)	(2)	(3)	(4)
1 month before bonus	.00027*	−.00006	.00032*	.00046**
	(.00016)	(.00018)	(.00019)	(.00020)
Bonus month	.00054***	.00090***	.00219***	.00350***
	(.00017)	(.00019)	(.00021)	(.00023)
1 month after bonus	.00062***	.00053***	.00143***	.00288***
	(.00017)	(.00018)	(.00020)	(.00022)
2 months after bonus	.00040**	.00042**	.00094***	.00095***
	(.00017)	(.00018)	(.00019)	(.00020)
3 months after bonus	.00006	−.00001	.00051***	.00083***
	(.00018)	(.00018)	(.00020)	(.00021)
Recent auto loan	−.00512***	−.00510***	−.00503***	−.00486***
	(.00014)	(.00015)	(.00016)	(.00016)
Bonus month and recent auto loan	−.00115**	−.00064	−.00124**	−.00136**
	(.00048)	(.00056)	(.00061)	(.00065)
Annual income ($10,000)	.00163***	.00104***	.00076***	.00040***
	(.00004)	(.00004)	(.00004)	(.00005)
Annual income squared	−.00006***	−.00004***	−.00002***	−.00001***
	(.000002)	(.000003)	(.000002)	(.000002)
Credit score (100)	.02121***	.02364***	.02878***	.02854***
	(.00038)	(.00047)	(.00058)	(.00070)
Credit score squared	−.00172***	−.00193***	−.00234***	−.00238***
	(.00003)	(.00004)	(.00004)	(.00005)
Month FEs	Yes	Yes	Yes	Yes
State FEs	Yes	Yes	No	No
Observations	8,640,492	7,655,208	7,354,896	6,692,904
R^2	.00109	.00113	.00144	.00184

*$p < .1$.
**$p < .05$.
***$p < .01$.
Notes: FEs = fixed effects.

than from a same-sized salary increase when the size is not too large (<$2,500). Appendix B provides detailed results.

Next, we run a similar regression as Equation 2, with an indicator variable for loans originated in the four months around receiving a base salary increase, to study the impacts on delinquencies. Regression results for 90 DPD and 60 DPD are in Columns 2 and 3 of Table 8, respectively. In sharp contrast to the results in Table 4, loans induced by a base salary increase do not have any significant impact on either 90 DPD or 60 DPD. These results suggest that the effects on loan delinquency from these two sources of income increase are very different.

In summary, while both a bonus payment and an increase in base salary lead to a significant increase in auto loan demand, only the bonus-induced loans have a higher delinquency rate. Therefore, the impact of receiving a bonus payment is quite different from a base salary increase. One possible reason is that, after receiving a bonus payment, a consumer' s future monthly income will drop back to the original level. A raise in the base salary, however, resets the consumer' s future income to a higher level. The stability of financial resources is important to alleviate future loan burden.

Mechanisms

In this section, we start by describing the potential mechanisms that can contribute to our results. To test against different mechanisms, we leverage data from individuals who do not receive a bonus, in addition to our main sample who do. Because these two groups can be systematically different, we use a matching approach that compares the behaviors of consumers who receive a bonus with those who do not but who otherwise have very similar observed characteristics. We conduct two matching analyses to study demand and delinquency effects.

The first possible mechanism that can explain our results is that bonus payments can lead to demand expansion on auto loans. Demand expansion can also happen for multiple reasons. First, consumers can adjust their expectations of future income after receiving a bonus and increase their consumption level.

Table 8. Auto Loan Origination and Delinquency with Salary Increase.

	Dependent Variable:		
	Demand Analysis: Originate Auto Loan (1)	Delinquency Analysis: 90 DPD (2)	Delinquency Analysis: 60 DPD (3)
1 month before pay increase	.00051***	.00017	−.00099
	(.00010)	(.00045)	(.00062)
Pay increase month	.00153***	.00008	−.00055
	(.00010)	(.00044)	(.00059)
1 month after pay increase	.00133***	.00004	−.00144**
	(.00010)	(.00045)	(.00061)
2 months after pay increase	.00084***	−.00030	−.00117*
	(.00010)	(.00048)	(.00065)
3 months after pay increase	.00058***	−.00014	−.00156**
	(.00010)	(.00051)	(.00069)
Recent auto loan	−.00497***		
	(.00008)		
Pay increase month and recent auto loan	−.00104***		
	(.00030)		
Annual income ($10,000)	.00105***	−.00148***	−.00189***
	(.00002)	(.00007)	(.00010)
Annual income squared	−.00003***	.00005***	.00007***
	(.000001)	(.000003)	(.000005)
Credit score (100)	.02578***	−.06221***	−.11179***
	(.00024)	(.00168)	(.00228)
Credit score squared	−.00211***	.00434***	.00768***
	(.00002)	(.00012)	(.00017)
Loan amount ($10,000)		.00188***	.00333***
		(.00029)	(.00039)
Loan amount squared		−.00011***	−.00031***
		(.00004)	(.00005)
Loan length (year)		−.00145***	.00072
		(.00033)	(.00045)
Loan length squared		.00004	−.00008**
		(.00003)	(.00004)
Interest		−.03774***	.08241***
		(.00686)	(.00930)
Interest squared		1.03619***	.92230***
		(.02756)	(.03733)
Month FEs	Yes	Yes	Yes
State FEs	Yes	Yes	Yes
Observations	30,343,500	529,001	529,001
R^2	.00129	.03804	.05172

*$p < .1$.
**$p < .05$.
***$p < .01$.
Notes: 90 (60) DPD refers to the 90-day (60-day) delinquency rate. FEs = fixed effects.

