



DISCUSSION PAPER

PAYMENT CARDS CENTER

Consumer Use of Fraud Alerts and Credit Freezes: An Empirical Analysis

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September 2014

***Summary:** Fraud alerts — initial fraud alerts, extended fraud alerts, and credit freezes — help protect consumers from the consequences of identity theft. At the same time, they may impose costs on lenders, credit bureaus, and, in some instances, consumers. We analyze a unique data set of anonymized credit bureau files to understand how consumers use these alerts. We document the frequency and persistence of fraud alerts and credit freezes. Using the experience of the data breach at the South Carolina Department of Revenue, we show that consumers who file initial fraud alerts or credit freezes likely do so out of precaution. Consumers who file extended alerts are more likely to be actual victims of identity theft. We find that consumers are heterogeneous in their choice of alerts and that their choices are correlated with important characteristics found in their credit bureau files. These facts are useful for interpreting consumer responses to data breaches and for policymakers.*

Keywords: Data breach, identity theft, fraud alert, credit freeze, credit report, Fair and Accurate Credit Transactions Act (FACTA)

JEL Classification Numbers: D14, D18, G21

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I. Introduction

The Fair and Accurate Credit Transactions Act of 2003 (FACTA), an amendment to the Fair Credit Reporting Act, provides consumers with additional rights to help them protect themselves from identity theft crimes when personal information has been stolen.¹ These protections include the right to place an initial fraud alert in a credit bureau file and the right to place an extended fraud alert in a credit bureau file.² A credit (or security) freeze is another protection mechanism available to consumers to reduce the risk of identity theft.

Although research and survey-based reporting have provided data about the explicit and opportunity costs to victims of identity theft as well as the magnitude of identity theft, little is known about the extent to which consumers use particular types of protections — initial fraud alerts, extended fraud alerts, or credit freezes — and how they make decisions about which one to select. Gaining a better understanding of how consumers use fraud alerts and credit freezes is important because they are complex mechanisms that impose additional costs on lenders, credit reporting agencies, and consumers. It is also important because this understanding will inform policymakers when they design strategies to better safeguard consumers from identity theft and to strengthen public confidence in our financial system.

In this paper, we explore the particular situations in which consumers choose one type of alert over another and develop some intuition about why consumers make these choices. We use a new and unique data set on the timing (or placement) and type of fraud alerts and credit freezes in consumer credit bureau files. We combine these data with detailed anonymized credit bureau information contained in the Federal Reserve Bank of New York Consumer Credit Panel/Equifax data set.

¹ Under federal law, it is a crime to “knowingly transfer or use, without lawful authority, a means of identification of another person with the intent to commit, or to aid or abet, any unlawful activity that constitutes a violation of Federal law, or that constitutes a felony under any applicable State or local law.” A means of identification includes a person’s name, address, date of birth, Social Security number (SSN), and credit card and bank account numbers. When this crime is committed, it is typically described as identity theft. When using the term *identity theft* in this paper, we are referring to financial fraud crimes such as using stolen payment card or account information to purchase goods and services or using stolen personal information to create new credit accounts.

² In the United States, a credit bureau record represents a record of an individual’s borrowing and repayment activity, including information on applications for credit (inquiries), loan balances, and delinquency. These records are also referred to as “credit reports” or “credit bureau files.” For more information on credit reporting in the United States, see Hunt (2005).

We estimate that about 2 million U.S. consumers placed a fraud alert or credit freeze in their credit bureau files in 2012. We document the frequency and persistence of the various types of alerts and discuss a significant change in business practices (the 2009 LifeLock settlement) that is important for interpreting these data. Our analysis shows that consumers use fraud alerts and freezes for different reasons. Using the example of the 2012 data breach at the South Carolina Department of Revenue, we present evidence consistent with a hypothesis that consumers tend to use initial fraud alerts as a precautionary measure. Additional analysis in this paper, and extended in Cheney et al. (2014), suggests that extended alert filers are more likely to be actual victims of identity theft.

We also find there is significant heterogeneity in consumers' choice of alerts and that those choices are correlated with important characteristics found in their credit bureau files. For example, we find that a risk score is an important predictor of the protection device a consumer will choose and that age and credit usage increase the likelihood that a consumer will have any type of alert. Consumers with prime risk scores (above 660) are more likely to obtain a credit freeze or file an initial fraud alert than those with lower risk scores. Consumers with subprime risk scores are more likely to file extended fraud alerts than consumers with higher credit scores.³

The remainder of this paper proceeds as follows. Section II describes the existing literature and publicly available data. Section III provides a detailed description of the characteristics of initial fraud alerts, extended fraud alerts, and credit freezes, and it highlights similarities and differences among these protection mechanisms. Section IV describes our data and methods. Section V summarizes our results including the frequency and entry into different types of alerts, the persistence of alerts; a case study examining how alerts were used in response to the South Carolina Department of Revenue data breach (a geographically limited breach), and the credit characteristics of alert filers. Section VI concludes.

II. Relation to Publicly Available Identity Theft Data and Reports

In 2003, the Federal Trade Commission (FTC) published the *Identity Theft Survey Report*, which was the first of its kind to provide information about the number of identity theft

³ In our 2012 estimate, we multiply the number of fraud alerts and credit freezes based on our 5 percent sample by 20.

incidents, the costs to victims, and the time victims took to resolve an incidence of identity theft.⁴ Importantly, this report defined and captured data for two separate categories of identity theft — existing account fraud and new account and other fraud. When combined, these categories affected 4.6 percent of the U.S. adult population. On average, these victims lost \$500 and spent 30 hours resolving problems stemming from the fraud. The average loss for victims of new account fraud and existing account fraud was \$1,180 and \$160, respectively. On average, victims of new account fraud spent 60 hours resolving problems stemming from the fraud, while victims of existing account fraud spent 15 hours.

Beginning in 2005, Javelin Strategy & Research began publishing annual continuations of the FTC report. In its *2013 Identity Fraud Report*, Javelin found identity fraud to have affected 5.3 percent of U.S. adults in 2012.⁵ New account fraud increased by almost 50 percent from 0.8 percent of all U.S. adults in 2011 to 1.2 percent of all U.S. adults in 2012. This report separately highlighted that consumers who had been notified that they were victims of a data breach were much more likely than the general population to be fraud victims. Specifically, in 2012, 22.5 percent of data breach victims reported being fraud victims, yet only 5.3 percent of the general population reported being fraud victims.⁶

The FTC also maintains a consumer complaint database that gathers information from a variety of sources, including civil and criminal law enforcement authorities. Using these data, the FTC reports annual metrics describing the types of complaints, including complaints about identity theft, received from consumers. In its *Consumer Sentinel Network Data Book for January–December 2012*, the FTC reported that consumers had logged more than 370,000 complaints about identity theft, more than in any other category. Indeed, consumers had filed more complaints about identity theft than any other category of complaints in each of the past 13

⁴ *Identity Theft Survey Report*, Federal Trade Commission, September 2003. See <http://www.ftc.gov/sites/default/files/documents/reports/federal-trade-commission-identity-theft-program/synovaterreport.pdf>.

⁵ *2013 Identity Fraud Report: Data Breaches Becoming a Treasure Trove for Fraudsters*, Javelin Strategy & Research, February 2013. See https://www.javelinstrategy.com/uploads/web_brochure/1303.R_2013IdentityFraudBrochure.pdf.

⁶ Javelin Strategy & Research calculated this result, in part, based on responses to the following survey question “In the last 12 months, have you been notified by a business or other institution that your personal or financial information has been lost, stolen or compromised in a data breach?”

years.⁷ According to these data, after falling in 2009 and 2010, identity theft complaints increased 47 percent by the end of 2012.

Harrell and Langton (2013) report results from the Identity Theft Supplement to the 2012 National Crime Victimization Survey. They estimate nearly 17 million consumers (7 percent of adults) were exposed to identity theft that year. The most common form involved the fraudulent use of an existing financial or nonfinancial account (85 percent of victims). About 7 percent of victims experienced the fraudulent opening of a new account. The authors found that 9 percent of identity theft victims reported the crime to the police. About 9 percent of victims contacted a credit bureau and a majority (70 percent) of those consumers placed an alert in their credit reports.

Verizon Enterprise Solutions,⁸ Privacy Rights Clearinghouse,⁹ and Open Security Foundation,¹⁰ as well as other sources track various aspects of data breaches over time, including the names or types of organizations breached, the number of records compromised, the type of information stolen, and the technique used in the breach (SQL injection, intrusion software, stolen laptop, insider threat, etc.). These organizations are careful to describe how they identify, count, and source information that they report on data breaches. This detail is important because inconsistency exists across these data sources, some of which is due to whether the report captures global or U.S.-only data breach incidents. For example, there is variation in the number of data breach or data loss incidents in 2011, with the Verizon report identifying 855 incidents, Privacy Rights Clearinghouse identifying 598 incidents, and the Open Security Foundation's DataLossDB identifying 1,099 incidents.¹¹ In particular, the Privacy Rights Clearinghouse notes that it includes only data breaches reported in the United States in its chronology. Similarly, the number of compromised records differs depending on the report. Verizon's 2012 Data Breach Investigations Report states that 174 million data records were compromised in 2011. In comparison, Privacy Rights Clearinghouse reports that 66 million records were compromised in

⁷ *Consumer Sentinel Network Data Book for January–December, 2012*, Federal Trade Commission, February 2013. See <http://www.ftc.gov/sites/default/files/documents/reports/consumer-sentinel-network-data-book-january/sentinel-cy2012.pdf>. For the press release announcing this report, see www.ftc.gov/opa/2013/02/sentineltop.shtm.

⁸ *2012 Data Breach Investigations Report*, Verizon Enterprise Solutions. See <http://www.verizonenterprise.com/DBIR/>.

⁹ See <https://www.privacyrights.org/>.

¹⁰ See <http://datalossdb.org/> and <http://datalossdb.org/statistics>.

¹¹ These reports were accessed on July 31, 2014.

2011. None of these reports show a consistent trend, either increasing or decreasing, in the number of data breach incidents or records compromised; all document a continued risk to the security of consumers' personal information and the potential for new account fraud to occur as a result.¹²

These reports are informative about the incidence of data breaches and identity theft and the explicit monetary and associated time costs incurred by victims in the immediate aftermath of an identity theft event. The results in this paper complement these existing reports and the data they draw upon because over time we are able to follow consumers who have placed initial fraud alerts, extended fraud alerts, or credit freezes in their credit bureau files. We can then compare the credit characteristics of consumers with one type of alert to consumers with another type of alert or to those with no alert at all.¹³ We document that there are varying responses to news of data breaches and to incidents of fraud and that the variation in consumer responses is correlated with certain credit characteristics including risk score and age.

III. Detailed Descriptions of Initial and Extended Fraud Alerts and Credit Freezes

Credit bureau files contain at least three types of alerts: initial fraud alerts, extended fraud alerts, and credit (or security) freezes.¹⁴ Initial and extended fraud alerts are rights provided to consumers free of charge under FACTA.¹⁵ Alternatively, credit freezes are rights governed by state law that varies with respect to whether identity theft victims and other consumers are charged a fee and the amount of the fee.¹⁶ Generally, three types of fees are associated with

¹² See also Sullivan (2010).

¹³ The results in our paper are also complementary to research in a number of areas including, for example, the literature on the effects of identity theft and fraud on consumer confidence in payment systems. For reference to a broader literature on identity theft, see Section II of Cheney et al. (2014).

¹⁴ An active duty alert is another form of fraud alert that may be placed on a credit bureau record. This alert is intended for use by service members deployed overseas as a way to increase attention on credit bureau file activity while military personnel members are serving overseas and may not be able to monitor their credit reports as closely as is otherwise possible.

¹⁵ FACTA, Pub.L.108-159

¹⁶ The credit freeze is a fee-based service unless otherwise provided for free of charge under state law. For example, state law varies with respect to the rights of identity theft victims to have a credit freeze placed in their credit file free of charge. State law also varies with respect to the amount of fees charged for placing the initial freeze, lifting the freeze temporarily, or removing it permanently for nonidentity theft victims, including for particular classes of consumers (e.g., consumers over the age of 65). Consumers may choose to apply a credit freeze to their credit bureau file if this service is available to them under state law or under the policies of the credit reporting agency. In most cases, an identity theft victim must submit documentation (e.g., a police report or identity theft report) supporting a case of identity theft in order to obtain a credit freeze free of charge (again, fee amounts vary by state

credit freezes — fees to place the initial freeze, to lift the freeze temporarily, and to remove it permanently from the credit bureau file.¹⁷

Consumers who assert “in good faith a suspicion that the consumer has been or is about to become a victim of fraud or related crime, including identity theft” may place an initial fraud alert in their credit bureau files.¹⁸ An initial alert remains in the credit file for 90 days and may be renewed multiple times by the consumer. To place an extended fraud alert in a credit bureau file, consumers must submit an Identity Theft Report. FACTA defines an Identity Theft Report as “at a minimum: a report that alleges an identity theft; that is a copy of an official, valid report filed by a consumer with an appropriate federal, state, or local law enforcement agency, including the United States Postal Inspection Service, or such other government agency deemed appropriate by the FTC; and the filing of which subjects the person filing the report to criminal penalties related to the filing of false information if, in fact, the information in the report is false.” The distinction between a good faith assertion of identity theft (initial fraud alert) and the requirement to file a police report alleging identity theft (extended fraud alert) is important to our analysis. Essentially, a consumer faces a higher burden of proof in the form of a police report (or Identity Theft Report) in order to file an extended fraud alert. An extended fraud alert remains in a credit file for seven years, unless the consumer removes it earlier. In addition, the filing of an extended fraud alert removes the credit bureau file from prescreened credit and insurance offers for five years. Again, both initial and extended fraud alerts are free of charge to the consumer.

