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Fintech and Crime: Evidence from Banks Partnering with Zelle

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Corresponding Author:	Bo Jiang Xi'an Jiaotong-Liverpool University International Business School Suzhou Suzhou, Jiangsu CHINA
First Author:	Bo Jiang
Order of Authors:	Bo Jiang
	Jiawen Zhou
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Suggested Reviewers:	Keda Zhu 2012210433@live.sufe.edu.cn Expert in Fintech and payment system.
	Su Wang wangsu@shanghaitech.edu.cn Expert in Fintech
	Alicia Dang dangh@union.edu Expert in development economics and applied microeconomics.

Cover Letter

Bo Jiang

Xi'an Jiaotong-Liverpool University

International Business School Suzhou

Department of Economics

No.111 Ren'ai Road, Dushu Lake Higher Education Town

Suzhou, China, 215123

Tel: +86 (195)2278-9676

E-mail: bo.jiang@xjtlu.edu.cn

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Dear Editor,

I am writing to submit a paper entitled "Fintech and Crime: Evidence from Banks Partnering with Zelle" for consideration in the *Economics Letters*.

This paper exploits how the rapid adoption of FinTech payment technology, Zelle, affects crime in the United States. We collect a novel dataset of Zelle's banking partners using an internet archive tool - Wayback Machine. We find that higher Zelle penetration is associated with a lower robbery rate and motor vehicle theft rate at the county level. To address endogeneity, we exploit that Zelle was launched by the seven largest U.S. banks in 2017. The difference-in-difference analysis shows that counties with large exposure to the seven largest U.S. banks before 2017 experienced a large decline in robbery and motor vehicle theft rates. The negative effect on the robbery rate was more pronounced in counties with lower education levels and fewer law employees. Our findings shed light on the social impact of FinTech adoption.

I would like to recommend Keda Zhu(2012210433@live.sufe.edu.cn) as our potential referee. Keda Zhu is an expert in FinTech.

I hope you find the paper interesting and I am looking forward to hearing from you.

Sincerely,

Bo Jiang

Fintech and Crime: Evidence from Banks Partnering with Zelle

Abstract

We study how the rapid adoption of the fintech payment technology Zelle has affected crime in the United States. We find higher Zelle penetration is associated with lower rates of robbery and motor vehicle theft at the county level. To address endogeneity, we exploit that Zelle was launched by the seven largest US banks in 2017. Our analysis shows that counties with high exposure to the seven largest US banks before 2017 experienced a large decline in their robbery and motor vehicle theft rates. The negative effect on the robbery rate was more pronounced in counties with lower education levels and fewer law enforcement employees.

JEL: G20; G21; K40; K42; K49

Keywords: Fintech; Bank; Crime; Payment System;

1 Introduction

The rapid growth in mobile payments driven by the fintech revolution has altered consumer habits and significantly reduced dependence on cash (Snellman et al., 2001). This shift has led to widespread societal changes. In this paper, we investigate how the rapid adoption of the payment technology Zelle has impacted crime in the US.

Zelle is the most widely used person-to-person (P2P) digital payment technology in the US (Balyuk and Williams, 2021). Zelle is integrated into the mobile banking applications of its partner banks, which encourages users to engage in online transactions. Since its establishment in 2017, Zelle has experienced a steadily growing adoption rate, and by 2022, it was partnered with more than 1,800 US banks and credit unions, covering about 80% of all US bank accounts[1]. The continued increase in the number of partner banks may lead to a decline in the amount of physical currency circulating on the streets. This reduction in cash circulation might decrease the prevalence of street crime by removing prime targets for criminal activity.

The main empirical challenge is the collection of historical information on Zelle's banking partners. Zelle's official website only provides the current list of banking partners, without details on when each bank joined the network. We overcome this problem with an internet archive tool, the Wayback Machine. The Wayback Machine allows us to collect information on when each banking partner first appeared on Zelle's website. We use the quarter in which the bank first appeared as the time it joined the Zelle network. We also use the FDIC summary of deposits data to construct county-level Zelle penetration ratios and the FBI Uniform Crime Report (UCR) data to construct county-level crime rates.