The economic theory of permanent income hypothesis (for a review, see Jappelli and Pistaferri [2010]) predicts a higher consumption level when individuals are expected to receive a higher future income. To smooth out the effect, consumers would borrow and increase consumption. However, if the expectation did not pan out, or if consumers increase the consumption level too much, then the loans may end up delinquent. Second, demand expansion can also arise due to psychological reasons. For example, the mental accounting literature (e.g., Epley, Mak, and Idson 2006; Thaler 1985) predicts a higher marginal propensity to consume out of income framed as a gain to the current state. This is especially relevant if the income is unexpected as a windfall (Arkes et al. 1994). Compared with regular salary, a bonus is more likely seen as a gain to the current state, because many consumers may not know for sure whether and how much they can get each year. Because of the nature of the bonus money, consumers can increase consumption and end up with a spontaneous purchase. When the purchase is made with a loan, these consumers take on a high financial burden, which can lead to a higher delinquency rate. It is also possible that consumers who are affected by psychological reasons are less financially savvy or have certain personality traits that correlate with the loan riskiness (Berg et al. 2019; Turkyilmaz, Erdem, and Uslu 2015).

The second possible mechanism is bonus payments leading to demand shifting on auto loans. The need for auto loans may already exist before the bonus payment. But with liquidity constraints, consumers may rely on the extra cash on hand from a bonus for the down payment. Receiving the bonus helps realize an existing need by providing the liquidity (e.g., Agarwal, Liu, and Souleles 2007; Johnson, Parker, and Souleles 2006), and therefore the demand is shifted to the time of receiving the bonus payment. Those who rely on a bonus for liquidity, however, are likely to be more financially constrained. Thus, the delinquency rate can be higher among those consumers. Even without liquidity constraints, it is possible for the bonus payments to serve as a purchase reminder or license to spend. Such psychological mechanisms can also effectively shift the timing of auto loans to when consumers receive a bonus payment.

To shed light on the mechanism, one needs to know the counterfactual situation if consumers did not receive the bonus. It is very challenging, if not impossible, to run such an experiment. We attempt to approximate this by comparing the behaviors of consumers with bonuses with those without bonuses. One obvious difficulty in such an approach is that consumers who receive a bonus and those who do not are systematically different. For example, the average income for those who receive a bonus is $73,000, while it is only $48,000 for those without bonuses. We solve this problem by a matching approach in which we match each "treated" consumer who receives a bonus to one "control" who receives no bonus but is otherwise very similar in observed characteristics. We perform a separate matching analysis for demand analysis and delinquency analysis.

Matching Analysis for Auto Loan Demand

We leverage a matching analysis that compares the behaviors of consumers who receive a bonus with those who do not but are very similar in terms of total income and credit score. Using

the matched consumers without bonuses as a benchmark, we should be able to distinguish the impact of demand shifting and demand expansion on our observed effects. Specifically, if the auto loan demand increases when consumers receive the bonus but decreases by the same amount during the months of no bonus, such a pattern can be explained by demand from non–bonus months shifting to the bonus months. Alternatively, if the auto loan demand increases during bonus months and the demand does not decrease during the non–bonus months, then the pattern is consistent with bonuses leading to demand expansion on auto loans. Finally, with both demand expansion and demand shifting, we expect to see a higher demand when consumers receive a bonus and a lower demand with no bonus, but the increase during bonus months is not entirely offset by the decrease during non–bonus months.

The aforementioned method relies on a critical assumption that these two groups are otherwise comparable except that one receives bonus payments as part of their overall compensation and the other group does not. Because we rely on cross-sectional comparison in this analysis, to ensure that these groups are as similar as possible, we perform a coarsened exact matching using two important observed economic variables: total income and credit score. More specifically, we group all consumers into bins on the basis of their income ($2,000 increments) and credit score (ten-point increments). Each consumer who receives a bonus is matched to one without bonuses who are in the same bin. Due to such coarsened exact matching, each consumer is very similar to their matched consumer, with at most $2,000 difference in total income and at most ten-point difference in credit score.

The detailed matching procedure is as follows:

- Step 1: Group all consumers into bins by total income ($2,000 increments) and credit score (ten-point increments).
- Step 2: For each bin, count the number of unique consumers with bonus (N_b) and the number of unique consumers without bonuses (N_{nb}).
- Step 3: If $N_b < N_{nb}$, for the N_b consumers with bonuses, we randomly select N_b consumers without bonuses as their matched controls. If $N_b \geq N_{nb}$, we randomly select N_{nb} consumers with bonuses as the matched treatment group for the N_{nb} control consumers.
- Step 4: Collect all the matched pairs of treatment and control consumers with their bin numbers.

With the matching procedure, we are left with 6,238 unique bins, with 2.5 million pairs of matched consumers (almost all consumers with a bonus have a matched pair). The average income is $72,900, and the average credit score is 696.6 for both the treatment and control groups.

