Fraud Profiling

MVP

Contents

August 07, 2018

Fraud/Charge-off Definitions

- **NSF Behavior:** *Non-Sufficient Funds or overdrafts often related to debit preauthorizations or debit hold issues.*
- **Mobile Deposit Chargeback:** *Mobile deposit returned by issuing bank, often leading to overdrawn accounts when customers spend the provisional credits.*
- **External Transfer Chargeback** *Customers spending provisionally credited funds transferred into their account before the funds are returned to the sending bank.*
- **Opening Deposit Chargeback** *Deposit used to open account is returned to issuing bank.*
- **ATM Deposit Chargeback** *Spending provisionally credited funds from an ATM deposit prior to the funds being returned to the issuing bank.*
- **Bank by Mail/In OPerson** *Spending provisionary funds from a bank or in person deposit before funds are returned to the issuing institution.*
- **Other** *All charge-off reasons that do not fit in the above categories.*

Note: For the purpose of this document, Opening Deposit Chargeback and Bank by Mail/In Person have been grouped in with Other in Other/Misc due to low cell counts.

Overview

Table 1: Overall count and cost of fraud (to date).

count	total_loss	hard_loss	fees
4222	$1,635,016.70	$1,365,837.78	$269,178.93

Table 2: Total counts by charge-off category

chargeoff_reason	count	rate
NSF Behavior	2494	59.07%
Mobile Dep Chargeback	413	9.78%
Ext Tran Chargeback	1207	28.59%
Other/Misc	19	0.45%
ATM Dep Chargeback	89	2.11%

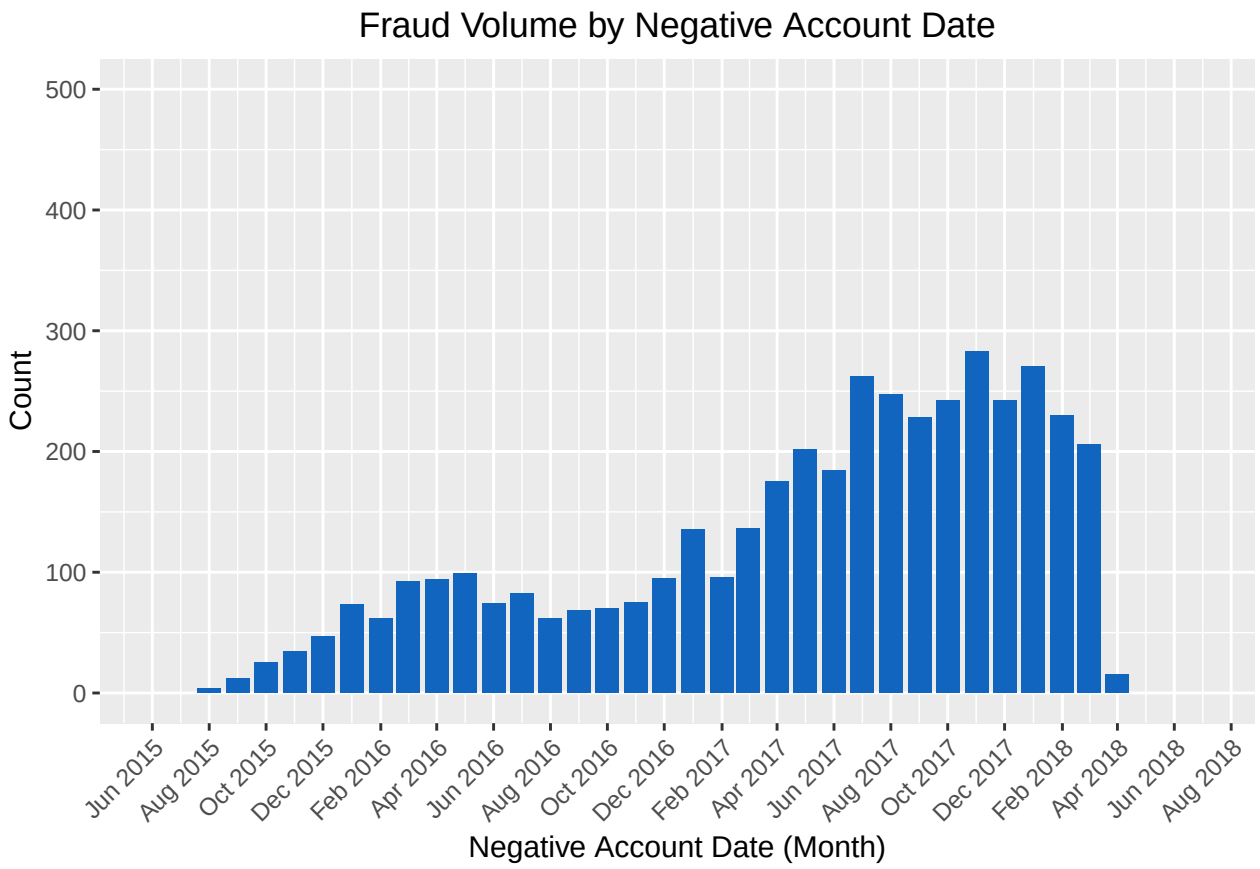
The most common type of charge-off is NSF Behavior, which accounts for 59.07% of all charge-off types.

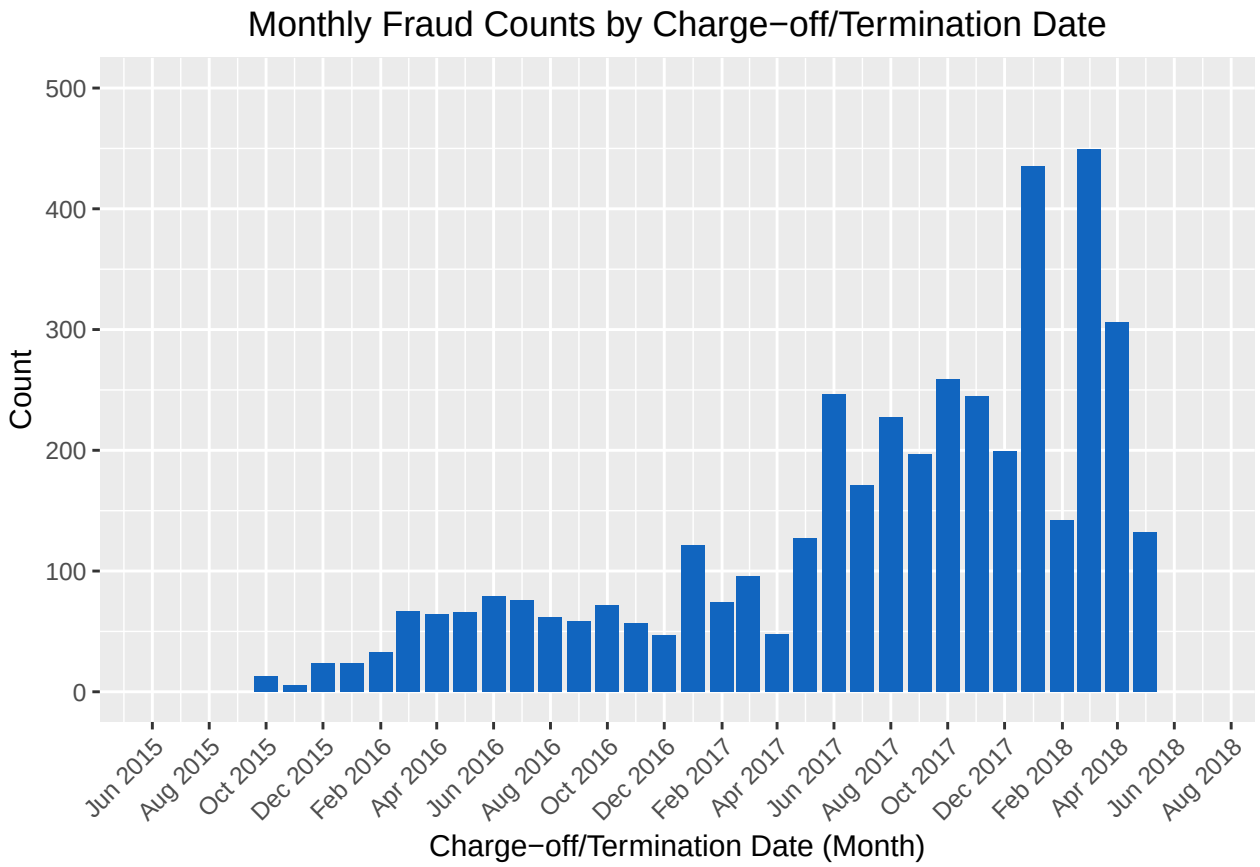
Fraud Volume

Four different methods of determining monthly fraud trends are presented below. They are calculated by the following:

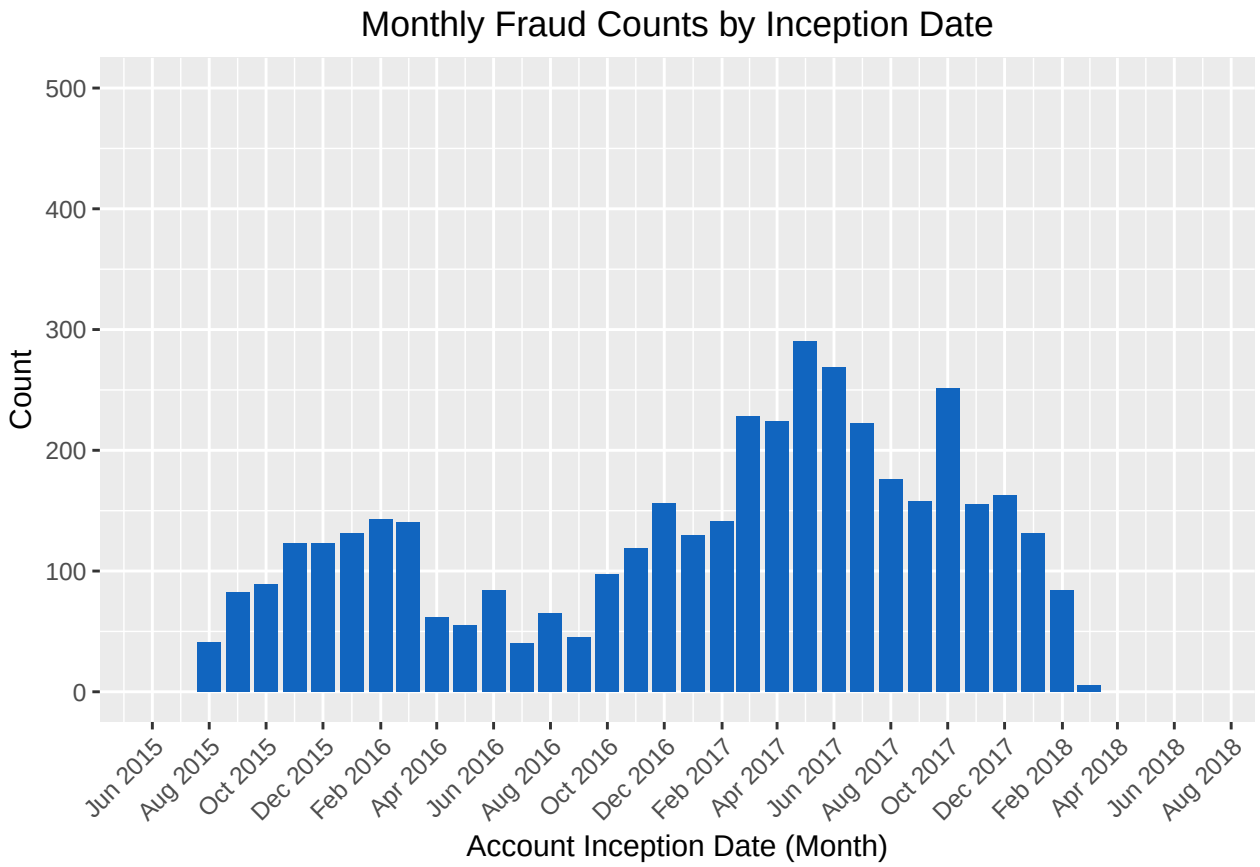
- **Negative Account Date:** The date at which an account becomes negative and stays negative for at least three consecutive days. This is in attempt to determine that date that the fradulant activity occured.
- **Charge-off/Termination Date:** The date that an account was charged-off, normally corresponding with an account termination.
- **Inception Date:** The date that the account was created.
- **Fraud Rate:** The proportion of fraudulent accounts versus non-fradulent accounts, calculated by any of the above date definitions.

Monthly Counts



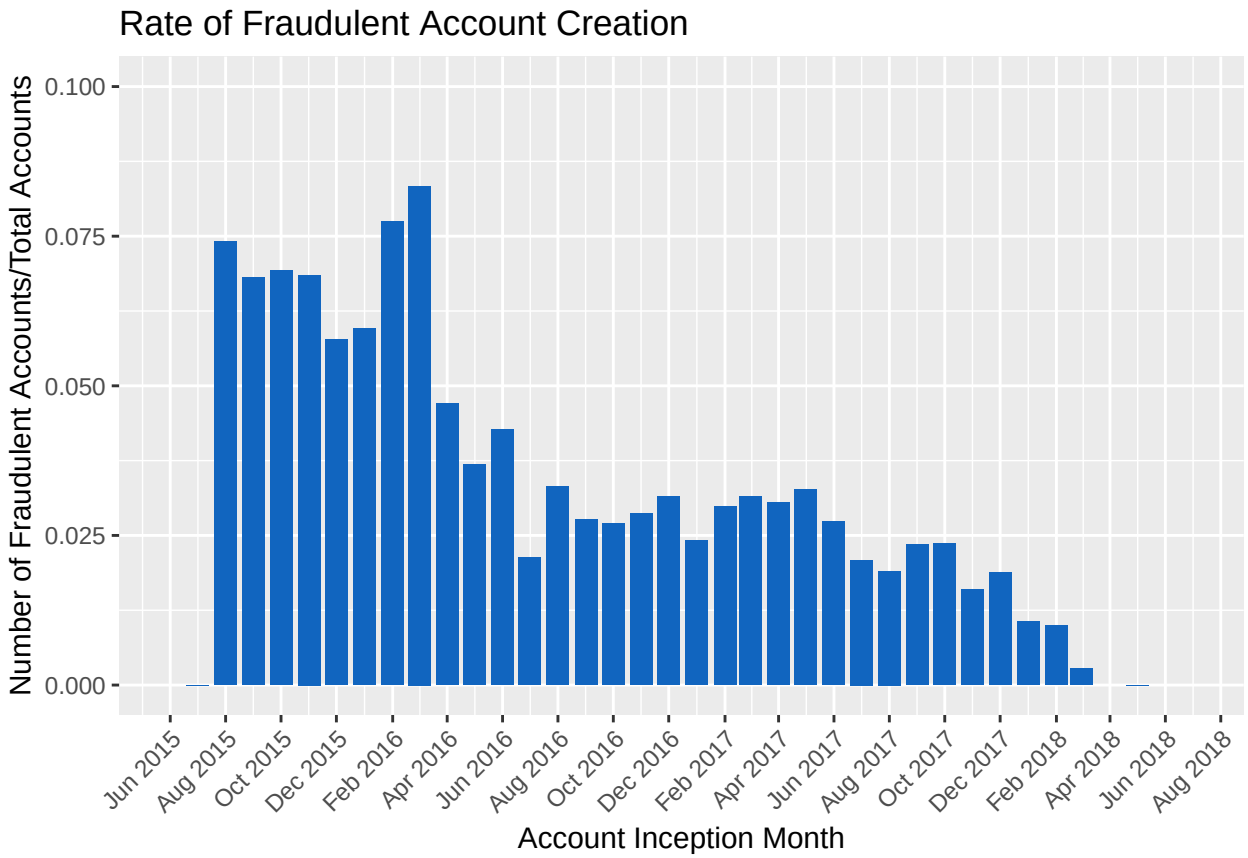


The above graph shows the discrepancy between when an account commits the fraudulent activity versus when the account is actually closed and charged-off, especcially noticed by the sporadic spikes in termination date verus negative account date. Previously, much of the account maintance and fraud mitigation was performed by Radius.