Our baseline specification finds that a higher Zelle penetration ratio is associated with lower robbery and motor vehicle theft rates. To address the identification problem, we exploit the fact that Zelle was owned and launched by the seven largest US banks. Our identification assumption is that the launch of Zelle is uncorrelated with local crime conditions and, thus, should be orthogonal to the crime rate. We construct the county-level exposure for the seven largest banks before 2017 and use a difference-in-difference (DiD) analysis to examine whether the launch of Zelle has impacted

[1]Kate Fitzgerald, "Zelle's Rocky Rise in 2022," American Banker, December 22, 2022. https://www.americanbanker.com/payments/list/zelles-rocky-rise-in-2022

crime. Indeed, we find that counties with a higher presence of the seven initiator banks experienced a decline in robbery and motor vehicle theft rates. We test the parallel trends assumption by conducting a dynamic event study.

The heterogeneity analysis finds that the decline in the robbery rate is more pronounced in counties with lower education levels and fewer law enforcement employees. We do not find significant heterogeneity in motor vehicle theft rate.

Our paper is closely related to the literature focusing on the social impact of the transition from cash to digital payments. The use of cash has historically facilitated certain types of crimes, particularly acquisitive crimes such as street robberies and burglary (Armey et al., 2014; Gandelman et al., 2023; Pridemore et al., 2018; Rainone, 2023; Warwick, 1993; Wright et al., 2017). The increasing digitization of payments, represented by the growing use of credit cards, online transactions, and mobile banking, is associated with a decrease in cash-related crimes. This shift has reduced the scale of the underground economy, money laundering, and tax evasion (Dalinghaus, 2017; Deutsche Bundesbank, 2017; Foley, 2011; Giammatteo et al., 2021; Gladisch, 2017; Kruisbergen et al., 2019; Kuchciak, 2013; Soudijn and Reuter, 2016; Warwick, 1993). Overall, the behavior of people and businesses is shifting from cash to electronic payments, which is effective in reducing cash holdings and thus controlling crime.

2 Data

2.1 Zelle Data

We assemble a novel dataset that contains a list of Zelle's partner banks from its current and historical websites.[2] We use each bank's website, as listed by Zelle, to obtain information about its headquarters and geographic location. If the linked website for each bank on Zelle is not accessible, we turn to Facebook, Twitter, and LinkedIn to find its headquarters and location information through the logo in the pop-out window on Zelle's website. Using each bank's headquarters and location information, we can find its unique identity number (RSSD ID) on the Federal Financial Institutions Examination Council (FFIEC) website. In total, there are 998 Zelle partner banks

[2]We use the Wayback machine, a digital archive of the World Wide Web, to trace Zelle's historical websites.

over the sample period of 2017Q3 to 2021Q4, among which 987 are successfully matched with their unique RSSD identified. The outcome from our matching process is comparable with the work by Balyuk and Williams (2021), in which 1.7% of Zelle partner banks are not matched in FFIEC. Figure 1 shows a plot of the number of Zelle partner banks over time.

We use the Summary of Deposits data from the FDIC to construct the county-level Zelle penetration ratio. Specifically, $ZellePen_{c,t}$ is constructed as the total deposits of Zelle partner banks in county c scaled by the total deposits in that county in year t. We standardize the Zelle penetration ratio to ease our coefficient interpretation.

2.2 Crime Data

The crime data are collected from the FBI UCR program. We collect US county-level annual data from 2012 to 2021. To compare crime rates before and after the launch of Zelle in 2017, we analyze data from the five years preceding its inception and compare them with data from the following five years. In addition to the total crime rate, the data include specific categories of offenses: violent crimes including murder and nonnegligent manslaughter, rape, robbery, and aggravated assault, as well as property crimes, namely, burglary, larceny/theft, motor vehicle theft, and arson. Arson data are excluded from this study due to their limited availability and lower relevance to cash transactions. We drop observations claimed as underreported, overreported, or incomparable to previous years' data based on the footnotes of the report.

We compute the county-level crime rate as the number of offenses in the county divided by the population in that county, then multiplied by 100,000. So the crime rate is interpreted as the number of offenses per 100,000 people. We use the annual county-level population data from the United States Census Bureau.

2.3 Control Variable Data

Our control variables include law enforcement employee rate, GDP, personal income, bachelor ratio, and poverty rate. All these control variables are at the county level. We retrieve the law enforcement employee rate from the FBI UCR program. We obtain data for all other variables from the US Bureau of Economic Analysis (BEA) data archives. We list the definitions of these control variables

in Appendix B. Table 1 provides the summary statistics of the data.