Using the matched sample, we compare the loan origination rate of consumers in the treatment group (who receive a bonus payment) with that of the control group (who receive no bonus). In particular, to shed light on the potential mechanisms, we separately estimate the difference in origination rates when the treated consumers receive the bonus as well as during other non–bonus months. We use regression analysis to control for bin, month, and state fixed effects.

Table 9. Auto Loan Origination with Matched Consumers with and without Bonus.

	Dependent Variable: Originate Auto Loan
	(1)
Bonus month	.00147***
	(.00009)
1 month after bonus	.00113***
	(.00009)
2 months after bonus	.00059***
	(.00008)
3 months after bonus	.00022**
	(.00009)
Non–bonus months	−.00007*
	(.00004)
Recent auto loan	−.00474***
	(.00005)
Bonus month and recent auto loan	−.00162***
	(.00028)
Bin FEs	Yes
Month FEs	Yes
State FEs	Yes
Observations	60,682,200
R^2	.00140

*$p < .1$.
**$p < .05$.
***$p < .01$.
Notes: FEs = fixed effects.

$$\begin{aligned} Loan_{im} = {} & \gamma_1 B_{im} + \gamma_2 B_{i,m-1} + \gamma_3 B_{i,m-2} + \gamma_4 B_{i,m-3} \\ & + \gamma_5 B_{i,oth} + \alpha A_{im} + \eta B_{im} A_{im} + bin_i + \beta X_{im} + \varepsilon_{im}. \end{aligned} \quad (3)$$

Similar to the main analysis, we use variables $B_{im}, B_{i,m-1}$, $B_{i,m-2}$, and $B_{i,m-3}$ to denote whether consumer i receives a bonus in month m to m − 3. In addition, we include $B_{i,oth}$, which equals 1 if consumer i receives a bonus payment but not in month m to m − 3 (i.e., non–bonus months). All these bonus indicator variables are 0 for consumers without bonuses, which serves as the baseline condition in this regression. bin_i is the bin fixed effects that control for the impact of different income and credit score groups. All the other variables are defined similarly as before, including the month and state fixed effects.

Table 9 presents the results. Consistent with the main results, the loan origination rate increases significantly when consumers receive a bonus. The increase is still significant, albeit smaller for the three months after receiving the bonus. Interestingly, the origination level is lower for the treated consumers during their non–bonus months compared with the control group without bonuses, but the magnitude is small. To better interpret the results, we translate the numbers into percentage terms by comparing with the average origination rate in the matched no-bonus sample (1.73%). Figure 3 shows the

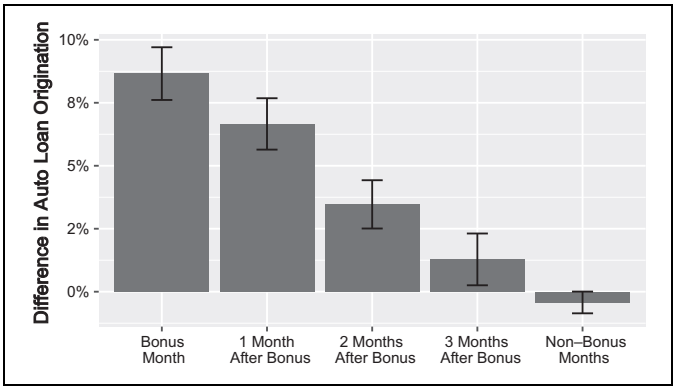

Figure 3. Difference in auto loan origination (compared with consumers without bonuses).

results. The total increase in the four months together is 19.7% compared with consumers without bonuses. During the non–bonus months, however, we do see a slight decrease of .4% in loan origination rate each month, which would add up to 3.2% in the eight months of non–bonus months.

By comparing consumers with bonuses with those without bonuses, the matching analysis helps shed light on the potential mechanisms. Because the increase in auto loan origination during bonus months far exceeds the decrease during non–bonus months, it suggests that bonuses lead to demand expansion on auto loans. In other words, consumers with the same total income will end up with different levels of loan consumption depending on their income composition. Moreover, we also find evidence of demand shifting: the loan origination level is lower during non–bonus months than for consumers without bonuses. This is consistent with some consumers shifting the timing of loan origination to when they receive the bonus, which will lead to a decreased demand in other months. Therefore, both demand expansion and demand shifting likely jointly contribute to the overall effect. On the one hand, bonus payments may be perceived as an unexpected gain or lead to the belief of a higher future income. Consequently, consumers may reward themselves with a big-ticket car purchase and thus need an auto loan. On the other hand, for individuals who are more liquidity constrained or receive larger bonuses, demand shifting may play a more important role in their financial decisions.

Matching Analysis for Auto Loan Delinquency

Next, we use a similar matching analysis to study the delinquency effect of bonus-induced loans. We compare the loans from consumers with bonuses with those from consumers without bonuses in the matching analysis. This helps rule out an alternative explanation from the main analysis that the higher delinquency rate for bonus-induced loans could be driven by the lack of a bonus after loan origination. This is because, for consumers who originate a loan when receiving a bonus (bonus-induced loans), they do not receive a bonus for the rest of the year, whereas those who originate a bonus in non–bonus months can receive a bonus later, which could help in repaying the loan. This concern is eliminated by matching bonus-induced loans to those originated from consumers without bonuses because neither group receives a bonus after the loan is originated.