There is a noticable dip in fraud based on account inception (origination). Further investigation into onboarding and/or marketing trends may shed further light, however comparing the rate of fradulent account originations verse total account originations (as in the following graph) indicates that there was actually a more steady decrease in the rate of fradulent account originations than the previous graph suggests (see figure bellow).

Monthly Fraud Rate



Aside from February and March of 2016, the rate of fradulent accounts created has been going down when compared to total account originations. However, most (if not all) of the charge-off/fraud data labeling has been heavily relied on by Radius. Spot checking a number of account who went negative and never became postive has indicated that there may be upwards to an additional 30% of accounts that should have been charged-off or labeled as such, but currently have not been. This is likely due to the processes and procedures dictated by Radius.

Cost of Fraud

Table 3: Total charged-off losses (principal + realized)

chargeoff_reason	sum	percent	mean	min	q25	q50	q75	max
NSF Behavior	$237,003.91	14.50%	$95.03	$0.01	$15.92	$38.45	$118.99	$8,165.58
Mobile Dep Chargeback	$400,062.11	24.47%	$968.67	$0.07	$193.60	$579.98	$1,329.51	$8,001.67
Ext Tran Chargeback	$848,532.33	51.90%	$703.01	$0.01	$115.02	$216.12	$550.95	$45,765.79
Other/Misc	$27,176.78	1.66%	$1,430.36	$0.03	$106.20	$174.77	$1,627.70	$8,733.81
ATM Dep Chargeback	$122,241.57	7.48%	$1,373.50	$17.04	$313.54	$710.09	$1,343.58	$12,021.23

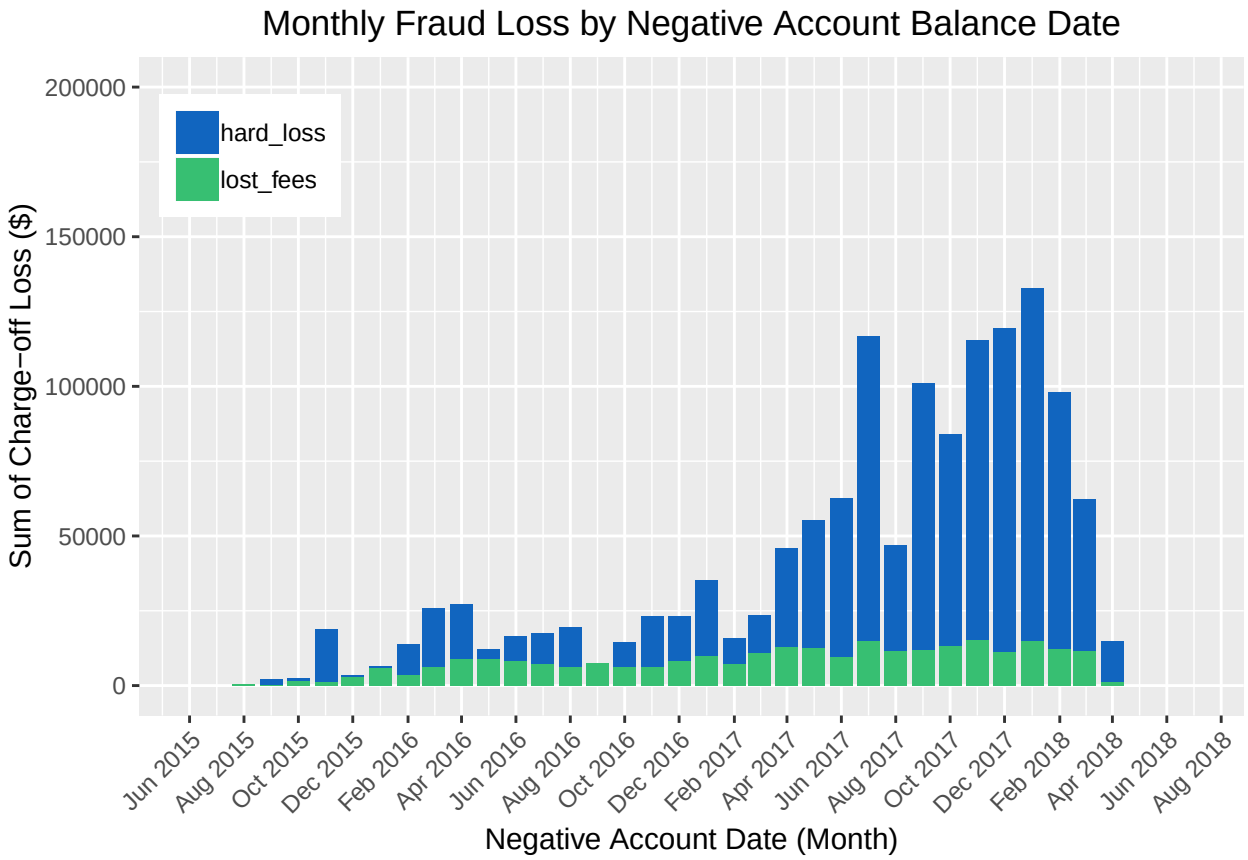
As displayed in the tables above, much of the total losses related to NSF Behavior are not actually realized. While NSF Behavior makes up the majority of volume of charge-offs, it is in fact, one of the least costly, especcially when compared to the cost of some of the other charge-off reasons as shown below.

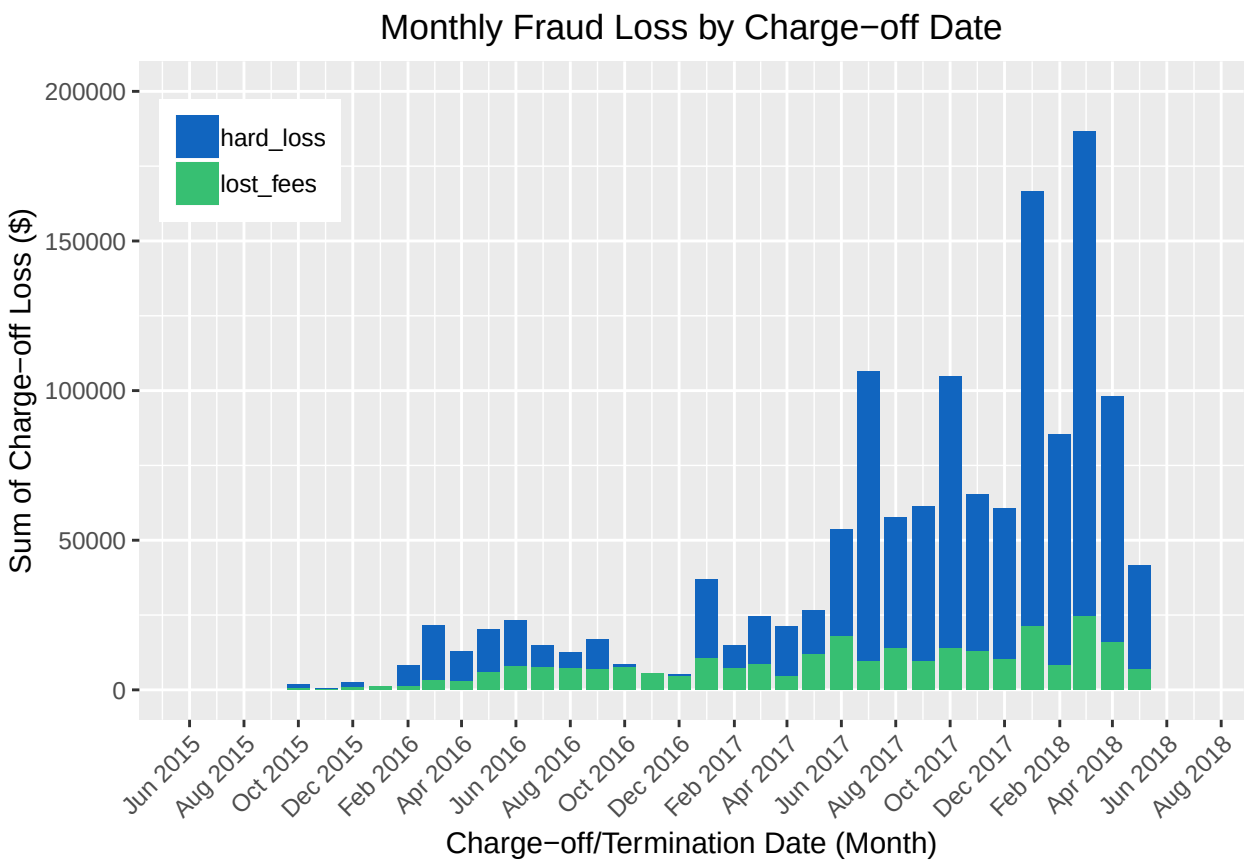
Table 4: Total charged-off losses (realized only)