3 Methodology

3.1 Baseline

Our baseline specification is as follows:

$$y_{c,t} = \beta ZellePen_{c,t-1} + X_{c,t-1}\gamma + \alpha_c + \alpha_t + \varepsilon_{c,t} \tag{1}$$

where the dependent variable includes the rates of all categories of crime in county c in year t, and $ZellePen_{c,t-1}$ is the Zelle penetration ratio in county c in year $t-1$. We lag one period to deal with the endogeneity issue. We standardize the Zelle penetration measure to ease coefficient interpretation. The notation $X_{c,t-1}$ represents a vector of control variables, including the county-level law enforcement employee rate, GDP, personal income, bachelor ratio, and poverty ratio. We include the county and time fixed effects. The standard deviation is clustered at the county level.

3.2 Reverse Causality

The baseline specification might suffer from reverse causality: the crime rate might impact the adoption of Zelle. To address this endogeneity issue, we exploit the fact that Zelle was launched by the seven largest US banks. These seven largest banks operate nationally, so the local crime rate is unlikely to be the main reason that these banks decided to launch the Zelle service. We construct county-level penetration rates for the seven largest US banks using the summary of deposits (SOD) from FDIC. Thus, we have the following specifications:

$$y_{c,t} = \gamma Post_t \times ZellePenBig7_c + \Gamma X_{c,t-1} + \alpha_c + \alpha_t + \epsilon_{ct} \tag{2}$$

where $Post_t$ is a dummy variable that is 1 after 2017 and 0 otherwise, and the sample period for this specification is from 2012 to 2021. Here, $ZellePenBig7_c$ represents the penetration ratio of the seven largest US banks in county c as of 2017. The control variables are the same as in our benchmark specification. We also include the county and year fixed effects.

We employ dynamic event study analysis to examine the parallel trend assumption. We only conduct dynamic event studies for the crime rates that are significantly impacted by the Zelle adoption at the county level, namely, the robbery and motor vehicle theft rates.

3.3 Heterogeneity Analysis

We conduct a heterogeneity analysis to examine how Zelle adoption affects the robbery rate in counties with different characteristics. The specification is as follows:

$$\begin{aligned} y_{c,t} =& \alpha Post_t \times ZellePenBig\gamma_c \times X_{ct} + \gamma Post_t \times ZellePenBig\gamma_c \times X_{ct-1} \\ &+ Post_t \times X_{ct-1} + \Gamma X_{ct-1} + \alpha_c + \alpha_t + \epsilon_{ct} \end{aligned} \tag{3}$$

We add a triple interaction term into the model including the law enforcement employee rate, GDP, personal income, bachelor ratio, and poverty ratio. The control variables are the same as in our benchmark specification. We also include the county and year fixed effects.

4 Results and Discussion

4.1 Benchmark Specification

We report our benchmark results in Table 2. Column 5 shows that a one standard deviation increase in Zelle penetration is associated with a 0.289 decline in annual robberies per 100,000 people. The result is significant at the 10% level. Column 10 shows that a one standard deviation increase in Zelle penetration is associated with a decline of 2.374 in annual motor vehicle thefts per 100,000 people. The result is significant at the 5% level. However, we do not find an overall decline in the crime rate. Since robbery and motor vehicle theft are crimes that are closely linked with wealth and personal belongings such as cash, the negative effect of Zelle penetration on these crime rates reveals that substituting away from cash through the adoption of Zelle could be responsible for the reduction in these crimes.

4.2 Reverse Causality

We report our DiD results in Table 3. The dependent variables in columns 1 and 2 are the robbery rate and the motor vehicle theft rate, respectively. Specifically, a one standard deviation increase in the penetration rate of the seven largest banks in a county is associated with a decline in the robbery rate of 0.515 per 100,000 people per year and a decline in the motor vehicle theft rate of 1.360 per 100,000 people per year. The result for the robbery rate is significant at the 1% level and the result for motor vehicle theft is significant at the 5% level. The results are consistent with our benchmark results.

We plot the coefficients of our dynamic event study for robbery and motor vehicle theft in Figures 3 and 4. The coefficients before 2017 are insignificant, suggesting there are no prior trends. Both crimes significantly dropped after the introduction of Zelle in 2017.