More specifically, we match each loan from consumers with bonuses (treatment group) with one originated from consumers without bonuses (control group). The loans in each matched pair are originated in the same month and from consumers with similar income ($2,000 increments) and credit score (ten-point increments). To identify the delinquency effect of bonus-induced loans, we further group the loans from consumers with bonus into those originated when receiving the bonus and those originated in other months. Each of these two groups will be compared with the matched loans from consumers without bonuses.

The matching procedure for delinquency analysis is as follows:

- Step 1: Group all loans into bins by the month of origination, total income ($2,000 increments), and credit score (ten-point increments).
- Step 2: For each bin, count the number of unique loans that are originated from consumers with bonuses (L_b), and the number of unique loans originated from consumers without bonuses (L_{nb}). The loans from consumers with bonuses can be further separated into two types: those originated when receiving a bonus and those that are originated outside of the bonus month.
- Step 3: If $L_b < L_{nb}$, for the L_b loans from consumers with bonuses, we randomly select L_b loans from consumers without bonuses as their matched control. If $L_b \geq L_{nb}$, we randomly select L_{nb} loans from consumers with bonuses as the matched treatment group for the L_{nb} loans from consumers without bonuses.
- Step 4: Collect all the matched pairs of treatment and control loans with their bin numbers.

With the matching procedure, we are left with 41,599 unique bins, with .5 million pairs of matched loans (about 99% of all loans from consumers with a bonus have a matched loan). The matched groups have very similar income ($74,300) and the same credit score (690.1). Even though we do not match consumers by loan characteristics, due to the high dimensionality of the variables, the average loan amount is $22,200 for treatment and $22,500 for control, and the average loan lengths (5.08 vs. 5.06 years) and interest rates (5.35% vs. 5.38%) are very close between the two groups.

Using the matched sample, we compare the loan delinquency rate of consumers who receive a bonus payment with that of consumers without bonuses. In particular, we separately estimate the difference in delinquency rates when the loan is originated when receiving the bonus as well as during other non–bonus months. Because loans in the same bin are originated in the same month and have similar income and credit score, we use regression analysis to further control for loan characteristics and fixed effects for each bin and state.

Table 10. Delinquency for Bonus-Induced Auto Loans with Matched Sample.

	Dependent Variable:	
	90 DPD	60 DPD
	(1)	(2)
Bonus loans	.00129***	.00147***
	(.00042)	(.00056)
Loans from non–bonus months	−.00005	−.00003
	(.00016)	(.00022)
Loan amount ($10,000)	.00214***	.00370***
	(.00019)	(.00026)
Loan amount squared	−.00013***	−.00031***
	(.00002)	(.00003)
Loan length (year)	−.00128***	−.00002
	(.00013)	(.00018)
Loan length squared	.00002**	−.00001
	(.00001)	(.00001)
Interest	−.00924*	.10864***
	(.00494)	(.00669)
Interest squared	.93245***	.78441***
	(.01990)	(.02696)
Bin FEs	Yes	Yes
State FEs	Yes	Yes
Observations	1,052,236	1,052,236
R^2	.10391	.11244

*$p < .1$.
**$p < .05$.
***$p < .01$.
Notes: 90 (60) DPD refers to the 90-day (60-day) delinquency rate. FEs = fixed effects.

$$\text{Delinq}_l = \delta_1 B_{lm} + \delta_2 B_{l,oth} + \text{bin}_l + \beta X_l + \varepsilon_1. \quad (4)$$

As before, we use variables B_{lm} to denote whether loan l is originated when receiving a bonus. In addition, we include $B_{l,oth}$ that equals 1 if loan l is originated by a consumer who receives a bonus but during non–bonus months. Both indicator variables are 0 for loans originated by consumers without bonuses, which serves as the baseline condition. bin_l is the bin fixed effects that control for the impact of month of origination and different income and credit score groups.

Consistent with results from the main analysis, we find a higher delinquency rate for bonus-induced loans than similar loans from consumers without bonuses (Table 10). The delinquency rates in terms of 90 DPD and 60 DPD are both significantly higher: compared with the baseline average in the control group (.705% for 90 DPD and 1.313% for 60 DPD), the increase in delinquency rate for bonus-induced loans is 18.3% for 90 DPD and 11.2% for 60 DPD. Loans that are originated during the non–bonus months, however, do not have a higher delinquency rate. The estimated differences in delinquency rates (for both 90 DPD and 60 DPD) compared with loans from consumers without bonuses are very close to zero. Results suggest that consumers who receive a bonus payment are not riskier in general. Only the loans that are likely influenced by receiving a bonus tend to have a higher risk. For the loans that are originated in non–bonus months, they have the same delinquency rates as loans from consumers without bonuses, all else equal.

So far, we have only focused on the effect on the propensity of taking auto loans. It is possible that, when receiving bonus payments, consumers will also increase their spending and therefore take out a larger loan. To investigate this possibility, we use the matched sample from the delinquency analysis and run Equation 4 but use loan amount (in $10,000) as the dependent variable in the regression analysis. Results are in Column 1 of Table 11. Loans originated after receiving a bonus payment do not appear to be larger. In fact, the average amount of those bonus-induced loans is about $200 smaller than loans from consumers without bonuses. Such a difference is very close to loans originated in non–bonus months.

General Discussion

The intended contribution of this study is to report new substantive empirical findings. We document how consumers respond to bonus payments with demand for auto loans. Importantly, these bonus-induced loans are associated with a higher delinquency risk, conditional on other observed characteristics such as credit score and income. By comparing consumers with bonuses with those without bonuses, we find that both demand expansion and demand shifting likely contribute jointly to the overall effect.