Credit freezes differ from initial and extended fraud alerts, primarily because 1) the credit file is locked down and 2) the service can be fee based. A credit freeze limits access to the credit file, unless the consumer lifts the freeze. As noted earlier, consumers may pay fees not only to place the initial credit freeze but also to lift the credit freeze temporarily and to remove it permanently.

Both initial and extended fraud alerts require a creditor to take additional steps in verifying a consumer’s identity when a request is made to open a new credit account, increase an

law). For more information about the varying state law governing consumer rights to place security freezes, see the Equifax website at https://help.equifax.com/app/answers/detail/a_id/75/~/security-freeze-fees-and-requirements (accessed on July 15, 2014).

¹⁷ Another credit freeze fee that may be assessed is a charge to replace the personal identification number (PIN) associated with the credit bureau file. This PIN enables the customer to lift or remove the freeze.

¹⁸ FACTA, §112

existing credit line, or issue an additional card associated with an existing credit account.¹⁹ For initial fraud alerts, the creditor (or user of the credit bureau report) must apply reasonable policies and procedures to verify the consumer's identity. For example, if the consumer specified a telephone number to be used for verification purposes, the creditor must contact the consumer using this number. If the consumer did not supply a telephone number, the creditor must use reasonable steps to verify the consumer's identity and to confirm that the credit inquiry is not the result of identity theft. For extended fraud alerts, the consumer specifies a telephone number or other reasonable contact method as part of the filing of an extended alert. Therefore, credit bureau report users must contact the consumer by the method identified in the alert to confirm that any applications for new credit, increases in credit limit, or requests for additional cards are not the result of identity theft.

For credit freezes, the consumer must lift the freeze in order to allow potential creditors access to his or her credit bureau file and may incur a fee to lift the freeze. Although identity theft victims who have submitted police reports to the credit reporting agency may not be charged a credit freeze fee in many states, these consumers must still take action to allow access to their credit bureau files. In contrast, the consumer is not required to take steps to allow access to his or her credit bureau file when an initial or extended alert is filed, aside from responding to contacts made to confirm the consumer's identity using the method provided in the alert filing.²⁰

IV. Data

The data set used in this study is the Federal Reserve Bank of New York Consumer Credit Panel/Equifax data set (hereafter CCP) combined with additional information on the timing (placement) and type of fraud alerts obtained from Equifax by the Payment Cards Center.²¹ This CCP data set consists of an anonymized 5 percent random sample of variables contained in the credit bureau records of U.S. consumers. The sample is constructed by selecting

¹⁹ In some cases, the breached company may provide consumers who are victims of a data breach with a vendor service that monitors the consumer's credit bureau file and places fraud alerts on his or her file.

²⁰ For more information about the differences between extended fraud alerts and credit freezes, see <http://www.consumer.ftc.gov/articles/0279-extended-fraud-alerts-and-credit-freezes>.

²¹ The CCP data go back to 1999, but the additional alert data we use span the period Q1:2008 to Q3:2013.

consumers with at least one public record or one credit account currently reported and with one of five numbers in the last two digits of their Social Security numbers (SSNs).²²

The CCP is an unbalanced panel in which new individuals are included over time as they obtain or report an SSN to a lender in their credit applications, open their first credit account, or gain their first public record. Similarly, consumers disappear from the sample when they die, change their SSNs, or “age off,” following a prolonged period of inactivity and no new items of public record. The sample is designed to produce a panel with entry and exit behavior similar to the population that uses credit or has a credit history (Lee and van der Klaauw, 2010).

In this paper, we focus on the characteristics of fraud alert filers at the time, or just before, they file a fraud alert or credit freeze.²³ Often, we make comparisons with consumers whose records contain no alerts or freezes. For this analysis, our inclusion criteria select nondeceased individuals who are present in the CCP for at least five consecutive quarters over the period from Q1:2007 to Q3:2013. As we describe later, using this criteria has an immaterial effect on the sample of consumers with an alert or credit freeze. However, it does eliminate from our analysis some “untreated” consumers (i.e., those without alerts or freezes). After the removal of individuals who are in the data set for fewer than five consecutive quarters, there are 12,948,078 individuals in our sample over the time period of our analysis (Q1:2008–Q3:2013).²⁴

We impose the five quarter criterion to reduce the possibility of contamination in our data by what we call “fragments.” There is no formal definition of the term, but in our implementation, it encompasses a number of possibilities. First, there will be some consumers who die or who are so marginally attached to credit markets that their information ages off of the file.²⁵ Second, in the day-to-day process of integrating new information from many thousand data furnishers, there will be some new records (individuals) created that are subsequently merged with an existing record after the bureau recognizes that two records correspond to the

²² Our data do not include actual SSNs. Equifax uses SSNs to assemble the data set, but the actual SSNs are not shared with researchers. In addition, the data set does not include any names, actual addresses, demographics (other than age), or other codes that could identify specific consumers or creditors.

²³ For a detailed analysis of outcomes in the aftermath of extended alerts, see Cheney et al. (2014).

²⁴ Prior to the removal of fragments, our data contain 14,200,059 individuals present from Q1:2008 to Q3:2013.

²⁵ These are consumers that will exit the data set anyway, but our restriction removes more of them from the analysis.

same person.²⁶ Third, some portion of these records represents fictitious identities that were created to obtain credit fraudulently. We cannot directly quantify the size of the two latter groups, but we certainly do not wish to include them in our sample for the purposes of making comparisons with consumers who file alerts or credit freezes. In addition, the records of these consumers contain numerous missing values, which means they would likely be dropped from the analysis anyway.²⁷

The following statistics suggest that our inclusion criteria have practically no effect on the population of consumers who file either alerts or credit freezes. In total, 596,227 consumers in our 5 percent sample file an alert or credit freeze between Q1:2008 and Q3:2013. Of these, 0.3 percent are excluded by our five quarter continuity requirement. In contrast, among the entire sample of consumers with credit bureau files, the proportion of consumers dropped due to the continuity constraint is 8.8 percent.

The CCP contains a rich set of variables that describe in detail the credit activity of consumers present in the data set. From the CCP, we can examine the number and type of open credit accounts, the age and balances of those accounts, the status of whether accounts are past due and for how long they have been past due, and the amount past due for each type of credit account. We also have information on the number of hard inquiries (defined as credit report requests when a consumer applies for credit) over the preceding three months and the preceding 12 months. A measure of credit risk contained in the CCP is the Equifax Risk Score, a proprietary credit score mathematically derived by Equifax that is akin to other commercially available credit scores. In addition to credit variables, the CCP also offers limited demographic information in the form of consumer age and geographic location (scrambled address, state, zip code, and Census tract/block).

²⁶ This can happen, for example, when consumers move or obtain new credit but not all of their financial accounts have the same address.

²⁷ Wardrip and Hunt (2013) conduct an analysis of “fragments” and find that in June 2010, 25 percent of those records have a missing risk score as compared with 8 percent among all other records. Note that most papers that use the CCP study consumers who are actively using credit — consumers with open mortgages and credit cards for example. For those applications, the issue of fragments is much less important.

V. Results

A. Prevalence of Fraud Alerts

Table 1 presents, at a quarterly frequency, the number of fraud alerts and credit freezes on consumers' files in the entire 5 percent sample ("Primary 5%") compared with consumers present in the CCP for at least five continuous quarters from Q1:2007 to Q3:2013 ("Restricted"). Table 1 measures the "stock" of alerts and freezes: newly filed alerts and freezes, plus all of the old alerts and freezes that have not yet expired or been voluntarily removed. The monotonic increase in the stock of extended alerts and credit freezes over time is due to 1) their relatively long life (see the next section) and 2) the fact that the number of new extended alerts or freezes filed generally has exceeded the number that wear off in any given quarter.

In Table 1, the number of initial fraud alerts present in the early quarters of our sample approaches or exceeds 100,000. The number falls off precipitously in Q4:2009 and oscillates around 30,000 thereafter. This pattern is also observable in Figures 1 and 2. The high volume of initial alerts in 2008 and most of 2009 is likely attributable to the practices of companies such as LifeLock at that time. LifeLock is a provider of identity theft protection services that filed hundreds of thousands of initial fraud alerts on behalf of its customers, including ones who had not experienced an instance of identity theft or fraud. Obviously, this practice influences the interpretation of initial alerts filed prior to 2010, a topic we explore in later sections of the paper. In September 2009, LifeLock settled a lawsuit filed by Experian and ceased this practice.²⁸ Because this change occurred in September 2009, we believe that our data set of initial fraud alerts is free of alerts placed under this LifeLock practice by Q4:2009. Moreover, we believe that initial fraud alerts do not demonstrate a monotonic increase in stock similar to extended fraud alerts and credit freezes primarily due to their shorter life: Initial fraud alerts remain in a consumer's file for 90 days unless refiled by the consumer.

Table 2 presents only the alerts and freezes that are newly filed in a particular quarter (i.e., the "flow" of initial alerts, extended alerts, and freezes). In any given quarter after Q3:2009, the ratio of first initial alerts to first extended alerts is anywhere between 7:1 and 16:1 (the

²⁸ See "LifeLock Settles with Experian to Not Set Fraud Alerts," found at <http://www.scmagazine.com/lifelock-settles-with-experian-to-not-set-fraud-alerts/article/156107/> (accessed on August 27, 2014).

analogous numbers for credit freezes are between 8:1 and 17:1).²⁹ Prior to Q3:2009, the comparable ratios are considerably higher because of the unusually high level of initial alerts likely filed by LifeLock or companies offering a similar service. The number of fraud alerts and credit freezes filed fluctuates slightly from quarter to quarter, with no apparent long-run trend within our sample period.

The frequency counts reveal that the incidence of initial alert, extended alert, and credit freeze usage is inversely related to the stringency of requirements (or consumer costs) of filing fraud alerts and credit freezes. Unlike extended alerts, initial alerts may be filed without a police report. Unlike freezes, initial alerts never involve a monetary cost nor do they completely restrict access to credit bureau files by creditors. The absence of these characteristics makes the initial alert an attractive option for individuals who cannot obtain a police report, who might need access to credit in the near future, or who file an alert out of precaution.

B. Transition Probabilities and Persistence of Alerts and Freezes

The presence of initial alerts, extended alerts, and credit freezes in credit bureau files is not mutually exclusive in any given quarter. We observe that a consumer can have only an alert, only a credit freeze, or a combination of an alert and a freeze active at any one time. A consumer can also repeatedly file the same type of alert or switch between alert types over time. To understand the coexistence and switching processes that govern these transitions, we calculated one quarter and two quarter transition probabilities between all possible alert and no alert combinations, and we computed a weighted average from Q1:2010 to Q3:2013.³⁰ These results are presented in Panel A of Table 3. We choose Q1:2010 as the starting point for our transition matrices due to the unusually high filing of initial alerts during the LifeLock era mentioned in section V.A. This topic is explored further in Section V.C.2.

The high probabilities of an extended alert after a previous extended alert or a freeze after a previous freeze are likely due to the longer term nature of these alert types described in Section III. The one quarter transition probabilities for initial alerts are composed of initial alerts that

²⁹ We call these first extended fraud alerts to distinguish between the quarter in which the alert is placed in the file and the subsequent quarters during which the alert is effective. In other words, we use the term to distinguish between the flow and stock of consumers with fraud alerts in our data.

³⁰ Averages are computed by weighing each quarter by the number of individuals transitioning out of an alert/no alert combination in that quarter.

were consecutively filed and those that were filed at the end of a quarter and are present in a consumer's credit file for two consecutive quarters. On average, initial alerts remained active for one quarter, extended alerts remained active for 27 quarters (6.75 years), and credit freezes remained active for six quarters (1.5 years). Comparing one quarter with two quarter transition probabilities, the likelihood of moving from any alert type to no alert was higher over a two quarter period as is to be expected considering the probability of old alerts or freezes "wearing off" increases over longer periods of time.