4.3 Heterogeneity Analysis

We conduct a heterogeneity analysis to determine how different county characteristics affect the robbery and motor vehicle theft rates. The results in Table 4 show that the crime attenuation effect of fintech adoption is more pronounced in counties with fewer law enforcement employees and those with a lower proportion of the population who have bachelor's degrees. We do not find significant heterogeneity for the motor vehicle theft rate.

5 Conclusion

We investigate the impact of fintech adoption on the crime rate in the US. We find counties with high Zelle penetration rates experienced a decline in robbery and motor vehicle theft rates. We find counties with a high presence of the seven largest banks experienced a larger decline in the robbery and motor vehicle theft rates than counties with a low presence. Our results shed light on the social impact of the fintech adoption.

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Appendix A: Figures and Tables

Figure 1: The Number of Zelle Partner Banks over Time

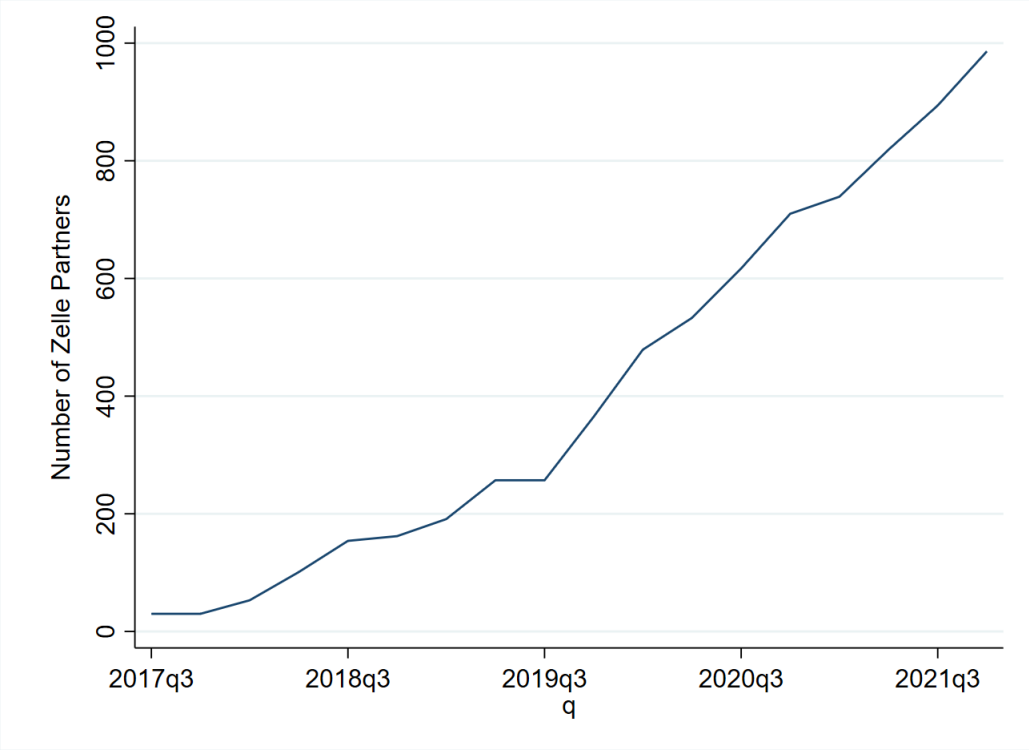

Figure 2: Zelle Penetration in Counties in 2021

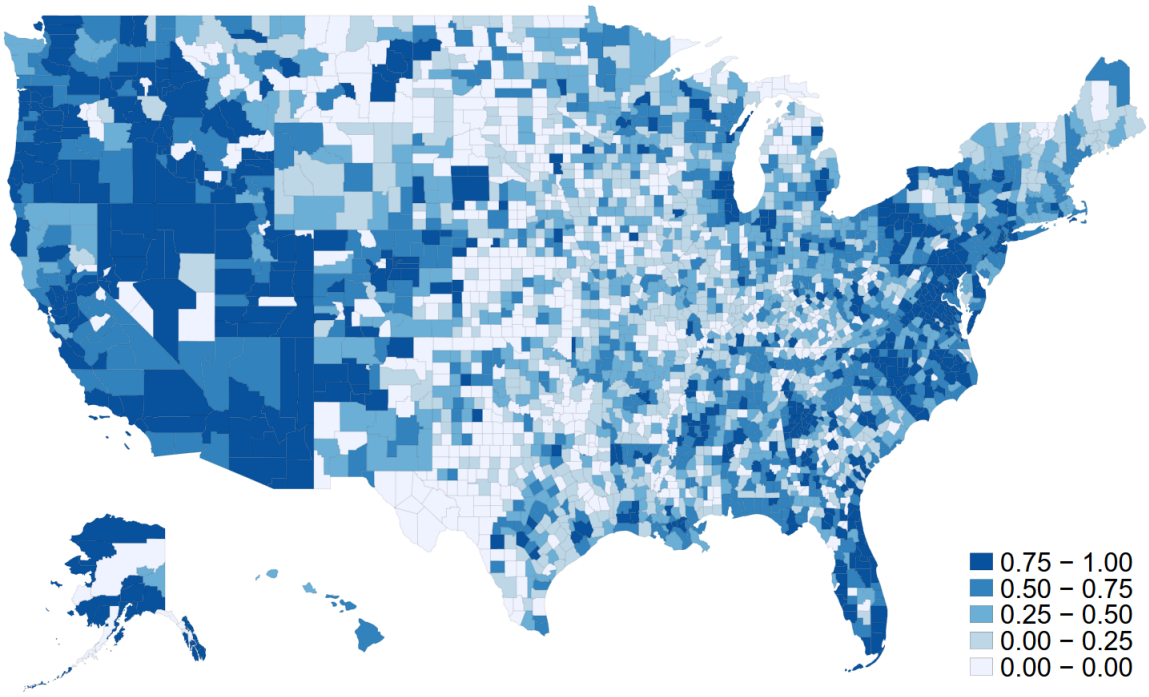

Figure 3: Event Study Estimates for Robbery Rates in the US

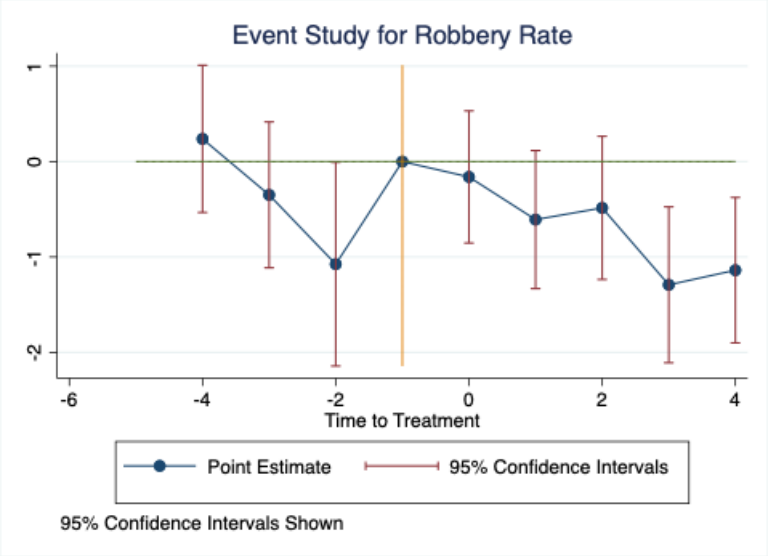

Figure 4: Event Study Estimates for Motor Vehicle Crime Rates in the US

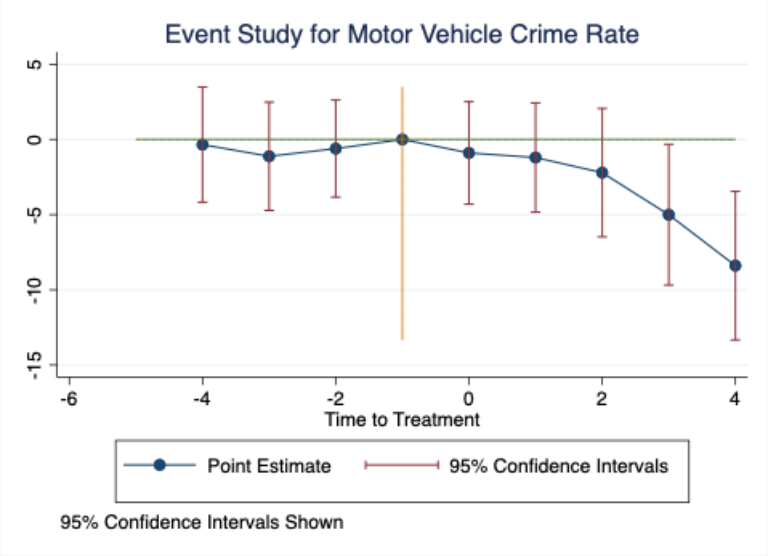

Table 1: Summary Statistics

This table presents the summary statistics of our sample period from 2017 to 2021. We present the definitions of the variables in Appendix B.