Our findings have important managerial implications. They help financial institutions predict when consumers are likely to need auto loans. More importantly, they suggest that financial institutions should take the additional risk into account, especially for consumers with low income and low credit scores. These managerial implications remain valid no matter which mechanism is driving the consumer responses to bonus payments.

To illustrate the importance of our findings, we run a regression analysis similar to Equation 2, with the interest rate (in percentage) as the dependent variable. Interestingly, we find that the interest rate for bonus-induced loans on average is .053% lower than that for other loans. Although the magnitude is small, it indicates that financial institutions do not currently take the increased risk into account. One possible explanation is that, when applying for auto loans, consumers may be required to show recent pay stubs, which will be higher in the month when bonus payments are received. This may bias the risk assessment of financial institutions. Our study shows that the delinquency risk associated with bonus payments should be evaluated separately from the risk associated with a base salary increase. Given that lenders increasingly have digital access to income and employment information (Chan et al. 2020), financial institutions can target consumers who with high need for auto loans and accordingly adjust the interest rate charged on the basis of their delinquency risk.

Our study provides firsthand evidence on how consumers react to bonus payments. Given that demand expansion plays an important role in our results, a program that helps reduce the

Table 11. Loan Amount for Bonus-Induced Auto Loans.

	Dependent Variable: Loan Amount ($10,000)
	(1)
Bonus loans	−.02045**
	(.00579)
Loans from non–bonus months	−.02170***
	(.00227)
Bin FEs	Yes
State FEs	Yes
Observations	1,052,236
R^2	.13126

*$p < .1$.
**$p < .05$.
***$p < .01$.
Notes: FEs = fixed effects.

purchase trigger of bonuses can be beneficial for consumers. For example, when consumers receive a bonus payment, it may be useful to provide financial education or a nudge to assist them with better financial decision making if it can be offered "just in time" (Fernandes, Lynch, and Netemeyer 2014). Empirical evidence of how consumers respond to potentially unexpected lump-sum payments is also important when designing fiscal policies with respect to natural disasters such as the COVID-19 pandemic. For policy makers, it may be worthwhile to consider ensuring the "ability to pay" when auto lenders extend credit to borrowers, similar to the mortgage industry. Such efforts can reduce the amount of predatory loans taken out by consumers who cannot afford them.

There are several limitations in this research that should be addressed in future studies. First, we focus on the impact of bonuses on auto loans. Given the limited knowledge of how bonuses affect consumers' financial decision making and the prevalence of bonuses in practice, future research should further investigate the impact on other important financial decisions, such as credit card purchases, mortgages, and repayment of previous debts. Moreover, if some of the financial decisions triggered by bonuses lead to future costly consequences, such as loan delinquencies that we document in this study, they can further influence consumers' future job performance and movements. A data set that combines consumer financial decisions and employment records enables future research in this direction. Finally, we call for research to tease apart the exact underlying mechanisms that drive consumers' financial decision making. Scholars could provide more causal estimates using field experiments on smaller samples.

Appendix A: Delinquency Analysis Using Alternative Measures

In Appendix A, we show the robustness of the delinquency results using alternative measures of delinquency. After loans become delinquent, consumers can stop making payments altogether, pay back the overdue amount in full, or make partial payments. In the regression analyses for 90 DPD and 60 DPD, we did not differentiate whether the delinquent loan is repaid later. However, the profit implications for financing institutions can be different. This is because consumers will be charged a substantial fee as a penalty for late payments. Thus, delinquent loans that are repaid later can be profitable for the financing institutions, but those institutions will suffer significant loss for loans that are totally defaulted. The implications for consumers can also be different. If they cannot repay the late payments and fees, their vehicles will be repossessed, and they may have to declare bankruptcy to unwind their obligation to pay the loans.

To measure severe delinquencies, we define a loan as truly delinquent when the consumer stops making any additional payments for at least six months in our data. We further explore if bonus-induced loans have a higher chance of true delinquency. We run a similar regression as in Equation 2, where the new dependent variable $Delinq_l$ equals 1 if loan l is truly delinquent within a year of loan origination. It takes a substantial amount of time for loans to become truly delinquent, according to our definition. To obtain a complete picture of true delinquency, we collect additional loan performance data to further check for true delinquency within three years of loan origination.

Columns 1 and 2 in Table 12 report the regression results. Similar to the results in the main delinquency analysis, the true delinquency rate is significantly higher for auto loans that originated in a bonus month. Compared with the baseline, the increase in true delinquency rate is 50% higher (.108% over .214%) among bonus-induced loans within one year of origination and 17.3% higher (.215% over 1.246%) within three years of loan origination.

We use another measure, months of payments overdue, for the delinquency analysis. It complements the delinquency rate in representing potential loss for financing institutions. We run a regression with the number of monthly payments overdue at the end of one year as well as three years after loan origination as the dependent variable. Results are reported in Columns 3 and 4 of Table 12. For loans that were originated in a bonus month, the number of monthly payments overdue is 23.6% higher (.0095 over .0403 months) within one year and 14.1% higher (.0352 over .2489 months) within three years.