For all consumers, there was about a 99.7 percent chance of not filing any type of alert two quarters after having no alert on file previously. This does not imply that only 0.3 percent of consumers become victims of identity theft every six months. The survey results of Harrell and Langton (2013) described in Section II suggest that only 9 percent of identity theft victims contact a credit bureau, and only two-thirds of those place an alert on their files.³¹ Initial alerts were the most favored type of fraud alert mechanism among all consumers, with a 0.18 percent and 0.23 percent probability of filing given no alert or freeze one quarter and two quarters ago, respectively. Although small, these probabilities are magnitudes larger than the corresponding probabilities for extended alerts and credit freezes.

The transition probabilities for all consumers indicate that those who had only an extended alert or credit freeze in their file rarely switched their alert type in subsequent periods. Consumers who had only initial alerts tended to switch to extended alerts at rates of 1.18 percent and 1.25 percent over one quarter and two quarter time periods, respectively. This suggests that, in some cases, initial alerts may serve as an immediate response to identity theft until more information is gained in order to satisfy the requirements to file an extended alert. Among consumers with both a freeze and an alert, about 68 percent kept the combination, while approximately 27 percent opted to have only a credit freeze after one quarter. Only about 3 percent decided to drop the freeze and keep either the initial or extended alert.

Panels B and C of Table 3 report transition matrices separately for consumers with subprime and prime risk scores.³² The panels reveal different behavior with respect to the usage

³¹ This suggests that our counts of filed *extended* fraud alerts substantially underestimate the number of identity theft victims. On the other hand, as we show in the next section, some consumers file initial fraud alerts out of precaution because they fear they may be victims of identity theft.

³² We define prime consumers as consumers with a risk score greater than 660 four quarters before the quarter they are transitioning into. More information on the use of lagged values can be found in Section V.E.

of each type of mechanism. Consumers with prime risk scores were more likely to have only a credit freeze irrespective of their alert status one quarter and two quarters earlier compared with subprime consumers. Subprime consumers were more likely to have only an extended alert irrespective of their alert status one quarter and two quarters earlier. These differences in transition probabilities imply that consumers' choice of the type of alert they file may depend on their credit characteristics. The selection of alerts by different types of consumers in different circumstances is important to understanding the utility of fraud protection mechanisms and will be explored throughout the rest of this paper.

C. Fraud Alerts as Preventive Devices: Evidence of Selection

1. South Carolina Department of Revenue Data Breach

As described in Section II, a variety of sources report information about data breaches in the U.S. Many of these breaches are national or superregional in scope, affecting consumers in many states and, frequently, across the country.³³ In addition, the data breach statistics imply that many breaches are occurring at the same time. The number of records reportedly compromised in these breaches exceeds by an order of magnitude or more the number of consumers reporting that they are victims of identity theft or the number of new alerts and freezes we observe in our data. All of these factors imply that associating a specific data breach with a specific set of customers in our anonymized data set who were affected by that breach will be difficult. Despite these challenges, we can identify at least one data breach with specific timing and geography that permits at least a qualitative assessment — the South Carolina Department of Revenue (“Department of Revenue”) data breach in October 2012. We use this example to examine how consumers react to news of a data breach.

In October 2012, the Department of Revenue announced that it had experienced a data breach that exposed the SSNs of 3.8 million taxpayers and 1.9 million dependents in addition to exposing information for more than 5,000 credit cards and 3.3 million bank accounts.³⁴ Because information was breached at the Department of Revenue, South Carolina residents primarily had

³³ Examples include the breaches at Target and with Sony PlayStation.

³⁴ See <http://www.tripwire.com/state-of-security/security-data-protection/south-carolina-department-of-revenue-data-breach-what-went-wrong/>.

reason to take immediate action to protect or correct their credit bureau files.³⁵ In addition, the free credit-monitoring services offered by the Department of Revenue beginning on October 26, 2012, were proprietary products and are separate from the alerts and freezes observed in credit bureau files, further making this breach ideal to study consumer reaction.³⁶ Figure 1 plots the stock of initial alerts, extended alerts, and freezes for South Carolina residents for the duration of our sample period. When the breach was announced, there was a large increase in the stock of initial alerts and credit freezes filed that persisted through Q1:2013. The subsequent decline in the stock of initial alerts is due to their 90-day lifespan, while the stock of freezes remains elevated due to their longer lifespan determined by the consumer.

Figure 2 graphs the flow of fraud alerts and credit freezes in South Carolina for the duration of our sample. The flows reveal that initial alerts and credit freezes were primarily filed in the Q4:2012 and the Q1:2013, apparently in response to news of the breach. During these quarters, there were 4,154 initial alerts and credit freezes filed in response to the Department of Revenue data breach in our restricted sample. It can be inferred from our sample size that about 83,080 South Carolinians took action via an initial alert or credit freeze as a preventive measure against the Department of Revenue data breach. As a share of South Carolina's population who had credit bureau files, 2.2 percent of consumers took the initiative to protect their credit files by placing initial fraud alerts and credit freezes.³⁷ Of all consumers who filed initial alerts during this time, 80% were prime consumers at the time of filing. Similarly, 92 percent of credit freeze filers were prime consumers at the time of filing. The number of extended alerts filed by South Carolinians was unresponsive to the announcement of the data breach, as it continued to hover around its steady state level.

The surge in initial alert and credit freeze usage around the announcement of the Department of Revenue data breach indicates that initial alerts and freezes are tools used by consumers as a precaution against expected identity theft, conditional on the occurrence of an information-exposing event. The nonresponsiveness of extended alerts to news of the breach is

³⁵ There may be a relatively small number of cases in which the information of some nonresidents was breached. For example, residents of other states who own vacation properties or small businesses in South Carolina may also have had their information compromised.

³⁶ See <http://www.sctax.org/security.htm>.

³⁷ The number of South Carolinians who had credit bureau files was about 3.7 million from Q4:2012 to Q1:2013 as estimated from our data.

as expected: Extended alerts have an associated burden of proof and cannot be filed unless concrete evidence of identity theft is present, thus limiting the ability of a consumer to use an extended alert as a precautionary tool.³⁸

2. LifeLock

The LifeLock practice change that occurred in Q3:2009 is a potentially exogenous event that we exploit to understand how consumers use initial alerts. Therefore, we split initial alert filers into a *LifeLock era* population, defined as consumers who filed an initial fraud alert before Q4:2009, and a *post-LifeLock era* population, defined as consumers who filed an initial alert only in Q4:2009 or later.³⁹ Then, we compare transition probabilities between these two populations after LifeLock ceased automatically issuing initial alerts.

Table 4 reveals a dramatic difference between the LifeLock era and the post-LifeLock era populations in terms of the probability of continuing to have only an initial alert. Consumers who may have been subject to LifeLock practices prior to Q4:2009 were more likely to file initial alerts repeatedly than those who did not, even after LifeLock stopped issuing alerts automatically. The difference between the two populations was even larger over two quarters. This provides more evidence of repeated filing since some initial alerts are filed at the end of a quarter, which affects one quarter transition probabilities. We also found that consumers in the LifeLock era population were more likely to have any kind of alert or freeze one or two quarters after they had no alert compared with the post-LifeLock era population. The differences present between the two populations suggest that consumers who may have used LifeLock services, whether of their own volition or encouraged by a company whose data had been breached, may behave differently than those who were not exposed to LifeLock services at that time.

The observed differences are more pronounced after disaggregating subprime and prime consumers within the LifeLock era and post-LifeLock era populations. Over a two quarter period, 24 percent of prime consumers in the LifeLock era population filed a second initial alert compared with 8 percent of prime consumers in the post-LifeLock era population. By contrast,

³⁸ Our data set provides about a year of data after the South Carolina Department of Revenue data breach. This period may be insufficient to observe changes in the number of extended fraud alerts because the use of the stolen information may occur over time.

³⁹ Although having an initial alert prior to Q4:2009 does not indicate that a consumer actually used LifeLock services, the definition of the LifeLock era population is specific enough to separate out (but not isolate) consumers who were exposed to LifeLock's practice from those who could not have been exposed to LifeLock's practice.

11 percent of subprime consumers in the LifeLock era population filed a second initial alert, compared with 6 percent of subprime consumers in the post-LifeLock era population. These differences between prime and subprime consumers may be explained by at least two possibilities. The increased likelihood of repeated initial alerts for prime consumers, who are more likely to be LifeLock customers, may be a result of their increased attentiveness to their credit bureau files. Such consumers may have continued to take the time to file initial alerts even after LifeLock stopped doing so on their behalf. Alternatively, consumers exposed to the LifeLock practice of filing precautionary initial alerts may have been more likely to perceive this protection as a safeguard and therefore continued the practice on their own.

D. Credit Characteristics of Fraud Alert Filers

Descriptive statistics presented in Table 5 reveal substantial variation in the credit characteristics of individuals who had fraud alerts compared with those who never did. Consumers with initial alerts and freezes in their credit bureau files had, on average, higher risk scores — by 22 and 72 points, respectively — compared with consumers who never had an alert on file during the length of our sample. Consumers with extended fraud alerts had risk scores 24 points lower, on average, compared with consumers who never had an alert on file. Indeed, 73.4 percent of consumers with initial alerts, 88.9 percent of consumers with credit freezes, and only 55.8 percent of consumers with extended alerts on file had prime risk scores. In comparison, 64 percent of the entire sample had a risk score greater than 660 (prime consumers).

Consumers with initial alerts or extended alerts had higher average numbers of hard inquiries compared with consumers who never had an alert. Consumers with credit freezes consistently had lower observed demand for credit than any other group: fewer hard inquiries, older recent accounts opened, and more accounts closed from quarter to quarter. This is to be expected given that a credit freeze restricts all credit report activity until, in many cases, a fee is paid to lift the freeze.

Although credit freezes restrict access to new credit, consumers with credit freezes had a higher average number of open credit cards with a positive balance than consumers who never had a fraud alert, but a lower average number than consumers with initial or extended alerts. Consumers with credit freezes had a median age of 56 years and were older than those who never filed an alert by seven years. Consumers with initial alerts on file had a median age of 47

years, and those with extended alerts on file had a median age of 45 years. The older age of consumers who file credit freezes further implies that credit freeze filers consist of consumers who have greater financial experience than consumers who use other types of alerts.

Credit performance varied across the fraud alert spectrum as well. Consumers with extended alerts had, on average, 0.43 occurrences of 30 days past due balances on bankcards in the past 24 months, compared with 0.38 occurrences for consumers who never filed a fraud alert. Consumers with credit freezes had the lowest average number of 30-day past due occurrences on bankcards, at 0.14, while consumers with initial alerts had 0.28. The same ordinal ranking existed for the number of 120+ days past due occurrences on bankcards and the number of bankcards with a current positive past due balance.

Consumers with initial alerts had lower average amounts past due on their bankcards (approximately \$168) when compared with consumers with credit freezes (approximately \$217), but both types of consumers had average past due balances lower than consumers with extended alerts or no alerts.⁴⁰ Extended alert consumers had an average past due bankcard balance of \$521, and consumers without fraud alerts had an average past due bankcard balance of \$338. A similar pattern is evident for the number of credit accounts 30 days past due.

These differences among different fraud alert filers suggest that consumers who use each type of alert are systematically different from one another and systematically different from consumers who do not use alerts. Consumers with extended alerts are, on average, worse credit risks than consumers who never had an alert, an initial alert on file, or a credit freeze on file. These consumers have a higher demand for credit, a higher utilization of credit, and poorer credit performance. Conversely, consumers with credit freezes are the best credit risks, on average, with low demand for credit and excellent credit performance. Initial alert consumers fall somewhere between these two extremes. These patterns likely result from a confluence of forces surrounding the design of the alerts themselves, selection into each alert, and the consequences of identity theft.

The requirements of each type of fraud protection mechanism and the implications on credit activity after filing can induce selection based on a consumer's characteristics before the alert is filed. As mentioned previously, prime consumers were more likely to use credit freezes,

⁴⁰ The mean of delinquent balances variable we report here is calculated over accounts updated in the last three months.

while subprime consumers were more likely to use extended alerts. This suggests that the cost to consumers of obtaining a credit freeze induces selection among consumers with stronger credit profiles. Subprime consumers who are often more financially constrained, or who may be less attentive (Cheney et al. 2014), are more likely to rely on extended alerts after they have been victimized.⁴¹

At the same time, the nonpecuniary cost of obtaining a police report or other proof of victimization for extended fraud alerts is likely to induce another form of selection. Rather than filing as a precaution, filers of extended alerts are more likely to have experienced instances of fraud. The resulting damage from this fraud may be visible in the consumer's credit file at the time the alert is filed or just before. Evidence in support of this conjecture is reported later.⁴² In the case of initial alerts and credit freezes, our examination of the 2012 South Carolina Department of Revenue data breach shows that they are often used as precautionary measures against fraud. Disentangling selection into fraud mechanisms and the effect of fraud on credit bureau files is important to understanding consumer behavior and the effects of fraud on consumer welfare. It is also important for detecting and interpreting trends in payment fraud. We pursue these questions in the following sections.