	mean	sd	min	max	count
Total Crime Rate	655.026	646.66	0.000	35087.719	10275
Violent Crime Rate	107.279	131.37	0.000	5263.158	10344
Murder Rate	1.808	5.17	0.000	191.571	10483
Rape Rate	15.705	26.25	0.000	1754.386	10344
Robbery Rate	5.047	10.18	0.000	198.055	10483
Aggravated Assault Rate	85.039	110.82	0.000	3508.772	10483
Property Crime Rate	554.242	553.69	0.000	29824.561	10414
Burglary Rate	152.352	154.73	0.000	3314.326	10483
Larceny/Theft Rate	343.015	415.40	0.000	28070.176	10414
Motor Vehicle Theft Rate	58.320	63.52	0.000	1994.302	10483
Law Enforcement Employee Rate	4.105	13.67	0.079	1039.880	12075
Branch Density	42.757	30.97	3.910	339.367	15280
Bachelor Ratio	14.345	5.69	0.000	48.000	16019
LnGDP	14.047	1.76	9.365	22.148	15855
LnPopulation	10.375	1.66	4.043	18.269	15862
Poverty Rate	15.775	7.82	0.000	67.100	16018
Age over 65 Rate	18.794	4.87	3.240	81.538	15447

Table 2: The Impact of Zelle Penetration on Crime

This table reports the regression results for different types of crime on the Zelle penetration at the county level. ZellePen is the county-level Zelle penetration, calculated as the ratio of the Zelle partners' deposits in the county divided by the total deposits in the county. ZellePen is standardized. The results in parentheses are p-values. The notation ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels. The standard deviation is clustered at the county level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Total	Violent	Murder	Rape	Robbery	Assault	Property	Burglary	LarcenyTheft	MotoTheft