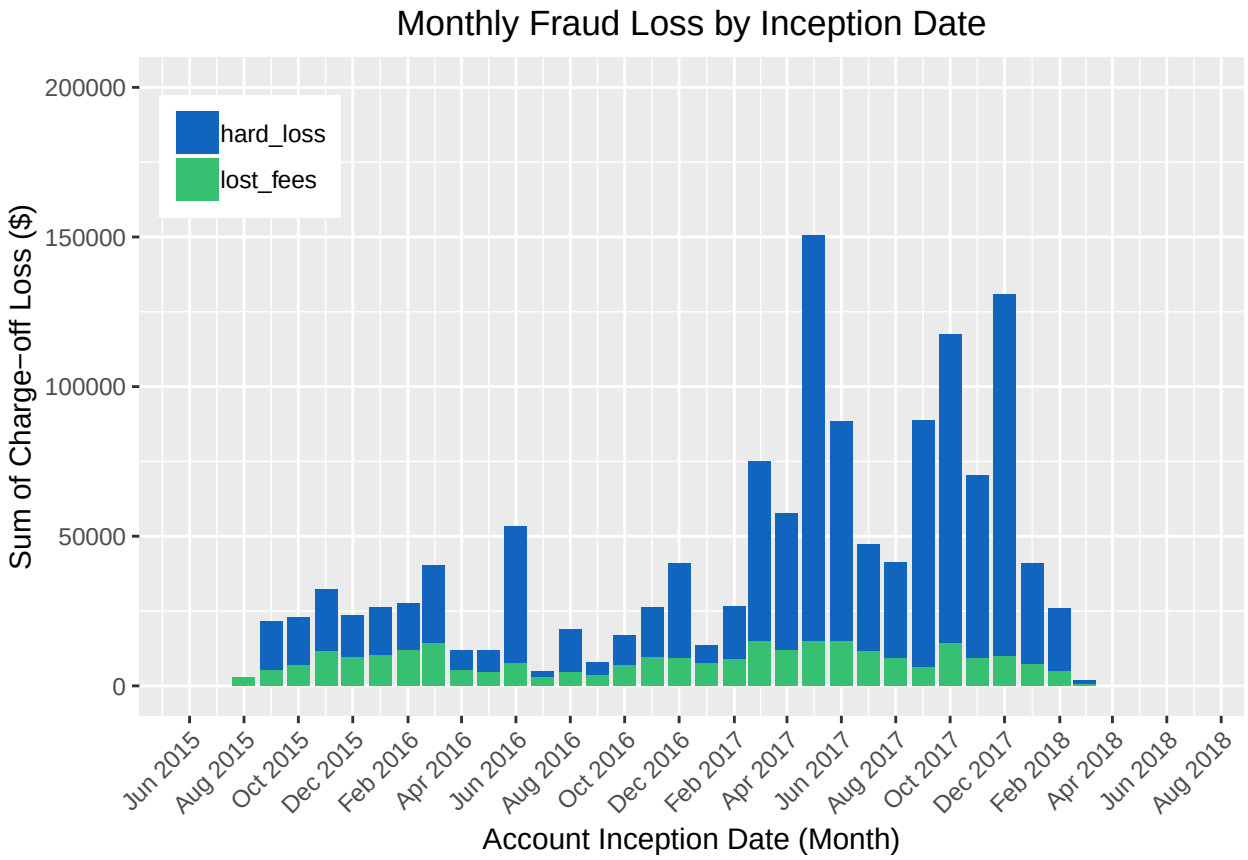
chargeoff_reason	sum	percent	mean	min	q25	q50	q75	max
NSF Behavior	$110,526.34	8.09%	$44.32	$0.00	$0.85	$15.25	$33.58	$8,075.58
Mobile Dep Chargeback	$366,152.04	26.81%	$886.57	$0.00	$103.47	$481.14	$1,249.51	$7,903.67
Ext Tran Chargeback	$748,748.50	54.82%	$620.34	$0.00	$25.09	$120.06	$465.01	$45,695.79
Other/Misc	$25,940.21	1.90%	$1,365.27	$0.00	$14.49	$146.77	$1,542.70	$8,733.81
ATM Dep Chargeback	$114,470.69	8.38%	$1,286.19	$0.00	$223.54	$620.09	$1,272.10	$11,931.23

Monthly Cost

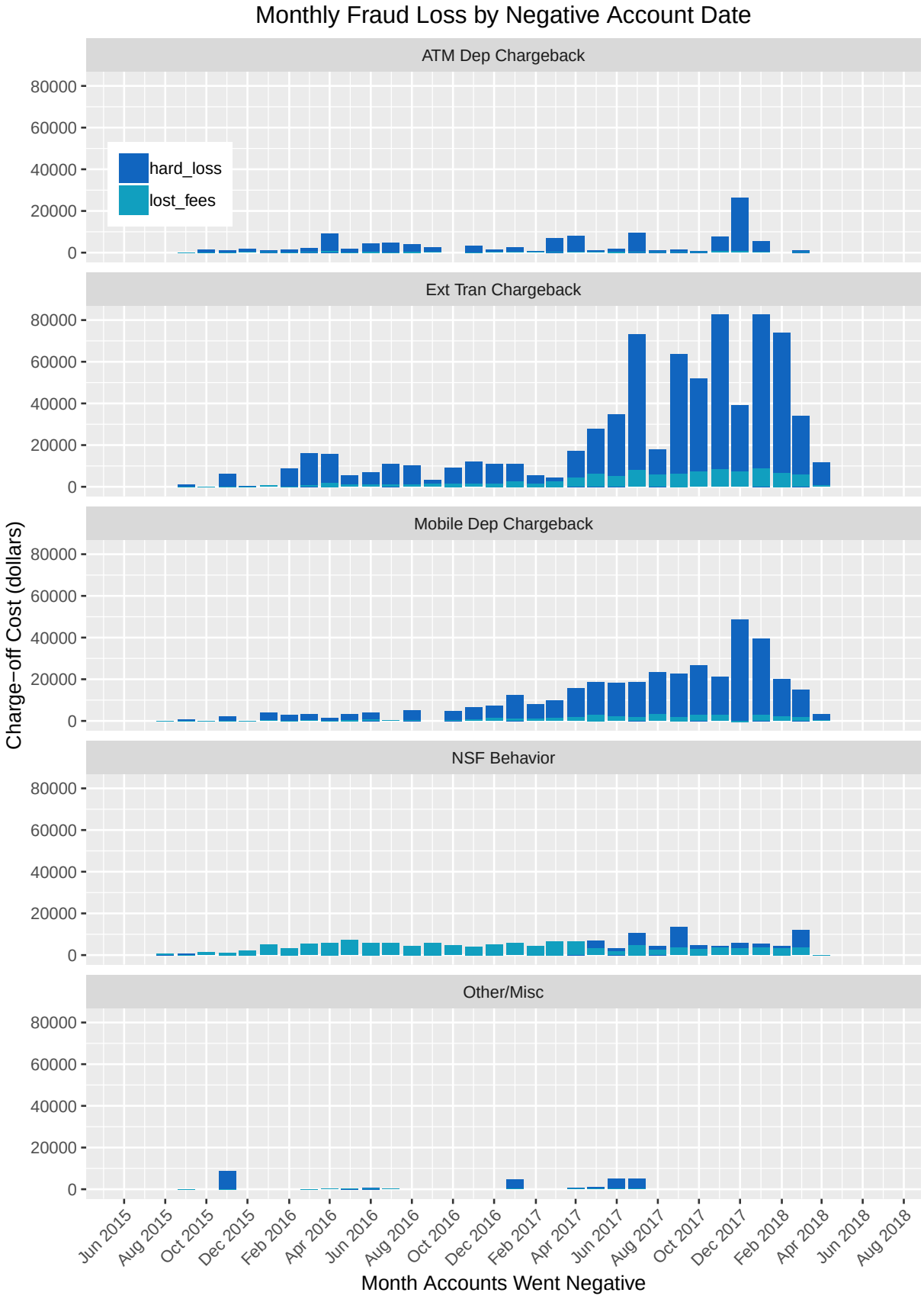
- **Lost Fees:** Overdraft fees that Aspiration was owed, but never collected.
- **Hard Loss:** Actual money lost.
- **Total Cost:** Combined Lost Fees and Hard Loss