E. Evidence of Fraud

We first identify when fraudulent activity is most likely to be present in consumers' credit bureau records in order to understand more precisely how different consumer credit characteristics drive selection into fraud alerts and credit freezes. We can use this information to determine the appropriate number of quarters prior to the placement of an alert that allows us to be reasonably certain our data are not contaminated by the fraud itself. For example, evidence of fraudulent activity can be inferred from large departures in credit card balances, the number of inquiries, accounts opened, changes of address, delinquencies, and/or sudden changes in risk score.

Since risk score is derived from a number of these variables, we plotted over time the share of consumers with a prime risk score who placed an initial alert, an extended alert, or a

⁴¹ For a detailed analysis of the credit histories and outcomes of consumers with extended alerts and the effect of extended alert placement on the attentiveness of this group of consumers, see Cheney et al. (2014).

⁴² Cheney et al. (2014) provide additional details about how changes in credit bureau attributes consistent with fraud can be detected in the CCP.

credit freeze in a particular quarter.⁴³ We refer to consumers who declared a particular alert in a given quarter as one “cohort.” For example, all consumers who declared an initial alert in Q1:2010 belong to the Q1:2010 initial alert cohort.⁴⁴ We calculate the proportion of prime consumers in each cohort for each quarter before and after the alert. In the figures that follow, the quarter of the alert placement is marked where the quarters since treatment (horizontal axis) equal zero. Specific to these figures, we only consider consumers who are continuously present from Q1:2008 to Q3:2013 in order to ensure cohort stability when following consumers over time.

A significant change in the shares of prime and subprime consumers across cohorts at some time before or just as they filed alerts likely indicates the period when fraud took place. Figures 3 and 5 clearly show that consumers who used initial alerts and credit freezes tended to be prime consumers. In addition, neither the initial alert nor the credit freeze cohorts show a material *discrete* change in the share of consumers with prime risk scores. The share of consumers in a given cohort with prime risk scores who file initial alerts remains fairly stable across time in all the cohorts.⁴⁵ The share of consumers with prime risk scores in each of the credit freeze cohorts rises over time, but there is no evidence that this trend is any different before the freeze is filed than after.⁴⁶ This lack of a material, discrete change in the share of consumers with prime risk scores for the initial alert and credit freeze cohorts suggests these consumers may not have experienced fraud on their accounts but are filing preventively. In other words, the patterns depicted in Figures 3 and 5 are consistent with what we observed in our analysis of the 2012 Department of Revenue data breach in the preceding section.

The most interesting trend is for extended alerts, shown in Figure 4. Across all cohorts that filed extended alerts, the share of consumers with prime risk scores was less than 50 percent

⁴³ We use this measure as a simple illustration of the point we are making. Our analysis of changes in other credit bureau variables leads us to the same conclusions we report here.

⁴⁴ We also “relabel” time from calendar time to the number of quarters either before or after the alert is first filed. This allows us to plot multiple cohorts on a single graph.

⁴⁵ Note the significant difference in the risk profile of the earliest and later initial alert cohorts, which we believe is an artifact of the LifeLock era (see Section V.A).

⁴⁶ This upward trend very likely reflects the effect of these consumers paying off their debts over time, while abstaining from new debt while the freeze is in place. It may also reflect improvements in the business cycle over time.

until the alert is filed, at which time it decreased and subsequently rose above prealert levels.⁴⁷ Two conclusions about the relationship between fraud and extended fraud alerts can reasonably be inferred from this figure. First, it is apparent that the majority of consumers who file extended alerts had subprime risk scores well before an alert is filed. These initially low scores do not appear to be the result of damage from fraud at the time the alert is filed. Second, the share of consumers with prime risk scores begins falling across all cohorts of extended alert filers about three quarters before the alert is filed. By one quarter after the extended alert is filed, the share of consumers with prime risk scores increases considerably, generally by more than it fell in the preceding quarters.

To summarize, the timing of fraud alerts or credit freezes does not directly identify when a consumer's account was fraudulently used (or a new account was fraudulently created) or the speed with which a credit bureau file is corrected once the alert is filed. Instead, it indicates when the consumer decided to take action in response to some stimulus. But it is clear from our analysis that consumers who file extended alerts are much more likely to have actually experienced fraud resulting from identity theft. If that is the case, Figure 4 suggests that it typically takes from zero to three quarters for consumers to react to an incident of fraud by filing an alert and that their credit record is usually corrected by the quarter following the placement of the alert.

Tables 6.A–6.C provide additional detail about the potential impact of fraud and the subsequent credit file cleanup for initial alerts, extended alerts, and credit freezes. These tables examine credit characteristics for alert and freeze filers before, during, and after the placement of alerts and freezes. The patterns in risk score over time for all three types of fraud protection mechanisms coincide with changes in the prime/subprime composition of cohorts observed in Figures 3–5. Risk scores for initial alert and credit freeze filers trend slightly upward throughout alert placement, while the risk score of extended alert filers falls briefly before alert placement and proceeds to rise to a level higher than four quarters before the alert placement.

The credit characteristics of extended alert filers around the time of alert placement exhibit patterns are indicative of fraudulent activity, as is evident from Table 6.B. These patterns are absent for initial alert and credit freeze filers, as shown in Table 6.A and 6.C. For example,

⁴⁷ Cheney et al. (2014) explores in much more detail the persistence of this subsequent increase in risk scores among certain filers of extended fraud alert.

there is a noticeable increase in the average number of inquiries filed in the past three and the past 12 months for extended alert filers, leading up to a peak in the quarter the alert is placed. Thereafter, the average number of inquiries drops by almost an entire inquiry four quarters later. Extended alert filers also show, on average, only 0.07 new accounts per quarter a year before the alert, but they show an average of 0.92 accounts closed in the quarter of the alert. Credit performance among extended alert filers also improves in the quarter of the alert, when the average number of bankcard accounts are past due, with the average number of past due occurrences, and as the average amount past due all decline, albeit slightly.

The increased inquiries, closed accounts, and improved indicators of repayment behavior around the date an extended fraud alert is filed suggest that many of these consumers were likely victims of fraud in the preceding quarters. Since extended alerts require a police report to be filed, it is very likely that these filers were the victims of an event (e.g., a data breach) that revealed personal information to unauthorized parties. The results in this section suggest that, for many filers of extended alerts, at least some of that stolen information was used to perpetrate fraud against these consumers. The absence of similar patterns for the initial alert and credit freeze populations suggests the majority of those consumers were not actually victims of fraud, yet they took action to protect themselves from the risk of fraudulent activity.

Another important observation follows from our data. Setting aside the effects of apparent fraud on the credit characteristics of extended alert filers, a much higher share of these consumers have subprime risk scores than we observe among the population of consumers who file initial alerts or credit freezes. This suggests that consumers' choice of the type of remedy may depend on their initial credit characteristics. This implication is explored further in the next subsection.

F. Selection into Fraud Alerts

Using logistic regression, we can identify which consumer credit record characteristics are likely to be associated with the filing of any type of fraud alert or freeze. We can also use this approach to see if the explanatory factors are different for initial alerts, extended alerts, and credit freezes. Understanding these differences is important for interpreting the alert data and why consumers take advantage of specific kinds of alerts.

Table 7 presents odds ratios from logistic regressions in which the dependent variables are binary indicators of the placement of any type of fraud alert or credit freeze, an initial alert, an extended alert, or a credit freeze.⁴⁸ Because fraud alerts are infrequent events in our data set, the regressions use a random 10 percent subsample of the control population to make the models estimable. We selected explanatory variables from the CCP to reflect both credit market behavior and consumer demographics. Consistent with the results of our analysis in the preceding subsection, we estimate the regression models using a four quarter lag of the explanatory CCP credit variables. That way, we can capture the effect of individual credit characteristics before the variables are contaminated by the effects of actual fraud.⁴⁹ We present two versions of each regression. In columns labeled with even numbers, we include controls for the state in which the consumer lives and for the time period.⁵⁰ Those controls are not included in the regression coefficients reported in the columns labeled with odd numbers.

In the regressions, the four quarter lagged risk score is divided into nine different score bins, with the indicator for a risk score less than 580 omitted as the reference group. The odds ratios for lagged risk score indicators display a monotonicity that is to be expected in light of the selection observed in the preceding analysis. The odds of filing a credit freeze rise for each 20 point increase in lagged risk score relative to consumers with a lagged risk score of less than 580. The same pattern exists for initial alerts as well, albeit with smaller effects. In contrast, as the lagged risk score rises, the odds of filing an extended alert falls relative to a consumer with a lagged risk score less than 580. The consistency of the change in odds ratios across lagged risk score bins and across the different types of alerts and the statistical significance of the coefficients is striking. No other consumer characteristic affects the likelihood that consumers file a fraud alert or credit freeze as significantly as the lagged risk score.

⁴⁸ The dependent variable only takes a value of “1” in the first quarter of a new alert or freeze. An odds ratio shows by how much the probability of a certain event (fraud alert or freeze filing) changes with the changes in explanatory variables. An odds ratio of greater (or less) than one implies a higher (or lower) likelihood of an outcome when the explanatory variable takes on larger values.

⁴⁹ This means these are not regressions that explain how specific acts of fraud (e.g., a surge in applications) induce consumers to file alerts. Rather, these regressions attempt to explain how the longer run credit characteristics of consumers influence their choice of which alert to file.

⁵⁰ State level controls may be important for a variety of reasons, including variations in data breach notification laws at the state level. The time dummies help to control for national trends, including the business cycle. As it turns out, including these controls does not have a material effect on our results.

Consumers who have a change of address are more likely to file any type of alert compared with those who do not. Along with risk score, mobility is consistently the most predictive measure for the placement of initial alerts, extended alerts, and credit freezes.⁵¹ *Ceteris paribus*, having an open first mortgage increases the likelihood of filing an initial alert four quarters later, decreases the likelihood of filing an extended alert, and has no effect on the likelihood of filing a freeze. The amount of shopping for credit (number of inquiries) increases the likelihood that a consumer declares an initial alert, extended alert, or credit freeze to similar degrees. Older consumers are more likely to file any type of fraud alert, particularly a credit freeze.

The prior usage of credit influences the likelihood that a consumer files any type of alert. The number of bankcards with a positive balance has a positive influence on the likelihood that a consumer files an initial alert or credit freeze four quarters later, yet it has no effect on the likelihood of filing extended alerts. A positive utilization rate decreases the likelihood that a consumer files an extended alert four quarters later. Moreover, the lagged number of bankcards with a positive past due balance increases the likelihood that a consumer files an extended alert but decreases the likelihood that a consumer files an initial alert or freeze. The lagged number of overall trade lines past due decreases the likelihood of any type of alert.

The effect of risk score on the odds of filing each type of alert suggests there is a form of selection in the filing of fraud alerts and credit freezes. The only other variable in our data that has a comparable effect is the consumer's mobility. Other credit bureau characteristics have smaller effects on the consumer's choice of alert. Because risk score is composed of these and many other variables, it is possible there are exogenous factors, such as financial fastidiousness or a higher awareness of fraud, that are responsible for the observed selection into alerts captured by the risk score. Regardless of the cause, the preceding results offer a compelling picture that initial alerts, extended alerts, and credit freezes each appeal to different consumers in different circumstances.

VI. Conclusion

This paper analyzes a new data set of fraud alerts and credit freezes merged with an anonymized and representative data set of credit bureau files. We document the frequency and

⁵¹ For more information on mobility and extended alerts, see Cheney et al. (2014).

persistence of initial fraud alerts, extended fraud alerts, and credit freezes over a period spanning more than five years. We show these patterns are affected by the business practices that prevailed at the time (e.g., LifeLock), which is important for interpreting these data. Using the example of the data breach at the South Carolina Department of Revenue, our analysis suggests that consumers tend to file initial alerts or obtain credit freezes as a precaution against fraud that might result from a data breach. Filers of extended fraud alerts appear more likely to be victims of fraud, as evidenced by substantial and discrete changes in the number of applications for credit, address changes, and changes in risk score. We show there is significant heterogeneity in consumers' choice of protection mechanism. Consumers with prime risk scores are relatively more likely to file an initial alert or obtain a credit freeze than consumers with lower risk scores. Consumers with subprime risk scores are relatively more likely to file an extended alert than consumers with higher risk scores. Our regression analysis shows that the likelihood of filing different types of alerts is influenced by a variety of other lagged credit bureau characteristics, which suggests there is selection in the choice of protection mechanism. We believe all of these facts are new to the literature.