L.ZellePen	1.926	0.983	−0.0259	0.427	−0.289*	0.658	0.263	4.035	−1.559	−2.324**
	(0.787)	(0.627)	(0.865)	(0.391)	(0.079)	(0.719)	(0.967)	(0.422)	(0.694)	(0.021)
L.LawEmployee	−0.113	−3.476**	0.129	−0.297	0.0795	−3.395**	3.380	−1.498	3.682	1.084
	(0.983)	(0.034)	(0.392)	(0.522)	(0.527)	(0.015)	(0.437)	(0.498)	(0.185)	(0.376)
L.Branch Density	2.187**	−0.340	0.00483	0.0359	−0.0307	−0.316	2.573**	1.221***	1.018	0.369*
	(0.046)	(0.434)	(0.901)	(0.723)	(0.153)	(0.472)	(0.024)	(0.002)	(0.281)	(0.077)
L.Bachelor	−1.209	−0.383	−0.127	0.490	0.0387	−0.868	−1.223	−0.381	1.191	−2.026***
	(0.777)	(0.758)	(0.174)	(0.200)	(0.706)	(0.433)	(0.753)	(0.845)	(0.699)	(0.004)
L.LnGDP	−2.696	−6.989	0.0149	2.982	−3.192	−5.513	10.84	47.77	−23.57	−14.09
	(0.968)	(0.728)	(0.990)	(0.579)	(0.123)	(0.768)	(0.859)	(0.256)	(0.576)	(0.211)
L.LnPop	−665.3**	−124.5*	−6.697	−8.816	11.25**	−114.7*	−517.0**	−165.7	−319.4*	−22.65
	(0.022)	(0.082)	(0.190)	(0.660)	(0.048)	(0.065)	(0.045)	(0.351)	(0.055)	(0.634)
L.Poverty Rate	2.635	0.556	−0.164**	0.523*	0.0205	0.365	2.554	2.087**	1.032	−0.511
	(0.276)	(0.499)	(0.026)	(0.058)	(0.795)	(0.626)	(0.230)	(0.038)	(0.523)	(0.265)
L.Age over 65 Ratio	−6.339	−1.169	0.345*	0.722	−0.230	−2.020	−4.980	−4.921	−3.031	2.933
	(0.505)	(0.679)	(0.055)	(0.376)	(0.236)	(0.395)	(0.548)	(0.243)	(0.647)	(0.136)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	6399	6451	6505	6451	6505	6505	6453	6505	6453	6505
R^2	0.928	0.870	0.559	0.641	0.777	0.859	0.920	0.829	0.912	0.828