Monthly Fraud Loss by Charge−off Date
hard_loss
lost_fees
Sum of Charge−off Loss ($)
200000
150000
100000
50000
0
Jun 2015
Aug 2015
Oct 2015
Dec 2015
Feb 2016
Apr 2016
Jun 2016
Aug 2016
Oct 2016
Dec 2016
Feb 2017
Apr 2017
Jun 2017
Aug 2017
Oct 2017
Dec 2017
Feb 2018
Apr 2018
Jun 2018
Aug 2018
Charge−off/Termination Date (Month)


Monthly Fraud Loss by Inception Date
hard_loss
lost_fees
Sum of Charge−off Loss ($)
200000
150000
100000
50000
0
Jun 2015
Aug 2015
Oct 2015
Dec 2015
Feb 2016
Apr 2016
Jun 2016
Aug 2016
Oct 2016
Dec 2016
Feb 2017
Apr 2017
Jun 2017
Aug 2017
Oct 2017
Dec 2017
Feb 2018
Apr 2018
Jun 2018
Aug 2018
Account Inception Date (Month)

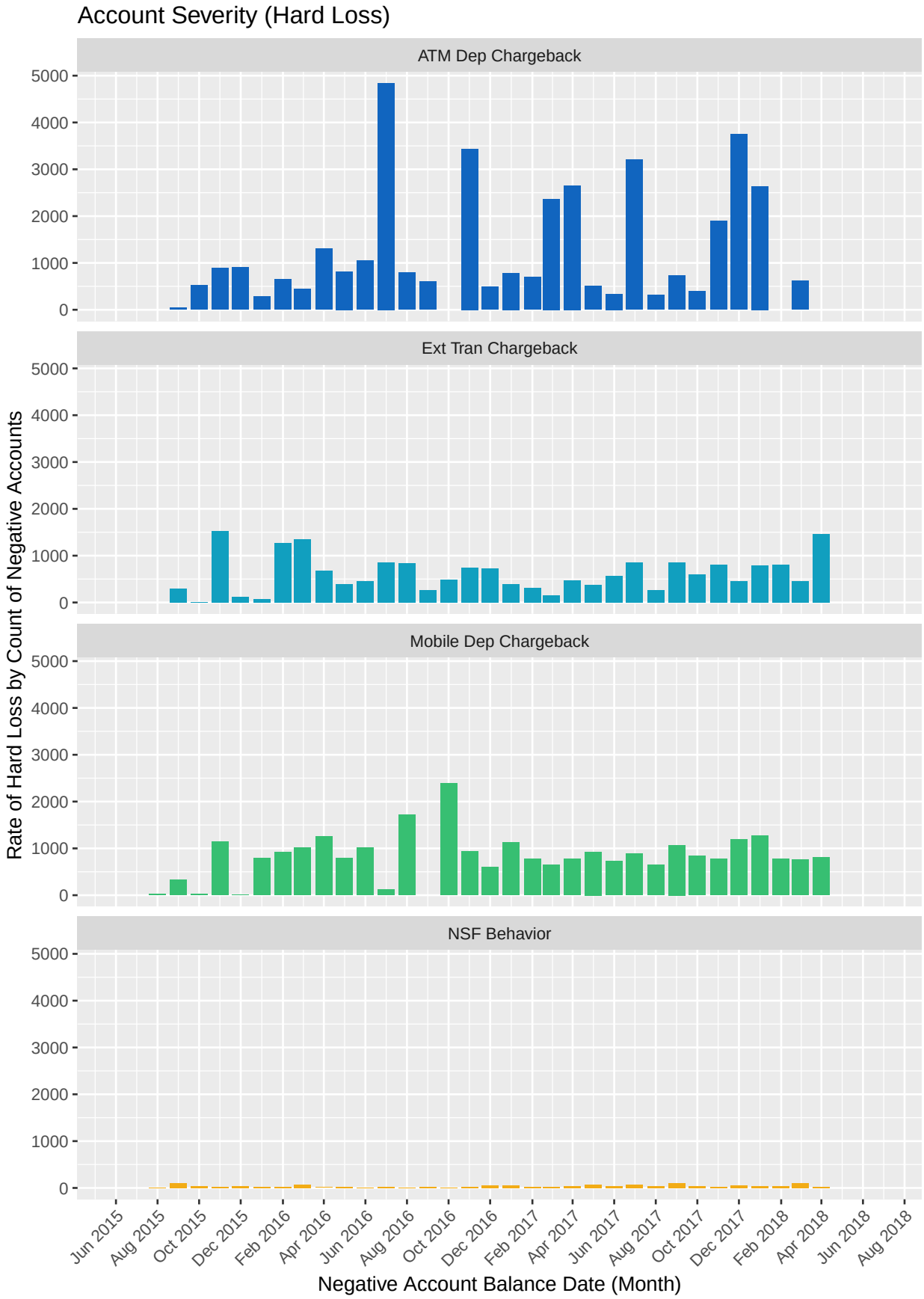
Cost by charge-off type



Note: Bank by Mail / In Person, Opening Dep Chargeback, and Other charge−off reasons remove due to low counts.

Account Severity

Similar to ther Fraud Rate, Account Severity refers to rate of hard loss by number of accounts per the given charge-off reason.


Account Severity (Hard Loss)
ATM Dep Chargeback
Ext Tran Chargeback
Mobile Dep Chargeback
NSF Behavior
Rate of Hard Loss by Count of Negative Accounts
0
1000
2000
3000
4000
5000
Jun 2015
Aug 2015
Oct 2015
Dec 2015
Feb 2016
Apr 2016
Jun 2016
Aug 2016
Oct 2016
Dec 2016
Feb 2017
Apr 2017
Jun 2017
Aug 2017
Oct 2017
Dec 2017
Feb 2018
Apr 2018
Jun 2018
Aug 2018
Negative Account Balance Date (Month)