While interesting in themselves, these results are also useful for thinking about public policy. For example, the number and geographic distribution of initial alerts and credit freezes might be used as an indicator of data breach activity as well as consumers' concern about data breaches and exposure to fraud. If those breaches involve the theft of consumer payment data, there may also be implications for confidence in consumer electronic payments. The number and geographic distribution of extended fraud alerts is likely to be more indicative of actual fraud experienced by consumers.⁵² The observed heterogeneity (and apparent selection) in the use of different types of alerts also suggests caution in making simple generalizations from these data. Certainly further research is warranted.

⁵² It is very likely the number of new extended alerts will be a substantial underestimate of the true level of fraud experienced by consumers. But the number of extended alerts likely comoves with the actual level of fraud.

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Table 1: Fraud Alert and Credit Freeze Frequency Counts (Stock)

Quarter	Initial Alerts		Extended Alerts		Freezes	
	Primary 5%	Restricted	Primary 5%	Restricted	Primary 5%	Restricted
Mar-08	74,823	74,763	56,972	56,945	9,152	9,151
Jun-08	87,476	87,411	59,455	59,433	10,952	10,950
Sep-08	101,286	101,195	61,728	61,706	13,454	13,452
Dec-08	105,075	105,024	64,042	64,019	15,523	15,523
Mar-09	91,089	91,072	64,539	64,521	17,159	17,159
Jun-09	100,596	100,579	65,609	65,591	17,779	17,779
Sep-09	103,054	103,019	66,834	66,815	18,791	18,789
Dec-09	39,189	39,170	66,435	66,412	19,953	19,953
Mar-10	29,482	29,465	64,670	64,650	21,106	21,104
Jun-10	31,770	31,759	64,267	64,253	22,152	22,150
Sep-10	30,825	30,818	65,530	65,517	22,833	22,832
Dec-10	28,607	28,592	66,658	66,645	23,511	23,511
Mar-11	28,236	28,214	67,856	67,845	24,337	24,336
Jun-11	36,312	36,287	69,081	69,064	25,799	25,797
Sep-11	27,808	27,801	70,202	70,191	26,922	26,921
Dec-11	27,784	27,779	71,420	71,408	27,928	27,926
Mar-12	30,819	30,806	72,716	72,698	29,209	29,206
Jun-12	33,384	33,373	73,656	73,640	30,310	30,308
Sep-12	24,753	24,746	74,397	74,382	31,307	31,307
Dec-12	31,328	31,167	75,783	75,722	33,416	33,403
Mar-13	30,267	29,964	77,517	77,417	35,488	35,444
Jun-13	29,610	29,262	79,148	78,986	36,948	36,894
Sep-13	29,117	28,387	80,143	79,877	37,951	37,836

Notes: The "Primary 5%" columns contain frequency counts of fraud alerts and credit freezes from the entire primary 5% CCP sample. The "Restricted" columns contain frequency counts of fraud alerts and credit freezes from the primary 5% CCP sample after our 5 quarter continuity constraint has been imposed. See text for further details.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

Table 2: Fraud Alert and Credit Freeze Frequency Counts (Flow)

Quarter	Initial Alerts Filed		Extended Alerts Filed		Freezes Filed	
	Primary 5%	Restricted	Primary 5%	Restricted	Primary 5%	Restricted
Mar-08	62,816	62,762	3,290	3,275	2,489	2,489
Jun-08	73,134	73,082	3,446	3,438	1,840	1,838
Sep-08	82,682	82,603	3,305	3,300	2,478	2,477
Dec-08	77,077	77,059	3,248	3,242	1,991	1,991
Mar-09	76,112	76,097	2,825	2,819	1,983	1,983
Jun-09	85,269	85,254	2,865	2,860	1,388	1,388
Sep-09	71,543	71,512	2,588	2,583	1,531	1,529
Dec-09	21,336	21,321	2,069	2,065	1,706	1,706
Mar-10	22,619	22,606	2,020	2,016	1,790	1,788
Jun-10	24,235	24,226	2,003	1,999	1,681	1,680
Sep-10	22,438	22,432	1,922	1,916	1,402	1,402
Dec-10	21,287	21,274	1,689	1,686	1,268	1,268
Mar-11	22,676	22,654	1,780	1,777	1,525	1,524
Jun-11	30,184	30,161	1,901	1,897	2,070	2,069
Sep-11	20,842	20,836	1,835	1,835	1,869	1,869
Dec-11	20,988	20,985	1,863	1,860	1,761	1,761
Mar-12	25,225	25,213	2,314	2,310	1,971	1,971
Jun-12	25,739	25,731	2,433	2,431	1,875	1,874
Sep-12	18,329	18,322	2,222	2,220	1,811	1,811
Dec-12	24,326	24,184	2,553	2,534	2,785	2,780
Mar-13	24,122	23,868	3,017	2,992	2,882	2,854
Jun-13	22,719	22,444	2,929	2,896	2,233	2,221
Sep-13	22,880	22,277	2,706	2,639	1,906	1,870

Notes: The "Primary 5%" columns contain frequency counts of fraud alerts and credit freezes from the entire primary 5% CCP sample. The "Restricted" columns contain frequency counts of fraud alerts and credit freezes from the primary 5% CCP sample after our 5 quarter continuity constraint has been imposed. The flow is derived from counting fraud alerts and credit freezes in the quarters when they are filed. See text for further details.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

Table 3: Transition Matrix Weighted Averages

		Panel A: All Consumers				
		Q1:2010 to Q3:2013				
		Current State				
State One Quarter Earlier	No Alert/ Freeze	Initial Only	Extended Only	Freeze + Alert	Freeze Only	
No Alert/ Freeze	99.79%	0.18%	0.01%	0.01%	0.01%	
Initial Only	73.58%	24.88%	1.18%	0.21%	0.15%	
Extended Only	1.50%	0.01%	98.42%	0.07%	0.00%	
Freeze + Alert	2.18%	1.24%	1.44%	68.00%	27.14%	
Freeze Only	2.26%	0.10%	0.01%	2.01%	95.63%	
State Two Quarters Earlier	No Alert/ Freeze	Initial Only	Extended Only	Freeze + Alert	Freeze Only	
No Alert/ Freeze	99.73%	0.22%	0.03%	0.01%	0.02%	
Initial Only	90.05%	8.24%	1.25%	0.22%	0.25%	
Extended Only	3.11%	0.03%	96.73%	0.12%	0.00%	
Freeze + Alert	4.88%	1.01%	2.63%	68.23%	23.25%	
Freeze Only	4.26%	0.12%	0.01%	1.30%	94.31%	

		Panel B: Subprime Consumers				
		Q1:2010 to Q3:2013				
		Current State				
State One Quarter Earlier	No Alert/ Freeze	Initial Only	Extended Only	Freeze + Alert	Freeze Only	
No Alert/ Freeze	99.79%	0.18%	0.02%	0.00%	0.01%	
Initial Only	70.42%	27.54%	1.83%	0.14%	0.07%	
Extended Only	0.86%	0.01%	99.07%	0.06%	0.00%	
Freeze + Alert	3.65%	2.96%	3.49%	69.84%	20.07%	
Freeze Only	5.12%	0.21%	0.02%	2.20%	92.45%	
State Two Quarters Earlier	No Alert/ Freeze	Initial Only	Extended Only	Freeze + Alert	Freeze Only	
No Alert/ Freeze	99.70%	0.23%	0.05%	0.00%	0.01%	
Initial Only	91.86%	5.74%	2.11%	0.15%	0.15%	
Extended Only	1.75%	0.03%	98.12%	0.09%	0.00%	
Freeze + Alert	8.69%	1.70%	6.02%	64.06%	19.52%	
Freeze Only	9.31%	0.27%	0.05%	1.85%	88.52%	

		Panel C: Prime Consumers				
		Q1:2010 to Q3:2013				
		Current State				
State One Quarter Earlier	No Alert/ Freeze	Initial Only	Extended Only	Freeze + Alert	Freeze Only	
No Alert/ Freeze	99.77%	0.20%	0.01%	0.01%	0.01%	
Initial Only	75.04%	23.70%	0.82%	0.25%	0.19%	
Extended Only	2.11%	0.01%	97.80%	0.08%	0.00%	
Freeze + Alert	1.85%	0.88%	1.00%	67.45%	28.81%	
Freeze Only	1.93%	0.08%	0.00%	2.01%	95.97%	
State Two Quarters Earlier	No Alert/ Freeze	Initial Only	Extended Only	Freeze + Alert	Freeze Only	
No Alert/ Freeze	99.71%	0.23%	0.02%	0.01%	0.03%	
Initial Only	89.11%	9.51%	0.83%	0.25%	0.30%	
Extended Only	4.37%	0.04%	95.44%	0.15%	0.01%	
Freeze + Alert	4.08%	0.88%	1.92%	68.94%	24.18%	
Freeze Only	3.69%	0.10%	0.01%	1.25%	94.95%	

Notes: Averages are weighted by row frequency over time. Subprime consumers are defined as those who have a risk score less than or equal to 660 four quarters before the quarter they are transitioning into. See text for further details.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

Table 4: LifeLock Transition Matrix Weighted Averages

LifeLock Era Population									
Q1:2010 to Q3:2013									
Current State									
State One Quarter Earlier	All			Subprime			Prime		
	No Alert / Freeze	Initial Only	Other	No Alert/Freeze	Initial Only	Other	No Alert/Freeze	Initial Only	Other
No Alert / Freeze	99.00%	0.89%	0.10%	99.04%	0.83%	0.13%	98.98%	0.93%	0.09%
Initial Only	69.98%	28.84%	1.18%	71.78%	26.20%	2.02%	69.35%	29.75%	0.91%
State Two Quarters Earlier									
State Two Quarters Earlier	No Alert / Freeze	Initial Only	Other	No Alert/Freeze	Initial Only	Other	No Alert/Freeze	Initial Only	Other
No Alert / Freeze	98.81%	0.99%	0.21%	98.68%	1.04%	0.27%	98.84%	0.98%	0.18%
Initial Only	77.44%	20.87%	1.70%	86.85%	10.54%	2.61%	74.40%	24.21%	1.37%

Post LifeLock Era Population									
Q1:2010 to Q3:2013									
Current State									
State One Quarter Earlier	All			Subprime			Prime		
	No Alert / Freeze	Initial Only	Other	No Alert/Freeze	Initial Only	Other	No Alert/Freeze	Initial Only	Other
No Alert / Freeze	99.81%	0.16%	0.03%	99.80%	0.17%	0.03%	99.80%	0.18%	0.03%
Initial Only	74.30%	24.10%	1.60%	70.24%	27.72%	2.04%	76.43%	22.22%	1.35%
State Two Quarters Earlier									
State Two Quarters Earlier	No Alert / Freeze	Initial Only	Other	No Alert/Freeze	Initial Only	Other	No Alert/Freeze	Initial Only	Other
No Alert / Freeze	99.75%	0.20%	0.06%	99.72%	0.22%	0.06%	99.73%	0.21%	0.06%
Initial Only	90.62%	7.35%	2.03%	91.85%	5.62%	2.53%	89.78%	8.48%	1.72%

Notes: Averages are weighted by row frequency over time. LifeLock era population is defined as individuals with an initial alert before Q4:2009. The 6 month transition probability weighted averages begin in Q2:2010 since by definition, the post LifeLock era population does not have initial alerts prior to Q4:2009 and the LifeLock era population may still be impacted by LifeLock's policy during this time. Subprime consumers are defined as those who have a risk score less than or equal to 660 four quarters before the quarter they are transitioning into. See text for further details.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