Appendix B: Demand Effects from a Bonus and a Base Salary Increase by Size

In the "Effects from an Increase in Base Salary" subsection, we show that the overall increase in auto loan demand is higher from a salary increase than from a bonus payment (27.8% vs. 21.5%). The larger demand impact may come from either a larger demand response to the salary increase or the salary increase being higher, on average, than the bonus amount. In Appendix B, we further compare the demand effect from a bonus and a salary increase by the size of the income increase.

Table 12. True Delinquency and Months of Payments Overdue.

	Dependent Variable:			
	True Delinquency		Months of Payments Overdue	
	1 Year	3 Years	1 Year	3 Years
	(1)	(2)	(3)	(4)
1 month before bonus	.00054**	.00188***	.00397**	.03528***
	(.00025)	(.00058)	(.00187)	(.00917)
Bonus month	.00108***	.00215***	.00947***	.03520***
	(.00025)	(.00058)	(.00188)	(.00921)
1 month after bonus	.00054**	.00059	.00348*	.00117
	(.00025)	(.00059)	(.00191)	(.00937)
2 months after bonus	.00031	.00006	.00212	−.00192
	(.00024)	(.00057)	(.00185)	(.00907)
3 months after bonus	.00040	.00081	.00077	.01757*
	(.00025)	(.00060)	(.00194)	(.00951)
Annual income ($10,000)	−.00047***	−.00244***	−.00621***	−.04521***
	(.00004)	(.00010)	(.00032)	(.00156)
Annual income squared	.00002***	.00008***	.00021***	.00155***
	(.000002)	(.000004)	(.00001)	(.00007)
Credit score (100)	−.01379***	−.05737***	−.30146***	−1.29471***
	(.00095)	(.00223)	(.00719)	(.03529)
Credit score squared	.00096***	.00392***	.02072***	.08880***
	(.00007)	(.00016)	(.00053)	(.00260)
Loan amount ($10,000)	.00057***	.00503***	.01059***	.07710***
	(.00016)	(.00038)	(.00124)	(.00608)
Loan amount squared	−.00006***	−.00051***	−.00070***	−.00654***
	(.00002)	(.00005)	(.00017)	(.00084)
Loan length (year)	−.00020	.00138***	−.00170	.02238***
	(.00019)	(.00044)	(.00141)	(.00694)
Loan length squared	.00002	−.00006	−.00013	−.00239***
	(.00002)	(.00004)	(.00013)	(.00062)
Interest	−.00397	.10803***	.12528***	1.97809***
	(.00385)	(.00909)	(.02931)	(.14378)
Interest squared	.29393***	.93065***	3.91435***	20.55868***
	(.01548)	(.03650)	(.11769)	(.57739)
Month of origination FEs	Yes	Yes	Yes	Yes
State FEs	Yes	Yes	Yes	Yes
Observations	529,001	529,001	529,001	529,001
R^2	.01078	.04544	.05248	.07510

*$p < .1$.
**$p < .05$.
***$p < .01$.
Notes: FEs = fixed effects.

To do so, in addition to the indicator for bonus months,[9] we add bonus size and its square and cubic terms to the regression to study the impact of the size of the bonus on the increase in auto loan demand. The indicator variable can be interpreted as a constant term that captures the effect of merely receiving a bonus. The third-order polynomial terms allow the impact of bonus size to be nonlinear. Similarly, in a separate regression, we include an indicator for salary increase months, as well as salary increase size and its square and cubic terms to study the impact of the size of salary increase.

Columns 1 and 2 of Table 13 report the results for a bonus payment a base salary increase, respectively. Comparing the estimates of the indicator variables, a bonus has a higher impact than a salary increase when the size of the increase is small. To make the comparison easier, we plot the estimated demand increase in auto loans from a bonus and a base salary increase by its size in Figure 4. The first observation is that the relationship is very close to linear in the plotted range. The demand increase is higher with a larger bonus, as well as with a larger salary increase. The rate of increase is higher for a bonus than a

[9] For simplicity, we use one variable to denote all four months after receiving a bonus, so that it equals 1 for the bonus month as well as one month, two months, and three months after the bonus. The estimated effect is the average across the four months. The total increase in auto loan demand is four times the estimated average effect each month.

Table 13. Auto Loan Origination with Size of Bonus and Salary Increase.

	Dependent Variable: Originate Auto Loan		
	Bonus		**Salary Increase**
	(1)		**(2)**
Bonus months	.00057***	Salary increase months	.00018**
	(.00006)		(.00007)
Bonus size ($10,000)	.00075***	Salary increase size ($10,000)	.00232***
	(.00011)		(.00013)
Bonus size squared	−.00009***	Salary increase size squared	−.00033***
	(.00004)		(.00002)
Bonus size cubed	.000002**	Salary increase size cubed	.00001***
	(.000001)		(.000001)
Recent auto loan	−.00499***	Recent auto loan	−.00500***
	(.00008)		(.00008)
Bonus month and recent auto loan	−.00060**	Bonus month and recent auto loan	−.00062**
	(.00027)		(.00029)
Annual income ($10,000)	.00107***	Annual income ($10,000)	.00106***
	(.00002)		(.00002)
Annual income squared	−.00003***	Annual income squared	−.00003***
	(.000001)		(.000001)
Credit score (100)	.02582***	Credit score (100)	.02574***
	(.00024)		(.00024)
Credit score squared	−.00211***	Credit score squared	−.00210***
	(.00002)		(.00002)
Month FEs	Yes	Month FEs	Yes
State FEs	Yes	State FEs	Yes
Observations	30,343,500	Observations	30,343,500
R^2	.00129	R^2	.00130

*$p < .1$.
**$p < .05$.
***$p < .01$.
Notes: FEs = fixed effects.