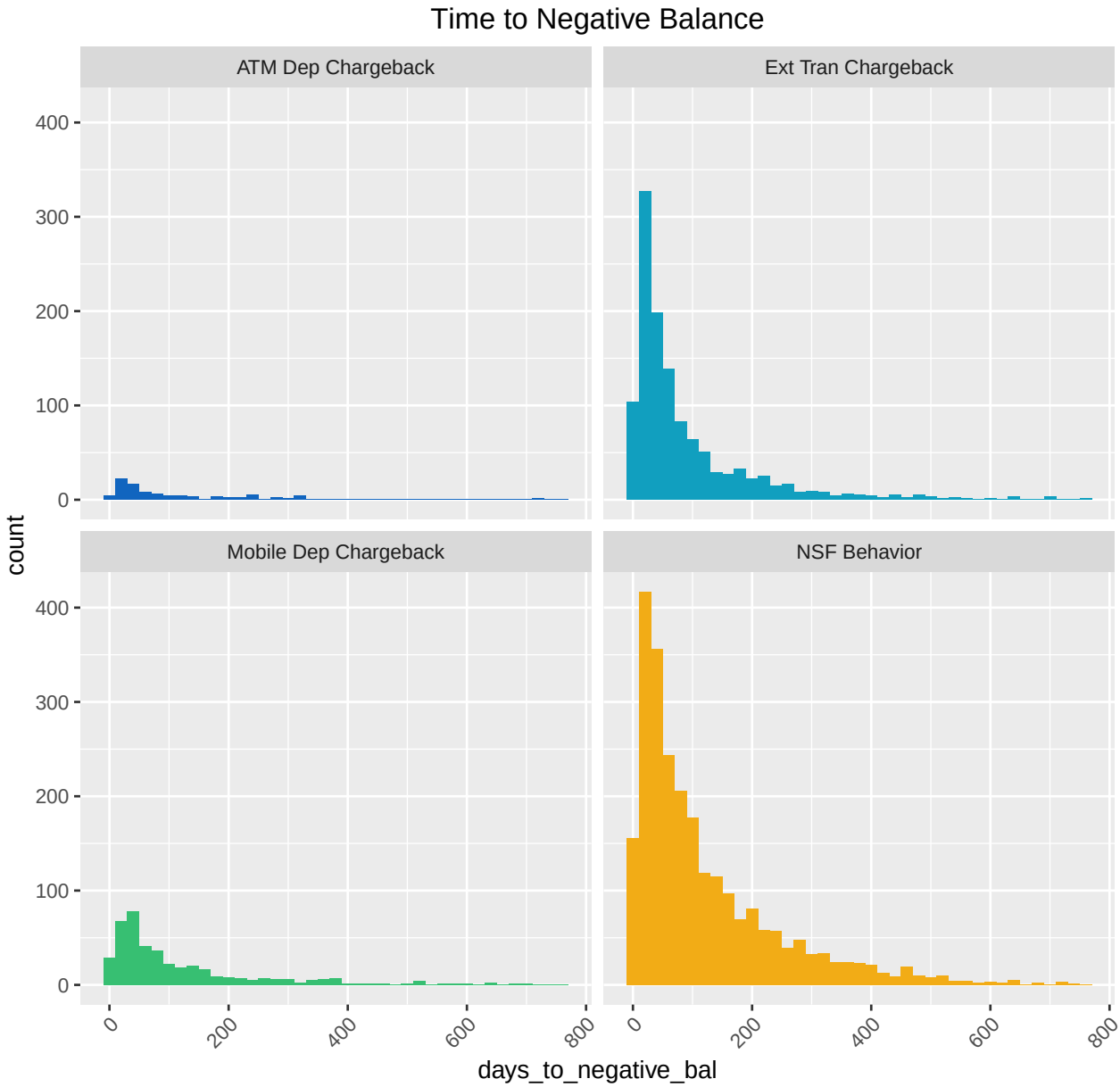
Time Till Fraud/Charge-off Act

Time between account creation and first day an account goes negative and stays negative for at least three days in a row.

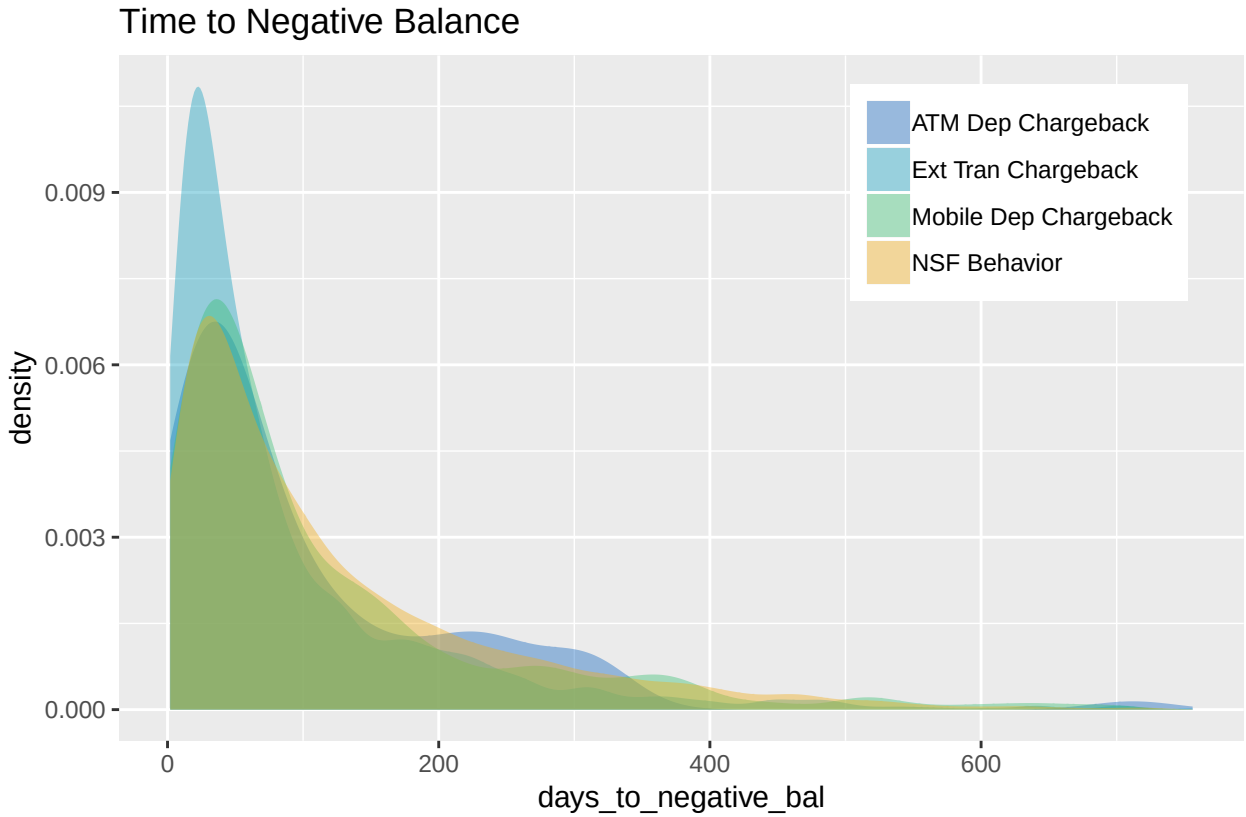
Table 5: Days from account creation to negative balance

chargeoff_reason	mean	min	q25	q50	q75	max
NSF Behavior	120.47	3	32.25	78.00	166.00	731
Mobile Dep Chargeback	113.81	2	33.00	65.00	148.00	700
Ext Tran Chargeback	86.61	2	21.00	47.00	107.00	756
Other/Misc	56.42	0	7.50	38.00	82.50	257
ATM Dep Chargeback	101.06	5	25.75	52.50	140.25	712

Both External Transfer Chargebacks and NSF Behavior has the larges volume as well as more accounts that have a longer time till committing fraud, though it seems mostly proportional to the other types of chargebacks, mostly differing in volume.



Note: Bank by Mail / In Person, Opening Dep Chargeback, and Other charge−off reasons remove due to low counts.



Note: Bank by Mail / In Person, Opening Dep Chargeback, and Other charge−off reasons remove due to low counts.