Table 5: Descriptive Statistics

Variable	Entire Data Set	Control Group	Initial Alert	Extended Alert	Freeze
Risk Score					
Mean	693.34	692.77	715.10	669.10	765.17
Median	714.00	713.00	747.00	678.00	796.00
Standard Deviation	107.56	107.44	102.18	114.45	78.74
Number of Inquiries Past 3 Months					
Mean	0.55	0.54	0.89	0.83	0.37
Median	0.00	0.00	0.00	0.00	0.00
Standard Deviation	1.01	1.00	1.43	1.45	0.94
Number of Inquiries Past 12 Months					
Mean	1.91	1.88	2.69	2.91	1.48
Median	1.00	1.00	2.00	2.00	1.00
Standard Deviation	2.28	2.23	3.14	3.57	2.19
Age of Newest Accounts (Months)					
Mean	32.28	32.92	18.20	23.88	35.67
Median	16.00	16.00	10.00	14.00	22.00
Standard Deviation	49.30	50.17	24.79	28.64	42.78
Change in Number of Accounts					
Mean	-0.02	-0.02	-0.08	-0.06	-0.17
Median	0.00	0.00	0.00	0.00	0.00
Standard Deviation	1.02	1.01	1.37	1.31	1.03
Utilization Rate (Percent)					
Mean	0.61	0.62	0.48	0.92	0.24
Median	0.15	0.14	0.17	0.25	0.08
Standard Deviation	340.32	350.45	104.31	446.05	9.30
Age (Years)					
Mean	50.30	50.43	47.74	46.94	55.53
Median	49.00	49.00	47.00	45.00	56.00
Standard Deviation	18.51	18.63	15.28	14.91	15.50
Number of Bankcard Accounts w/ Update w/in 3 Months w/ Balance >\$0					
Mean	1.59	1.58	1.80	1.74	1.62
Median	1.00	1.00	1.00	1.00	1.00
Standard Deviation	1.46	1.46	1.56	1.52	1.36
Number of Trades Currently 30 Days PD					
Mean	0.04	0.04	0.04	0.06	0.02
Median	0.00	0.00	0.00	0.00	0.00
Standard Deviation	0.26	0.26	0.26	0.31	0.18
Number of Bankcard Accounts with PD Amount >0					
Mean	0.19	0.19	0.12	0.26	0.07
Median	0.00	0.00	0.00	0.00	0.00
Standard Deviation	0.66	0.66	0.53	0.78	0.49
Number of Bankcards Currently 30 Days PD					
Mean	0.01	0.01	0.01	0.02	0.01
Median	0.00	0.00	0.00	0.00	0.00
Standard Deviation	0.14	0.14	0.14	0.15	0.10
Total Number of 30 Days PD Occurrences On Bankcards w/in 24 Months					
Mean	0.37	0.38	0.28	0.43	0.14
Median	0.00	0.00	0.00	0.00	0.00
Standard Deviation	1.40	1.40	1.17	1.41	0.87
Total Number of 120 Days PD Occurrences On Bankcards w/in 24 Months					
Mean	0.59	0.59	0.31	0.72	0.25
Median	0.00	0.00	0.00	0.00	0.00
Standard Deviation	3.19	3.21	2.19	3.64	2.48
Total Past Due Amount Bankcard Accounts w/ Update w/in 3 Months (\$)					
Mean	335.16	339.36	167.98	520.63	217.43
Median	0.00	0.00	0.00	0.00	0.00
Standard Deviation	2525.48	2529.77	1869.62	4466.58	2821.51
Total Number of Observations	273,755,078	260,371,611	1,150,653	1,577,737	551,731

Notes: Unit of observation is person-quarter. Statistics for the treatment groups are calculated at the times when alerts/freezes are on file. Observations with missing values are omitted from calculations. See text for further details.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

Table 6.A: Descriptive Statistics for Initial Alert Filers

		Four Quarters Before	Two Quarters Before	Initial Alert Impact	Four Quarters After
Risk Score					
	Mean	718.66	719.59	720.69	722.54
	Median	751.00	752.00	753.00	757.00
	Standard Deviation	99.77	100.06	99.59	101.02
Number of Inquiries Past 3 Months					
	Mean	0.71	0.70	0.79	0.60
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	1.23	1.22	1.35	1.08
Number of Inquiries Past 12 Months					
	Mean	2.42	2.38	2.43	2.12
	Median	2.00	2.00	2.00	1.00
	Standard Deviation	2.86	2.84	2.88	2.57
Age of Newest Accounts (Months)					
	Mean	17.46	18.09	18.88	20.74
	Median	10.00	10.00	11.00	13.00
	Standard Deviation	24.23	24.81	25.45	26.38
Change in Number of Accounts					
	Mean	0.00	-0.01	-0.11	-0.05
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	1.22	1.23	1.35	1.11
Utilization Rate (Percent)					
	Mean	0.31	0.37	0.50	0.67
	Median	0.15	0.15	0.15	0.16
	Standard Deviation	6.92	45.83	117.80	170.77
Age (Years)					
	Mean	47.47	47.81	48.27	49.22
	Median	47.00	48.00	48.00	49.00
	Standard Deviation	15.24	15.31	15.35	15.29
Number of Bankcard Accounts w/ Update w/in 3 Months w/ Balance >\$0					
	Mean	1.80	1.80	1.78	1.75
	Median	1.00	1.00	1.00	1.00
	Standard Deviation	1.54	1.55	1.54	1.51
Number of Trades Currently 30 Days PD					
	Mean	0.03	0.03	0.04	0.04
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	0.23	0.23	0.24	0.26
Number of Bankcard Accounts with PD Amount >0					
	Mean	0.12	0.11	0.11	0.13
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	0.51	0.51	0.50	0.59
Number of Bankcards Currently 30 Days PD					
	Mean	0.01	0.01	0.01	0.01
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	0.12	0.13	0.13	0.14
Total Number of 30 Days PD Occurrences On Bankcards w/in 24 Months					
	Mean	0.29	0.28	0.26	0.28
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	1.20	1.17	1.14	1.21
Total Number of 120 Days PD Occurrences On Bankcards w/in 24 Months					
	Mean	0.32	0.31	0.29	0.35
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	2.24	2.24	2.15	2.36
Total Past Due Amount Bankcard Accounts w/ Update w/in 3 Months (\$)					
	Mean	155.67	151.48	158.69	221.60
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	1693.25	1567.91	1879.21	2183.77

Notes: Unit of observation is person-quarter. There were 896,903 initial alerts filed between Q1:2008 and Q3:2013. Observations with missing values are omitted from calculations. See text for further details.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

Table 6.B: Descriptive Statistics for Extended Alert Filers

		Four Quarters Before	Two Quarters Before	Extended Alert Impact	Four Quarters After
Risk Score					
	Mean	637.26	636.53	651.31	651.22
	Median	631.00	628.00	649.00	652.00
	Standard Deviation	118.10	115.93	108.44	112.75
Number of Inquiries Past 3 Months					
	Mean	1.18	1.23	1.64	0.93
	Median	1.00	1.00	1.00	0.00
	Standard Deviation	1.90	1.98	2.29	1.61
Number of Inquiries Past 12 Months					
	Mean	3.84	3.92	4.31	3.40
	Median	2.00	3.00	3.00	2.00
	Standard Deviation	4.45	4.53	4.62	4.20
Age of Newest Accounts (Months)					
	Mean	17.90	17.87	18.72	20.05
	Median	10.00	10.00	10.00	12.00
	Standard Deviation	22.73	23.04	25.09	24.95
Change in Number of Accounts					
	Mean	0.07	0.06	-0.92	0.04
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	1.42	1.53	2.61	1.27
Utilization Rate (Percent)					
	Mean	0.41	0.42	0.41	0.43
	Median	0.29	0.30	0.29	0.32
	Standard Deviation	0.49	0.68	1.22	0.64
Age (Years)					
	Mean	43.16	43.56	44.00	44.62
	Median	41.00	41.00	42.00	42.00
	Standard Deviation	14.69	14.71	14.71	14.68
Number of Bankcard Accounts w/ Update w/in 3 Months w/ Balance >\$0					
	Mean	1.85	1.87	1.74	1.76
	Median	1.00	1.00	1.00	1.00
	Standard Deviation	1.61	1.61	1.55	1.54
Number of Trades Currently 30 Days PD					
	Mean	0.07	0.07	0.06	0.07
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	0.32	0.32	0.30	0.33
Number of Bankcard Accounts with PD Amount >0					
	Mean	0.38	0.37	0.24	0.28
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	0.90	0.87	0.67	0.82
Number of Bankcards Currently 30 Days PD					
	Mean	0.02	0.02	0.02	0.02
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	0.18	0.18	0.15	0.17
Total Number of 30 Days PD Occurrences On Bankcards w/in 24 Months					
	Mean	0.61	0.58	0.41	0.46
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	1.66	1.56	1.26	1.35
Total Number of 120 Days PD Occurrences On Bankcards w/in 24 Months					
	Mean	0.94	0.90	0.52	0.61
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	3.78	3.76	2.74	3.03
Total Past Due Amount Bankcard Accounts w/ Update w/in 3 Months (\$)					
	Mean	534.30	521.47	374.81	438.62
	Median	0.00	0.00	0.00	0.00
	Standard Deviation	3471.65	3631.43	2856.63	3443.30

Notes: Unit of observation is person-quarter. There were 56,590 extended alerts filed between Q1:2008 and Q3:2013. Observations with missing values are omitted from calculations. See text for further details.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

Table 6.C: Descriptive Statistics for Freeze Filers

Variable	Four Quarters Before	Two Quarters Before	Freeze Impact	Four Quarters After
Risk Score				
Mean	739.60	740.47	742.23	745.07
Median	774.00	775.00	776.00	781.00
Standard Deviation	91.80	91.13	88.95	91.48
Number of Inquiries Past 3 Months				
Mean	0.71	0.74	0.79	0.42
Median	0.00	0.00	0.00	0.00
Standard Deviation	1.35	1.43	1.54	1.01
Number of Inquiries Past 12 Months				
Mean	2.36	2.39	2.46	1.38
Median	1.00	1.00	2.00	1.00
Standard Deviation	3.10	3.17	3.18	2.46
Age of Newest Accounts (Months)				
Mean	20.70	21.11	21.32	25.20
Median	11.00	12.00	11.00	16.00
Standard Deviation	29.04	29.56	29.88	31.30
Change in Number of Accounts				
Mean	-0.03	-0.03	-0.10	-0.12
Median	0.00	0.00	0.00	0.00
Standard Deviation	1.18	1.23	1.47	1.17
Utilization Rate (Percent)				
Mean	0.26	0.26	0.26	0.27
Median	0.11	0.11	0.11	0.11
Standard Deviation	0.42	0.36	0.35	0.35
Age (Years)				
Mean	49.66	50.07	50.69	51.35
Median	49.00	49.00	50.00	51.00
Standard Deviation	15.27	15.31	15.34	15.25
Number of Bankcard Accounts w/ Update w/in 3 Months w/ Balance >\$0				
Mean	1.74	1.76	1.76	1.74
Median	1.00	1.00	1.00	1.00
Standard Deviation	1.46	1.48	1.48	1.47
Number of Trades Currently 30 Days PD				
Mean	0.03	0.03	0.03	0.03
Median	0.00	0.00	0.00	0.00
Standard Deviation	0.20	0.22	0.21	0.23
Number of Bankcard Accounts with PD Amount >0				
Mean	0.09	0.09	0.08	0.10
Median	0.00	0.00	0.00	0.00
Standard Deviation	0.49	0.48	0.46	0.59
Number of Bankcards Currently 30 Days PD				
Mean	0.01	0.01	0.01	0.01
Median	0.00	0.00	0.00	0.00
Standard Deviation	0.11	0.12	0.12	0.12
Total Number of 30 Days PD Occurrences On Bankcards w/in 24 Months				
Mean	0.22	0.21	0.19	0.21
Median	0.00	0.00	0.00	0.00
Standard Deviation	1.06	1.06	1.02	1.04
Total Number of 120 Days PD Occurrences On Bankcards w/in 24 Months				
Mean	0.29	0.27	0.24	0.29
Median	0.00	0.00	0.00	0.00
Standard Deviation	2.27	2.24	2.11	2.50
Total Past Due Amount Bankcard Accounts w/ Update w/in 3 Months (\$)				
Mean	165.59	173.27	173.32	248.57
Median	0.00	0.00	0.00	0.00
Standard Deviation	1994.85	2156.04	2234.83	3055.60

Notes: Unit of observation is person-quarter. There were 44,143 credit freezes filed between Q1:2008 and Q3:2013. Observations with missing values are omitted from calculations. See text for further details.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