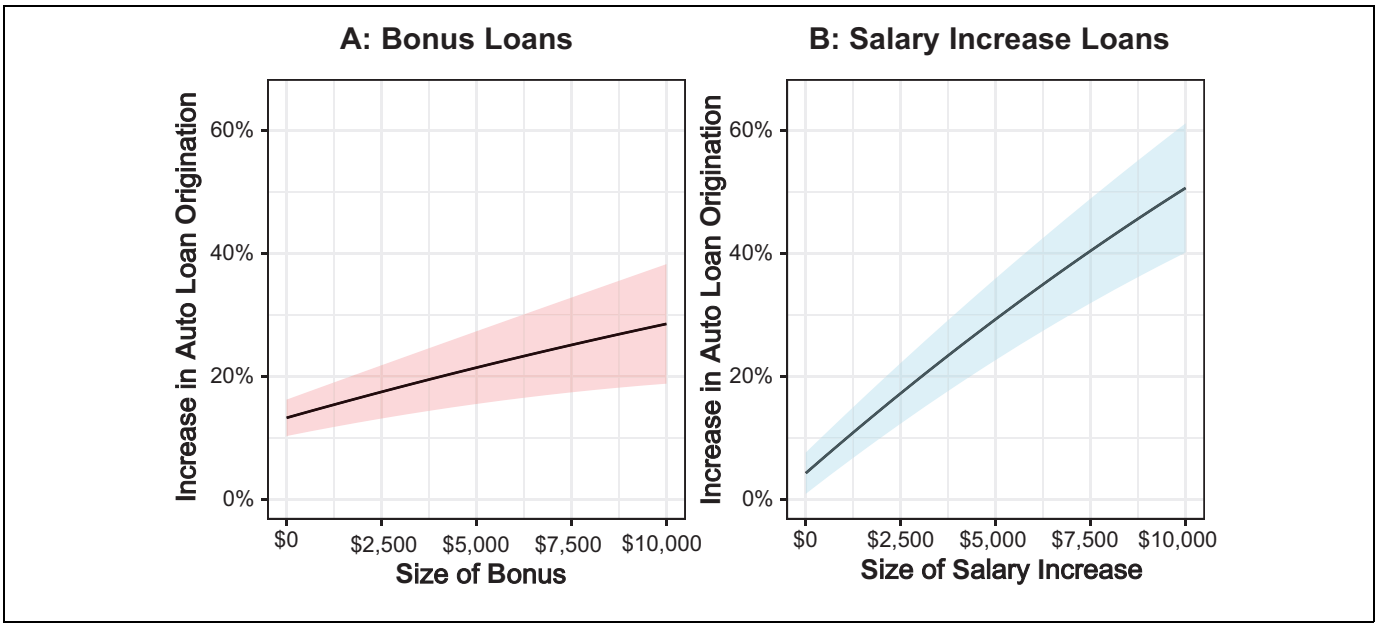

Figure 4. Auto loan origination with size of bonus and salary increase.

base salary increase when the size is not too large (<$2,500). For a larger amount, the impact of a salary increase is higher than that from a bonus payment.

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References

Agarwal, Sumit, John C. Driscoll, Xavier Gabaix, and David Laibson (2009), "The Age of Reason: Financial Decisions over the Life Cycle and Implications for Regulation," *Brookings Papers on Economic Activity*, 2009 (2), 51–117.

Agarwal, Sumit, Chunlin Liu, and Nicholas S. Souleles (2007), "The Reaction of Consumer Spending and Debt to Tax Rebates-Evidence from Consumer Credit Data," *Journal of Political Economy*, 115 (6), 986–1019.

Akerlof, George A. (2007), "The Missing Motivation in Macroeconomics," *American Economic Review*, 97 (1), 5–36.

Arkes, Hal R., Cynthia A. Joyner, Mark V. Pezzo, Jane Gradwohl Nash, Karen Siegel-Jacobs, and Eric Stone (1994), "The Psychology of Windfall Gains," *Organizational Behavior and Human Decision Processes*, 59 (3), 331–47.

Arrow, Kenneth Joseph (1965), *Aspects of the Theory of Risk-Bearing*. Helsinki: Yrjö Jahnssonin Säätiö.

Berg, Tobias, Valentin Burg, Ana Gombović, and Manju Puri (2019), "On the Rise of FinTechs: Credit Scoring Using Digital Footprints," *Review of Financial Studies*, 33 (7), 2845–97.

Chan, Tat, Naser Hamdi, Xiang Hui, and Zhenling Jiang (2020), "The Value of Verified Employment Data for Consumer Lending: Evidence from Equifax," SSRN, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3556554.

De Janosi, Peter E. (1959), "Factors Influencing the Demand for New Automobiles" *Journal of Marketing*, 23 (4), 412–18.

Einav, Liran, Mark Jenkins, and Jonathan Levin (2012), "Contract Pricing in Consumer Credit Markets," *Econometrica*, 80 (4), 1387–1432.