Marketing Channels and Fraud

Table 6: Maketing channel group by customer vs fraud/charge-off

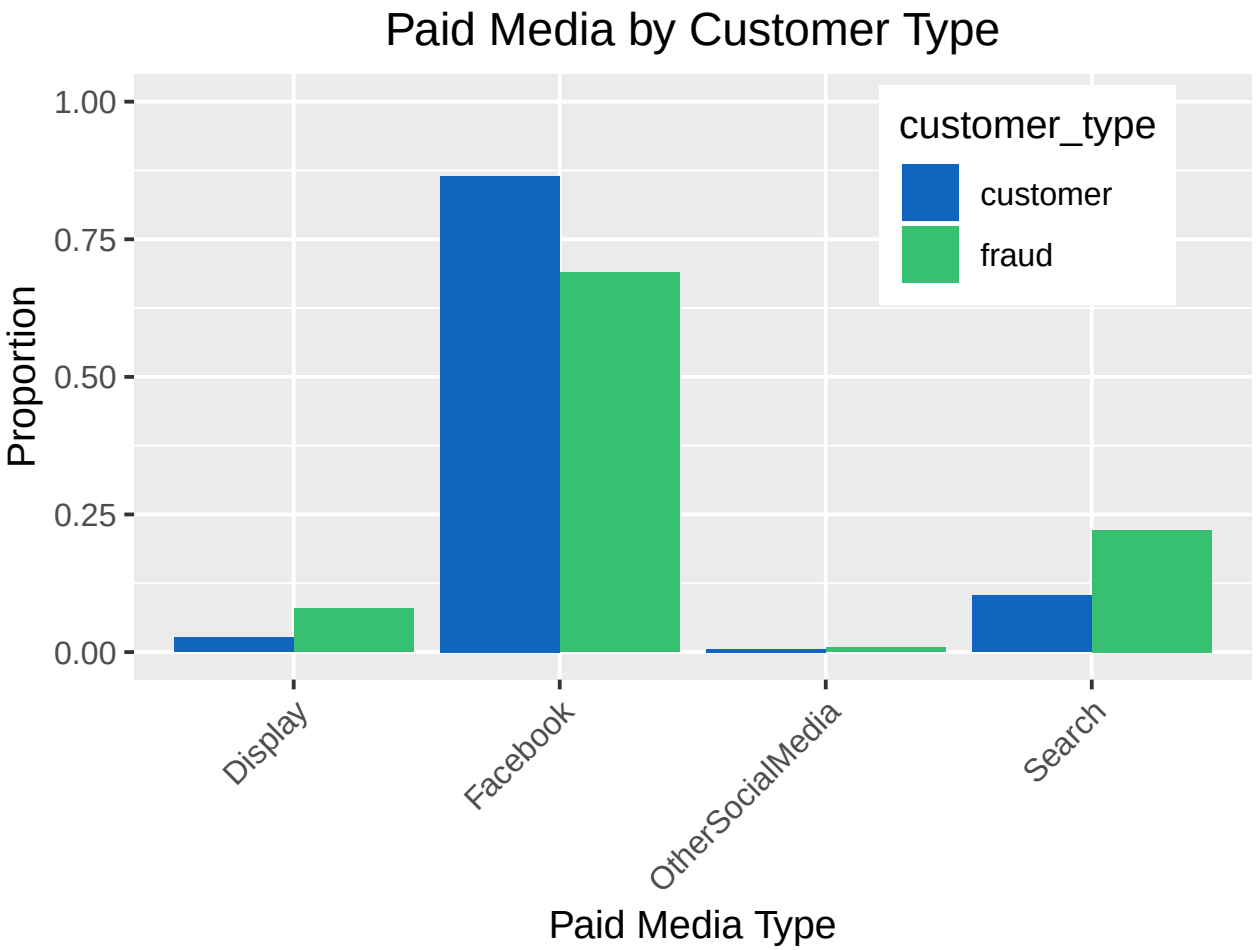
	Affiliates	Organic	PaidMedia	Unattributed
customer	74362 (48.64%)	353 (0.23%)	24619 (16.1%)	53542 (35.02%)
fraud/charge-off	1340 (31.75%)	9 (0.21%)	1421 (33.67%)	1451 (34.38%)

Table 7: Marketing channel group by charged-off reason

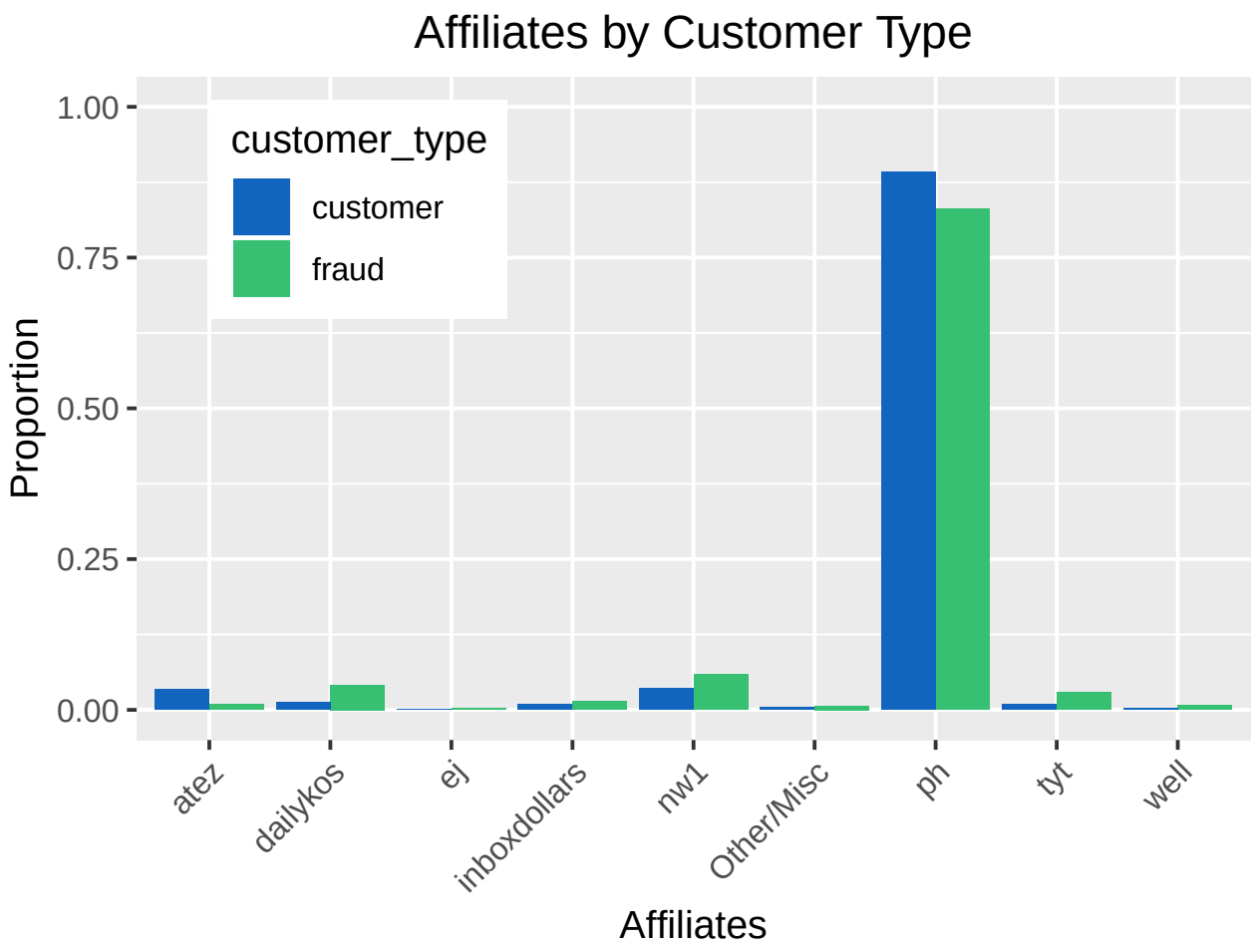
	Affiliates	Organic	PaidMedia	Unattributed
ATM Dep Chargeback	13 (14.61%)	1 (1.12%)	46 (51.69%)	29 (32.58%)
Ext Tran Chargeback	420 (34.8%)	2 (0.17%)	313 (25.93%)	472 (39.11%)
Mobile Dep Chargeback	110 (26.63%)	0 (0%)	143 (34.62%)	160 (38.74%)
NSF Behavior	797 (31.97%)	6 (0.24%)	908 (36.42%)	782 (31.37%)
Other/Misc	0 (0%)	0 (0%)	11 (57.89%)	8 (42.11%)

Both Paid Media and Affiliates seem to have a higher rate among fradulent and charged-off accounts.