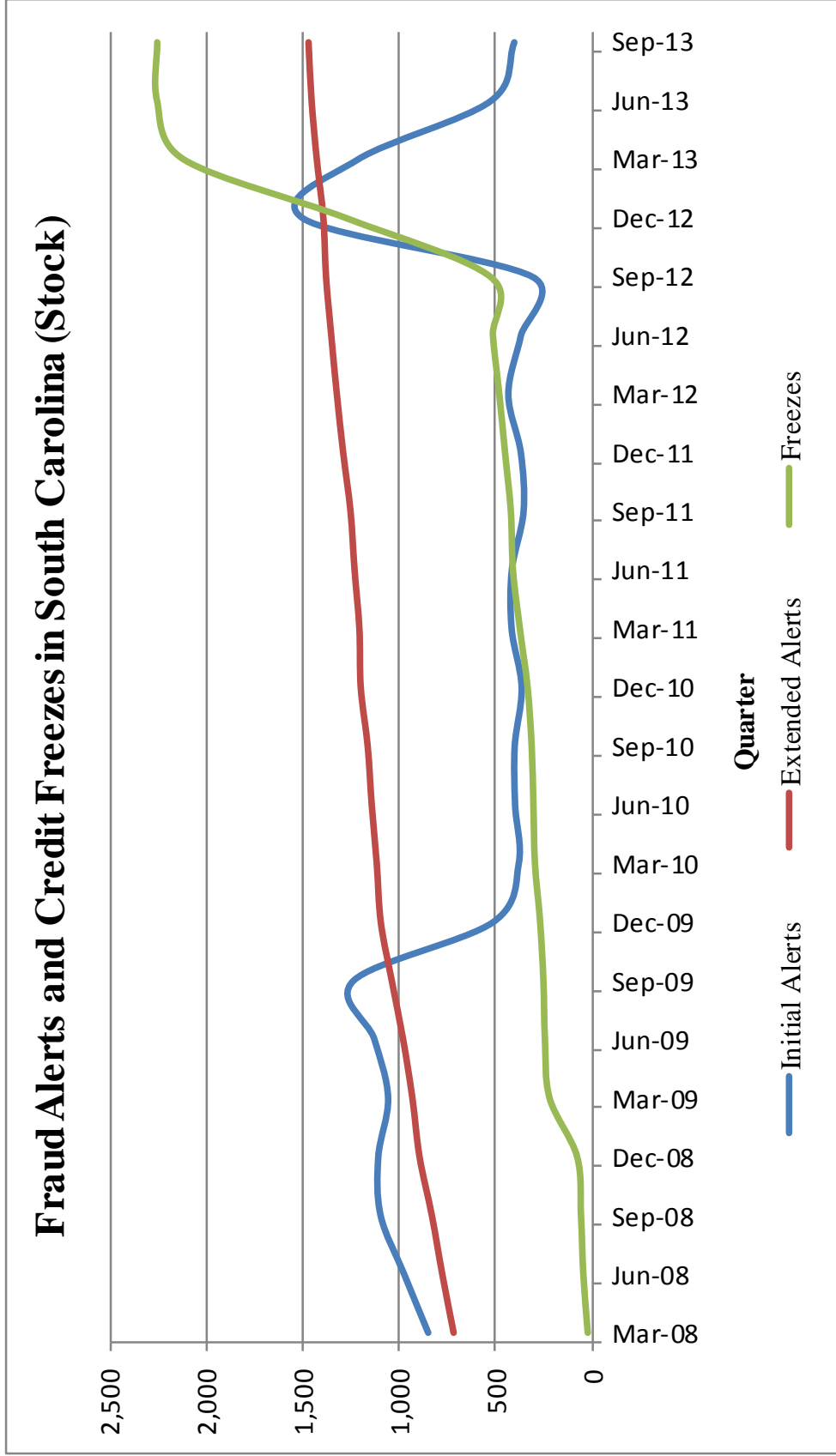
Table 7: Selection into Alerts

Variable	Comparison Group	Dependent Variable							
		Any Alert	Initial Alert	Extended Alert			Freeze		
		1	2	3	4	5	6	7	8
Score < 580	580 ≤ Score < 620	1.085 ***	1.106 ***	1.133 ***	1.156 ***	0.781 ***	0.785 ***	1.133 ***	1.145 ***
	620 ≤ Score < 640	1.131 ***	1.177 ***	1.198 ***	1.250 ***	0.674 ***	0.681 ***	1.306 ***	1.323 ***
	640 ≤ Score < 660	1.191 ***	1.251 ***	1.282 ***	1.351 ***	0.596 ***	0.604 ***	1.333 ***	1.349 ***
	660 ≤ Score < 680	1.254 ***	1.326 ***	1.361 ***	1.445 ***	0.540 ***	0.549 ***	1.433 ***	1.446 ***
	680 ≤ Score < 700	1.307 ***	1.386 ***	1.430 ***	1.523 ***	0.469 ***	0.480 ***	1.591 ***	1.609 ***
	700 ≤ Score < 760	1.465 ***	1.566 ***	1.621 ***	1.739 ***	0.416 ***	0.429 ***	1.877 ***	1.904 ***
	760 ≤ Score < 850	1.646 ***	1.865 ***	1.825 ***	2.085 ***	0.316 ***	0.332 ***	2.831 ***	2.871 ***
	Missing Score	0.373 *	0.435	0.453	0.530	0.001	0.001	0.005	0.003
	Number of Inquiries Past 3 Months	1.011 ***	1.014 ***	1.007 ***	1.011 ***	1.032 ***	1.031 ***	1.015 **	1.012 *
	Number of Inquiries Past 12 Months	1.051 ***	1.035 ***	1.047 ***	1.030 ***	1.068 ***	1.065 ***	1.067 ***	1.047 ***
Age of Newest Account (Months)	0.997 ***	0.999 ***	0.996 ***	0.999 ***	0.997 ***	0.997 ***	1.004 ***	1.003 ***	
Change in Number of Accounts	0.986 ***	0.980 ***	0.986 ***	0.979 ***	0.987 ***	0.986 ***	0.981 ***	0.985 ***	
.25 ≤ Utilization Rate < .5	0.992 **	1.029 ***	0.999	1.039 ***	0.901 ***	0.911 ***	0.946 ***	0.933 ***	
.5 ≤ Utilization Rate < .75	0.957 ***	1.034 ***	0.967 ***	1.052 ***	0.784 ***	0.800 ***	1.020	0.999	
.75 ≤ Utilization Rate < 1	0.878 ***	1.008	0.893 ***	1.038 ***	0.661 ***	0.685 ***	0.993	0.973	
Utilization Rate ≥ 1	0.882 ***	0.977 **	0.894 ***	0.999	0.717 ***	0.736 ***	0.858 ***	0.851 ***	
Utilization Rate Missing	1.165 ***	1.106 **	1.189 ***	1.120 ***	0.907	0.918	0.812	0.925	
Age (Years)	1.027 ***	1.030 ***	1.026 ***	1.029 ***	1.027 ***	1.026 ***	1.034 ***	1.032 ***	
Age Squared	1.000 ***	1.000 ***	1.000 ***	1.000 ***	1.000 ***	1.000 ***	1.000 ***	1.000 ***	
Number of Bankcard Accounts w/ Update w/in 3 Months w/ Balance > 0	1.057 ***	1.046 ***	1.059 ***	1.048 ***	1.011 ***	1.003	1.067 ***	1.070 ***	
First Mortgage	1.082 ***	1.073 ***	1.096 ***	1.086 ***	0.890 ***	0.910 ***	0.997	0.983	
Change of Address	1.162 ***	1.128 ***	1.147 ***	1.111 ***	1.389 ***	1.371 ***	1.131 ***	1.134 ***	
Number of Trades Currently 30 Days PD	0.886 ***	0.891 ***	0.899 ***	0.905 ***	0.812 ***	0.812 ***	0.913 **	0.921 **	
Number of Bankcard Accounts with PD Amount > 0	0.946 ***	0.930 ***	0.931 ***	0.913 ***	1.062 ***	1.059 ***	0.917 ***	0.922 ***	
Number of Bankcards Currently 30 Days PD	1.062 ***	1.067 ***	1.059 ***	1.067 ***	1.099 **	1.100 **	1.025	1.025	
Total Number of 30 Days PD Occurrences On Bankcards w/in 24 Months	1.000	0.992 ***	1.005 ***	0.996 ***	0.964 ***	0.968 ***	0.982 **	0.985 **	
Total Number of 120 Days PD Occurrences On Bankcards w/in 24 Months	0.997 ***	1.001	0.997 ***	1.001	0.998	0.998	1.006 *	1.006 **	
Total PD Amount Bankcard Accounts w/ Update w/in 3 Months (\$)	1.000 ***	1.000	1.000 ***	1.000	1.000	1.000	1.000 ***	1.000 ***	
Quarter-Year Controls	No	Yes	No	Yes	No	Yes	No	Yes	
State Controls	No	Yes	No	Yes	No	Yes	No	Yes	
Constant	-4.459	-5.0611	-4.6207	-5.2522	-6.3046	-6.9351	-8.2009	-9.2122	
Num. Observations	39,425,458	39,425,458	39,425,458	39,425,458	39,425,458	39,425,458	39,425,458	39,425,458	
Pseudo R-Squared	0.0094	0.0613	0.0101	0.0678	0.0233	0.0311	0.0104	0.0347	

Notes: Results presented are odds ratios from logistic regressions run using a 10 percent subsample of the control population and 100 percent of individuals who filed an alert or freeze. An odds-ratio of greater (less than) than one implies a higher (lower) likelihood of an outcome when the explanatory variable takes on larger values. Significance levels are as follows: *** = 0.01 ** = 0.05 * = 0.10. The dependent variable is equal to one in the first quarter of a new alert or freeze, and zero otherwise. All independent variables are four quarter lags. Observations with missing values are omitted from calculations. See text for further details.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

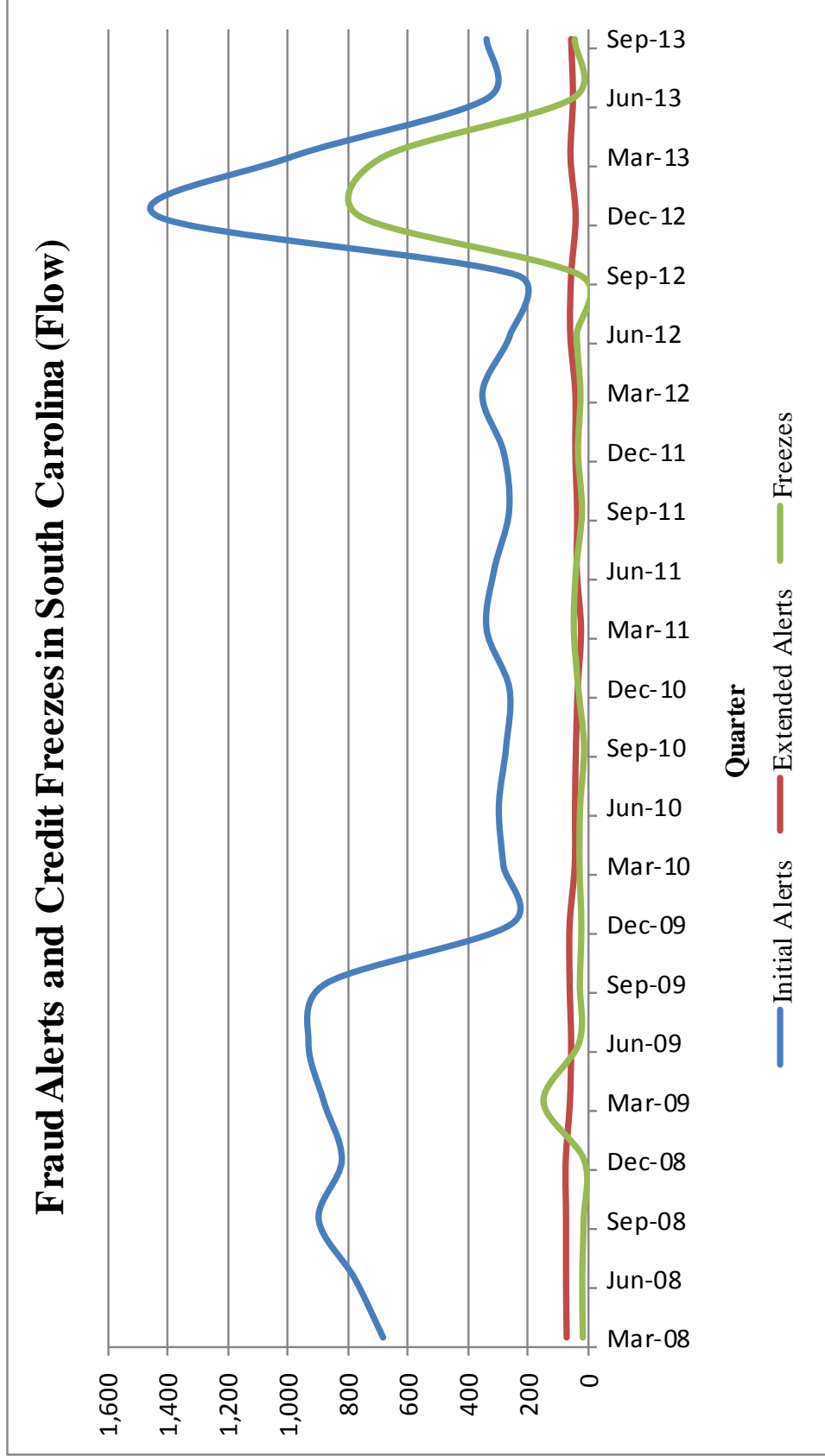
Figure 1



Notes: This figure depicts the stock of initial alerts, extended alerts, and credit freezes in South Carolina between Q1:2008 and Q3:2013. The stock of initial alerts and credit freezes increases at the time of the Department of Revenue data breach that took place in Q4:2012.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