Epley, Nicholas, Dennis Mak, and Lorraine Chen Idson (2006), "Bonus of Rebate: The Impact of Income Framing on Spending and Saving," *Journal of Behavioral Decision Making*, 19 (3), 213–27.

Federal Reserve Bank of New York (2019), "Quarterly Report on Household Debt and Credit, 2019: Q1," Center for Microeconomic Data (May), https://www.newyorkfed.org/medialibrary/interactives/householdcredit/data/pdf/hhdc_2019q1.pdf.

Fernandes, Daniel, John G. Lynch Jr, , and Richard G. Netemeyer (2014), "Financial Literacy, Financial Education, and Downstream Financial Behaviors," *Management Science*, 60 (8), 1861–83.

Flavin, Marjorie A. (1981), "The Adjustment of Consumption to Changing Expectations about Future Income," *Journal of Political Economy*, 89 (5), 974–1009.

Friedman, Bernard (1974), "Risk Aversion and the Consumer Choice of Health Insurance Option," *Review of Economics and Statistics*, 56 (2), 209–14.

Ganong, Peter and Pascal Noel (2019), "Consumer Spending During Unemployment: Positive and Normative Implications," *American Economic Review*, 109 (7), 2383–2424.

Hankins, Scott, Mark Hoekstra, and Paige Marta Skiba (2011), "The Ticket to Easy Street? The Financial Consequences of Winning the Lottery," *Review of Economics and Statistics*, 93 (3), 961–69.

Henry, Jim (2013), "Fewer Cash Buyers, More F&I Opportunity," *Automotive News* (December 18) https://www.autonews.com/article/20131218/FINANCE_AND_INSURANCE/131219875/fewer-cash-buyers-more-f-i-opportunity.

Jappelli, Tullio and Luigi Pistaferri (2010), "The Consumption Response to Income Changes," *Annual Review of Economics*, 2 (1), 479–506.

Johnson, David S., Jonathan A. Parker, and Nicholas S. Souleles (2006), "Household Expenditure and the Income Tax Rebates of 2001," *American Economic Review*, 96 (5), 1589–1610.

Madrian, Brigitte C. and Dennis F. Shea (2001), "The Power of Suggestion: Inertia in 401 (k) Participation and Savings Behavior," *Quarterly Journal of Economics*, 116 (4), 1149–87.

McCarthy, Patrick S. (1996), "Market Price and Income Elasticities of New Vehicle Demands," *The Review of Economics and Statistics*, 78 (3), 543–47.

McKenzie, Craig R.M. and Michael J. Liersch (2011), "Misunderstanding Savings Growth: Implications for Retirement Savings Behavior," *Journal of Marketing Research*, 48 (Special Issue), S1–S13.

O'Curry, Suzanne and Michal Strahilevitz (2001), "Probability and Mode of Acquisition Effects on Choices Between Hedonic and Utilitarian Options," *Marketing Letters*, 12 (1), 37–49.

Olafsson, Arna and Michaela Pagel (2018), "The Liquid Hand-to-Mouth: Evidence from Personal Finance Management Software," *Review of Financial Studies*, 31 (11), 4398–4446.

Parker, Jonathan A. (1999), "The Reaction of Household Consumption to Predictable Changes in Social Security Taxes," *American Economic Review*, 89 (4), 959–73.

Shapiro, Matthew D. and Joel Slemrod (2003), "Consumer Response to Tax Rebates," *American Economic Review*, 93 (1), 381–96.

Society for Human Resource Management (2018), "2018 Employee Benefits: The Evolution of Benefits," report, https://www.shrm.org/hr-today/trends-and-forecasting/research-and-surveys/Documents/2018%20Employee%20Benefits%20Report.pdf.

Stephens, Melvin and Takashi Unayama (2011), "The Consumption Response to Seasonal Income: Evidence from Japanese Public Pension Benefits," *American Economic Journal: Applied Economics*, 3 (4), 86–118.

Sudhir, Karunakaran (2001), "Competitive Pricing Behavior in the Auto Market: A Structural Analysis," *Marketing Science*, 20 (1), 42–60.

Sullivan, Mary W. (1998), "How Brand Names Affect the Demand for Twin Automobiles," *Journal of Marketing Research*, 35 (2), 154–65.

Sussman, Abigail B. and Adam L. Alter (2012), "The Exception Is the Rule: Underestimating and Overspending on Exceptional Expenses," *Journal of Consumer Research*, 39 (4), 800–814.

Thaler, Richard (1985), "Mental Accounting and Consumer Choice," *Marketing Science*, 4 (3), 199–214.

Thaler, Richard H. and Hersh M. Shefrin (1981), "An Economic Theory of Self-Control," *Journal of Political Economy*, 89 (2), 392–406.

Turkyilmaz, Ceyda Aysuna, Sakir Erdem, and Aypar Uslu (2015), "The Effects of Personality Traits and Website Quality on Online Impulse Buying," *Procedia-Social and Behavioral Sciences* 175, 98–105.

Yang, Sha, Livia Markoczy, and Min Qi (2007), "Unrealistic Optimism in Consumer Credit Card Adoption," *Journal of Economic Psychology*, 28 (2), 170–85.

Zhang, C. Yiwei and Abigail B. Sussman (2017), "The Role of Mental Accounting in Household Spending and Investing Decisions," in *Client Psychology*, C. Chaffin, ed. New York: John Wiley & Sons, 65–96.