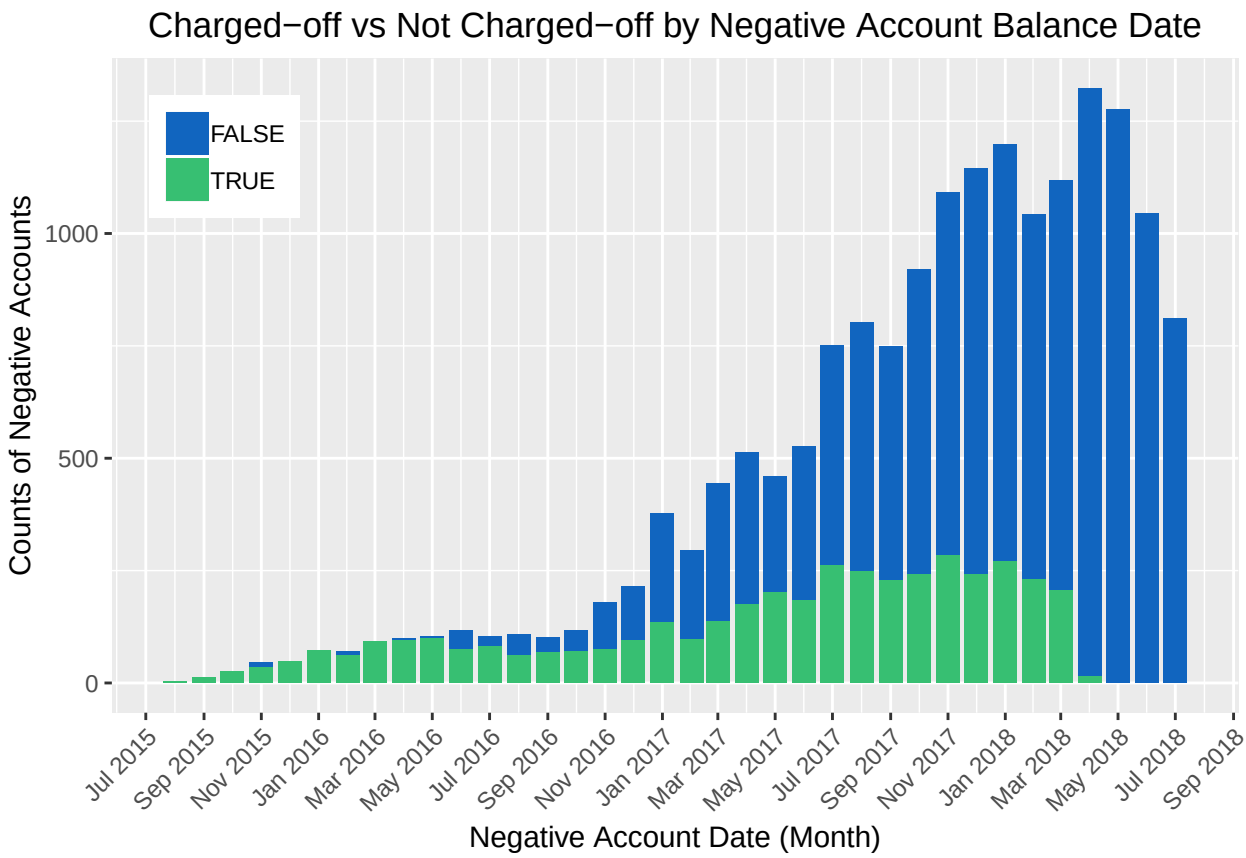
Paid Media



The proportion of Search results is higher among fradulent/charged-off accounts, which could be a result of users seeking out institutions like Aspiration for more malicious behaviors.


Affiliates by Customer Type
customer_type
customer
fraud
Proportion
1.00
0.75
0.50
0.25
0.00
atez
dailykos
ej
inboxdollars
nw1
Other/Misc
ph
tyt
well
Affiliates

Negative Account Balance Data by Charge-off Status



Recomentations

Data Quality

Thus far, much, if not all, of the fraud reporting and labeling has been dictated by Radius. Numerous accounts have been found that display fraudulent behaviors, but have not been reported as fradulent by Radius to Aspiration. Review of such accounts as well as the continued work in the Ops department to take control over the process and procedures around mitigation of risk and fraud, including labeling, will improve the ability to monitor and model fraud.

Furthermore, Radius has not passed on information regarding 1st or 3rd party fraud verses synthetic fraud. Since these groups tend to have very different qualities, it would be wise to differentiate between them going forward, so as best to target the different types of fraud while optimizing the customer experience for good customers.

Time to Account Termination

The average time between an account going negative and it being charged-off ranged between 56 and 120 days. While radius has a standard of charging off accounts after 30 days of being over drafts, the data shows that they have not always stuck to their deadline. Shortening the time to account termination for fradulent accounts could prevent further loss.

TO DO

- ~~**Compare counts of fraud vs total accounts to see if rate of fraud is increasing or not**~~
- ~~**Charge-off per account incepted**~~
- ~~**Cost by chargeoff reason in a stacked bar - fees vs hard loss by fraud loss type (facet_wrap?)**~~
- ~~**Remove low counts from graphs and add footnote of their removal**~~
- ~~**Switch from histograms to density plots**~~
- **Look at edge cases, give some qualitative insight**
- ~~**Ignore ignore from marketing tables**~~
- ~~**Look at utm channel type to see what is causing the increase in PaidMedia**~~
- **Break down also by browser (chrome, etc)**: Data seems to be in `web_db.user_browser_fingerprint` table, but doesn't list actual browser names, just coded variables. Waiting for hear back on what the dummy labels correspond to.
- **Distribution of accounts by states (counts of accounts vs fraud)**
- **Profiling fraud vs non with account origination data**
- ~~**Add monthly counts of attempted date (aka, negative balance).**~~
- **Break down fraud ratio by chrageoff type**: This turns out to be harder said than done, but working on it
- ~~**Look at chargeoff types that have min of $0**~~ This is due mostly to fees charged for OD accounts. Should we include in report?
- ~~**Remove low count of charge off groups**~~
- ~~**Update fraud count graphs to be on same x and y axis**~~
- ~~**Next steps section to include difference between negative account date and charge off date as somethi**~~
- **Look at percentage of accounts that went negative but werent charged off as a comparision/validation of using negative account balace date - count be as a talking point, and if 3 days right? or is 10 days better? or dollar amount** - In process, confirming new data
- ~~**Show graph of % of fraud inception**~~
- **If I were to make a recommendation what would it be? Filter all the charts like that**
- ~~**Collapse into 5 grouops, call it other/Misc**~~
- ~~**trend of fraud by inception month/overall fraud by, what is industry**~~ Industry has been reported as ~10%, though some Fintech's have been reportedly closer to 35%. Current Aspiration rates seem very low, perhaps due to not actively onboarding? Or failure to correctly label all fraud due to Radius?
- ~~**2 fraud rates: fraud by counts and fraud by dollars**~~
- ~~**Note about no way to distinguish 1st vs 3 vs synthestic fraud**~~
- ~~**Account severity: loss of 18K in External transfer and it was 10 people to see if it really increasing or**~~
- ~~**Add graph of counts by inception date**~~
- **Why do some people wait so long? After 200 days - compare customers who regularly engage account who then commit fraud. Is it sleeper accounts?** This needs more evaluation using a better metric

- ~~call out data mislabeling~~
- ~~Look at affiliate fraud for marketing like done for paid media~~
- ~~Move script and all coding to the end for an appendix~~

Fraud Section, Cost Section,