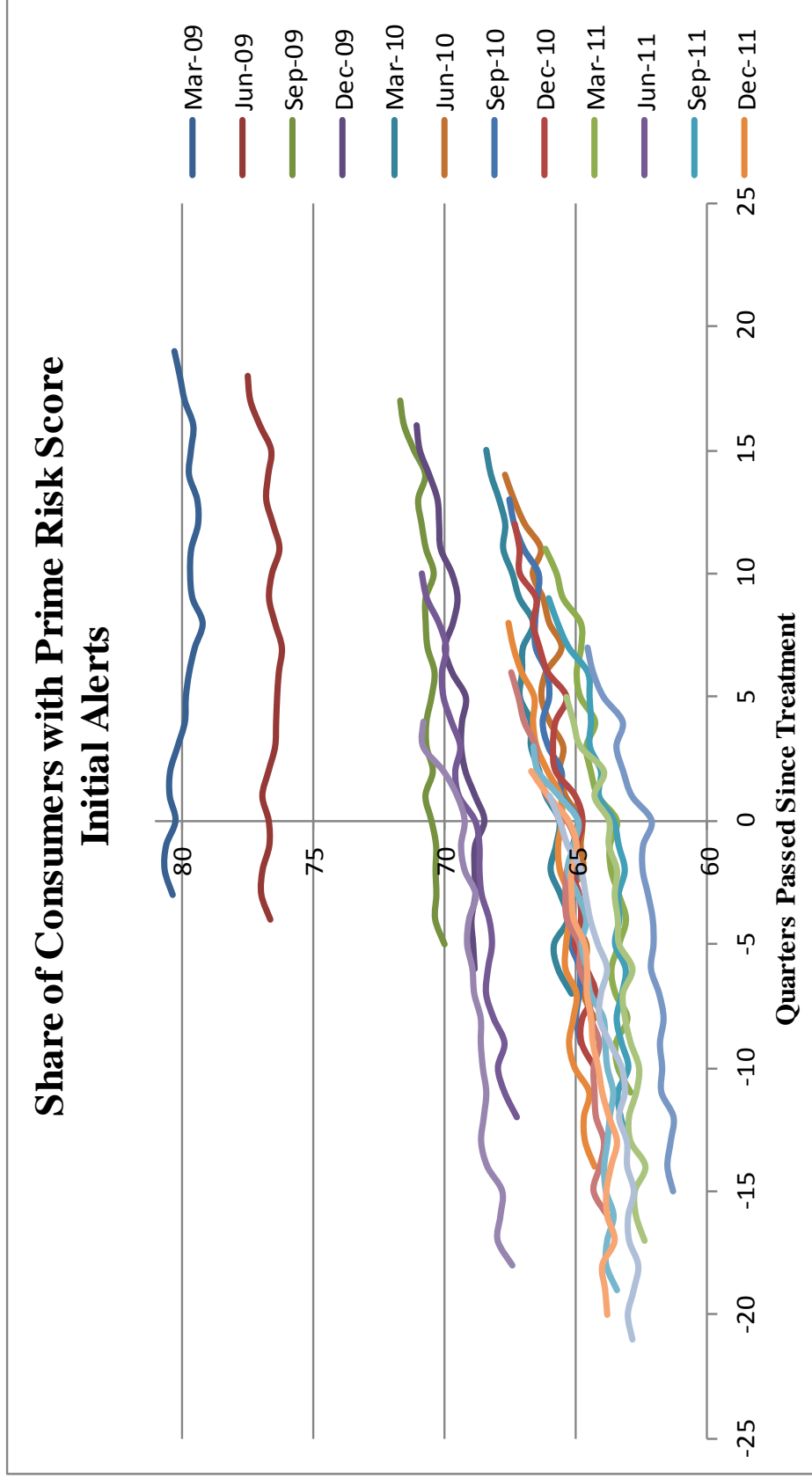
Figure 2



Notes: This figure depicts the flow of initial alerts, extended alerts, and credit freezes in South Carolina between Q1:2008 and Q3:2013. The flow of initial alerts and credit freezes increases at the time of the Department of Revenue data breach that took place in Q4:2012. The increased level of filing persists through Q1:2013; thereafter it returns to a steady state level.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

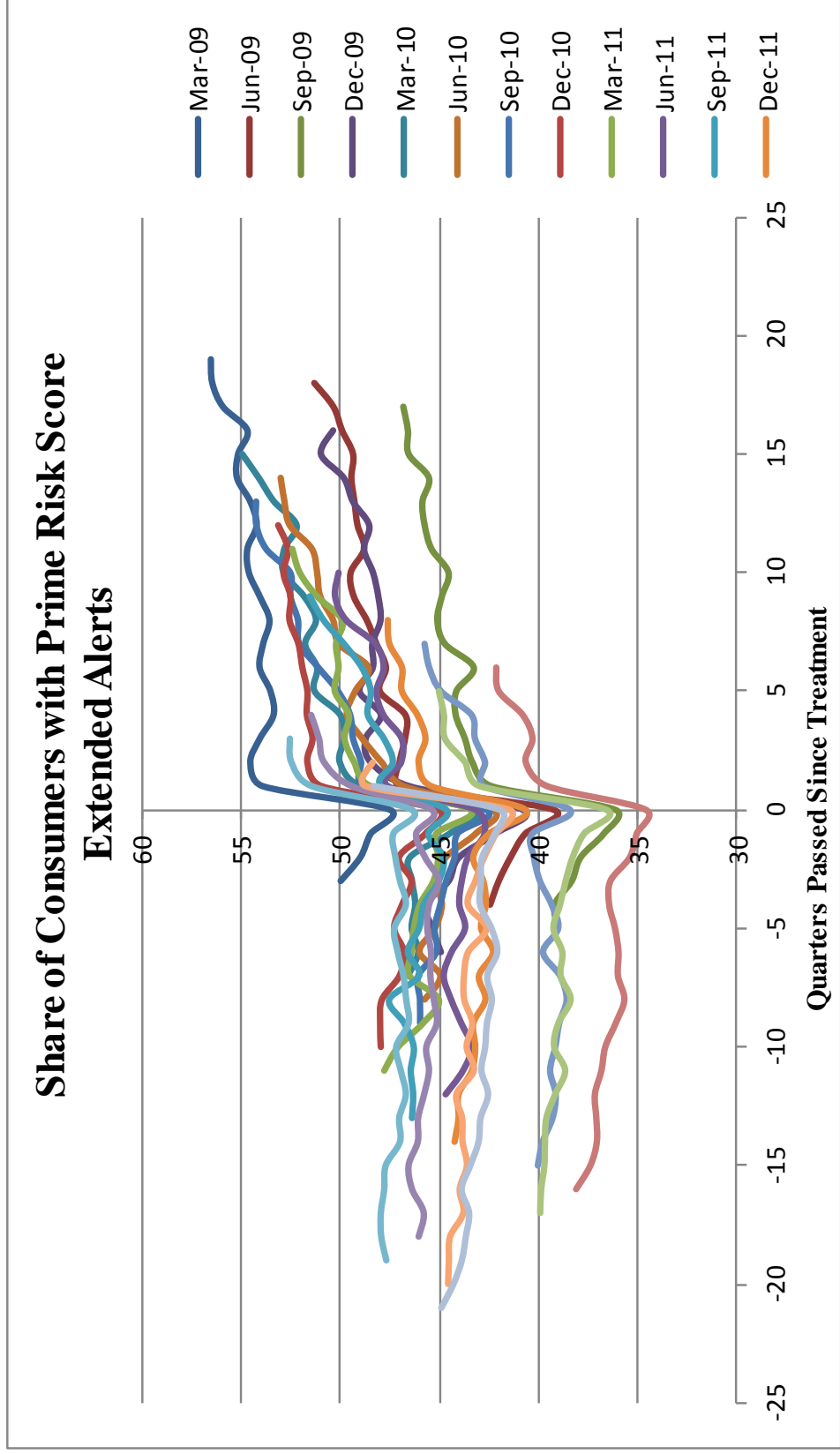
Figure 3



Notes: This figure depicts the share of prime consumers in cohorts of consumers who placed an initial alert at time 0. Cohorts are defined based on the quarter of fraud alert placement.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

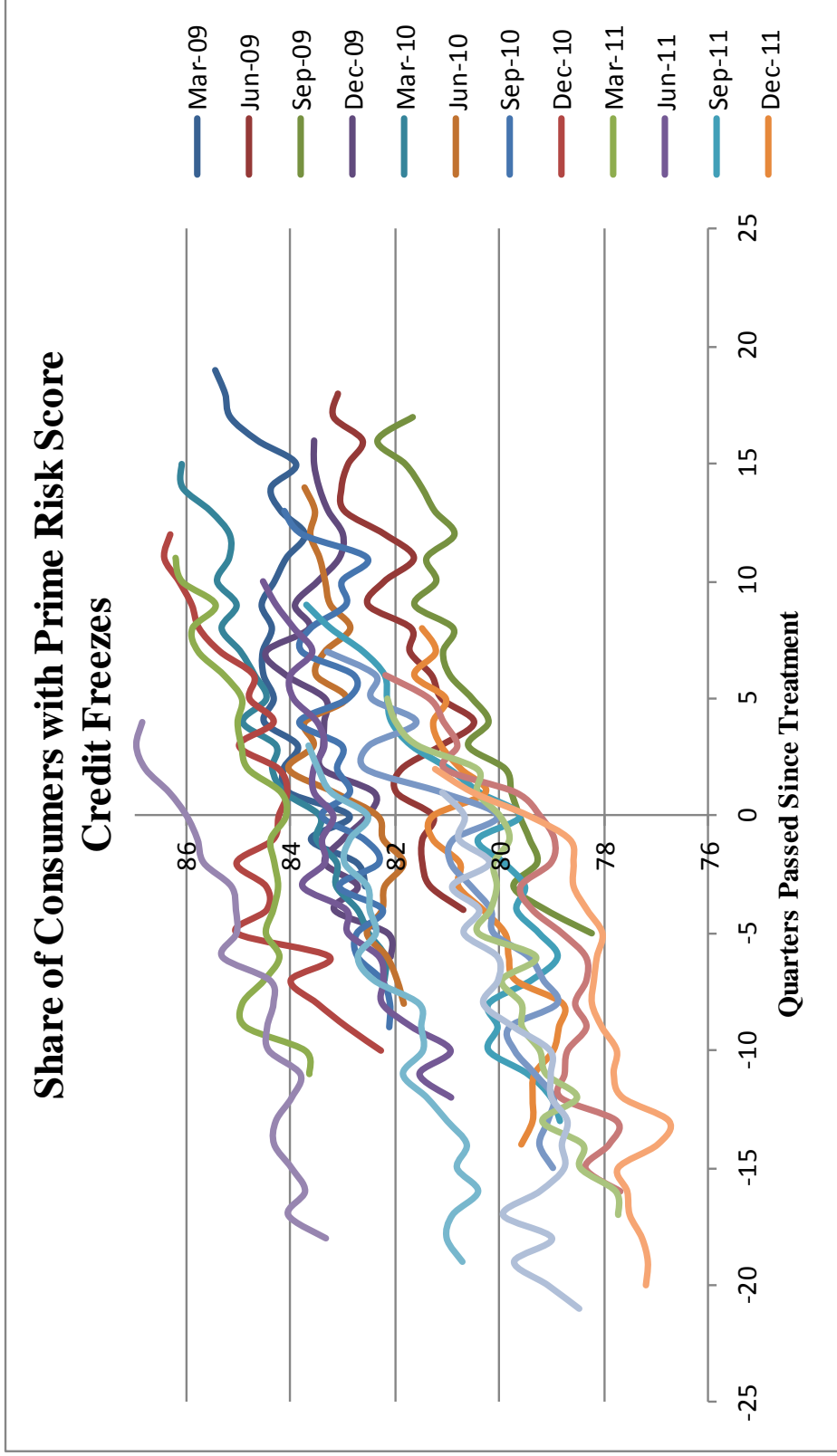
Figure 4



Notes: This figure depicts the share of prime consumers in cohorts of consumers who placed an extended alert at time 0. Cohorts are defined based on the quarter of fraud alert placement. The noticeable decline in this proportion approximately 3 quarters before the filing of an alert suggests that fraudulent activity takes place around that time.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center

Figure 5



Notes: This figure depicts the share of prime consumers in cohorts of consumers who placed a credit freeze at time 0. Cohorts are defined based on the quarter of credit freeze placement.

Source: Authors' calculations using data from FRBNY Consumer Credit Panel/Equifax, augmented with variables obtained by the Payment Cards Center