Table 3: The Impact of the Penetration of the Seven Zelle Initiators on Crime

This table reports the regression results for robbery and motor vehicle theft rates on the Zelle penetration at the county level. ZellePenBig7 is the county-level penetration rate for the seven Zelle initiators in 2017. ZellePenBig7 is standardized. The results in parentheses are p-values. The notation ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels. The standard deviation is clustered at the county level. The variables are defined in Appendix B.

	(1)	(2)
	Robbery	MotoTheft
ZellePenBig7*Post	-0.515^{***}	-1.360^{**}
	(0.001)	(0.048)
L.LawEmployee	0.00583^{*}	-0.0242^{*}
	(0.092)	(0.091)
L.Branch Density	-0.00950	0.234^{**}
	(0.479)	(0.035)
L.Bachelor	-0.0259	-1.211^{***}
	(0.652)	(0.004)
L.LnGDP	-0.0872	11.10^{**}
	(0.896)	(0.023)
L.LnPop	-0.0219	-37.11^{**}
	(0.993)	(0.013)
L.Poverty Rate	-0.0299	-0.299
	(0.408)	(0.203)
L.Age over 65 ratio	-0.150^{*}	1.081^{*}
	(0.082)	(0.059)
County FE	Yes	Yes
Year FE	Yes	Yes
N	19270	19270
R^2	0.680	0.714

Table 4: The Impact of Zelle Penetration on Robbery: Heterogeneity Analysis

This table presents the results of regressing the robbery rate on the interaction of ZellePenBig7 and counties' one-year lagged characteristics. All continuous variables are winsorized at the 1st and 99th percentiles. The standard deviation is clustered at the bank level. The variables are defined in Appendix B. The results shown in parentheses are p-values. The notation ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels.

	(1) Robbery Rate	(2) Robbery Rate
L.ZellePen	-0.574^{***}	-1.007^{***}
	(0.000)	(0.001)
L.ZellePen*L.LawEmployee	0.002^{*}	
	(0.070)	
L.ZellePen*L.Bachelor		0.029^{*}
		(0.050)
County FE	Yes	Yes
Year FE	Yes	Yes
Control	Yes	Yes
N	8669	8669
R^2	0.773	0.773

Appendix B: Variable Definitions

The Law Enforcement Employees dataset consists of yearly data gathered on law enforcement officers and non-officer personnel working within law enforcement agencies. It includes details on the number of officers and civilians employed, as well as the ratio of law enforcement employees to the county population. According to the UCR program, law enforcement officers are defined as individuals typically equipped with firearms and badges, possessing full arrest authority, and receiving payment from designated governmental funds allocated for sworn law enforcement roles.

Annual real GDP data are available for each county, presented in thousands of chained 2017 US dollars. They consist of the total GDP of all industries, including both private industries and government sectors within each county.

The population data provide estimates of the number of individuals, including both civilian and military, residing in each county. Personal income refers to the total income received by individuals, consisting of earnings from their provision of labor, land, and capital used in current production, along with other sources of income such as personal current transfer receipts. The ratio of bachelor's degrees represents the estimated percentage of individuals aged 25 years and over who have attained a bachelor's degree within each county.

The poverty rate is the percentage of individuals below the poverty level within each county. Following the guidelines outlined in the Office of Management and Budget's Statistical Policy Directive 14, the Census Bureau uses a set of income thresholds that vary based on family size and composition to ascertain poverty status. If a family's total income is lower than the designated threshold, all members of that family are classified as living in poverty.