

# Stimulus and Response: The Path from Naïveté to Sophistication in the Credit Card Market

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The views expressed in this paper are not necessarily those of the Federal Reserve Bank of Chicago or of the Federal Reserve Board.

# 1 Motivation

- Does lack of sophistication among some consumers affect the market equilibrium?
- Two reasons that consumer errors might not matter:

1. “Competition will protect the consumer.”
2. “Consumers will learn.”

“Competition will protect the consumer” Gabaix and Laibson, *Shrouded Attributes* (QJE, 2006)

- In equilibrium, naïve consumers subsidize sophisticates.
- “Curse of debiasing”: training consumers to be rational makes it harder to win their business or profit from them.
- There is no incentive for a firm to educate consumers or to offer products without the cross subsidy.
- Debiasing consumers / unshrouding is not profitable in equilibrium, even in competitive markets. Inefficiencies associated with shrouding persist.

“Consumers will learn” Today’s paper.

- Consumers initiate new financial relationships without fully understanding the fee structure.
- Does learning produce convergence to the rational benchmark?
- We study learning in the field.
- Panel dataset containing three years of credit card records, representing 128,000 consumers, and 100 million individual transactions.
- We study late payment fees, over limit fees, and cash advance fees.

- Fees average \$16/month for new accounts (*and* trigger interest rate  $\Delta$ 's)
- Controlling for person fixed effects, fee payments fall by 75% during first four years of account life.
- Learning is driven by feedback. Making a late payment (i.e. paying a fee), sharply cuts the probability of a late payment in the next month.
- However, card holders act as if their hard-earned experiential knowledge is depreciating.
  - Monthly probability of a fee payment *increases* as previous fee payments recede into the past.
  - Knowledge depreciates at about 15% per month.

- Learning is powerful
- But “depreciation” (inattention) partially offsets learning.
- Decision-makers learn best when the feedback was recent
- As yesterday’s information recedes into the past, we cease to notice it and our behavior tends to backslide.

Some related credit card research:

Ausubel (1991): Rents and over-optimistic consumer spending forecasts.

Ausubel (1999): Adverse selection in response to credit card solicitations.

Gross and Souleles (2002a): Rise in default rates in mid-1990s.

Gross and Souleles (2002b): Response to change in credit limits.

Shui and Ausubel (2004): Teaser rates and reluctance to switch contracts.

Agarwal, Chomsisengphet, Liu, and Souleles (2005): Choice of contracts.

Agarwal, Driscoll, Gabaix and Laibson (2007): U-shaped pattern of fee payment, APRs by age.

DellaVigna and Malmendier (2004): Equilibrium with present bias and naivete.

## 2 Our Data

- Representative credit card panel from a large bank (1/2002 – 12/2004).
- We focus analysis on three types of fees:
  1. **Late Payment Fees:** \$30-\$35. Penalty pricing (i.e.  $APR > 24\%$ ) may be imposed.
  2. **Over Limit Fee:** Also \$30-\$35. Penalty pricing may also be imposed.
  3. **Cash Advance Fee:** Greater of: 3% of the amount advanced, or \$5. No penalty pricing, but 16% APR on cash advances.

Figure 1: Fee Frequency and Account Tenure

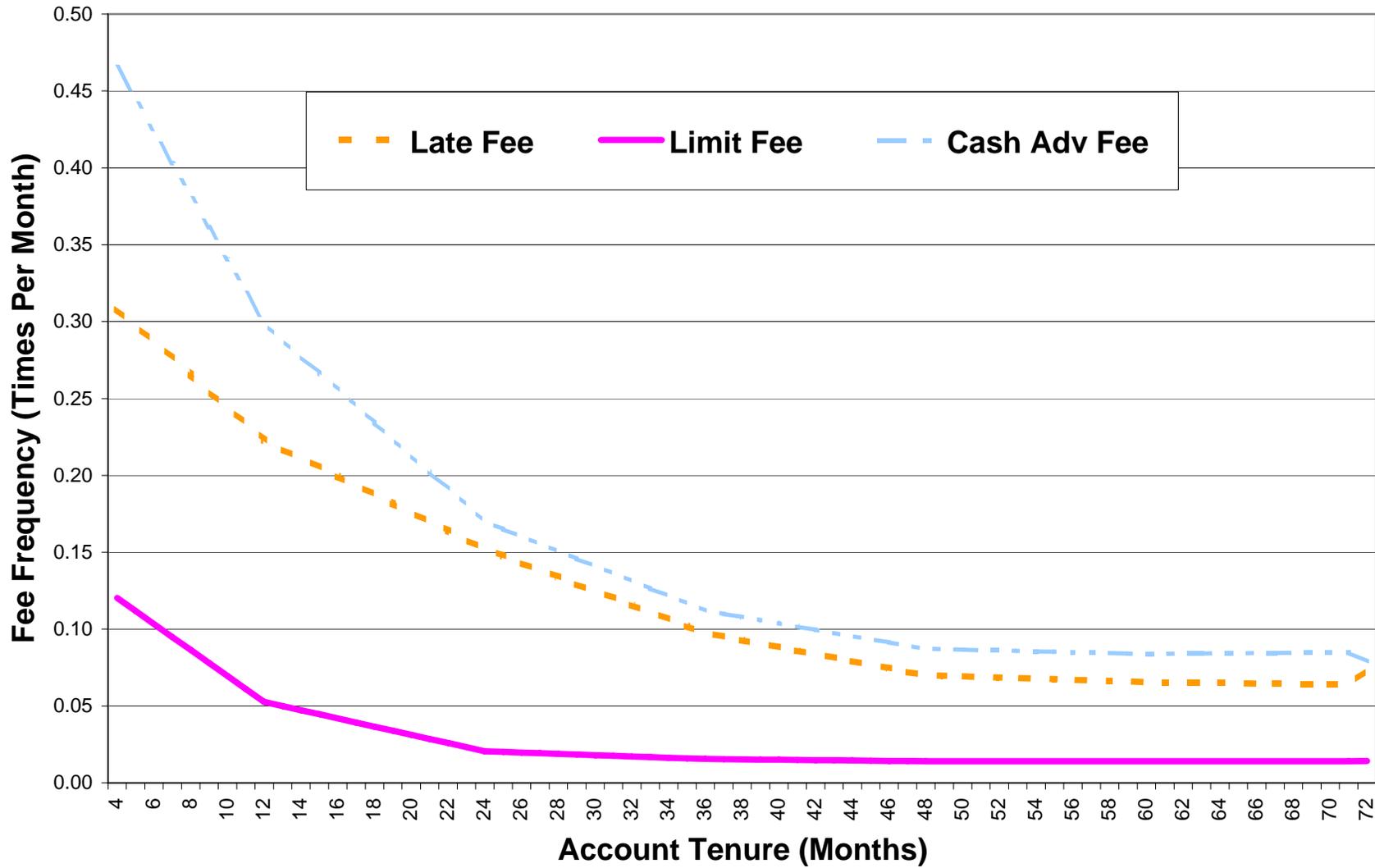
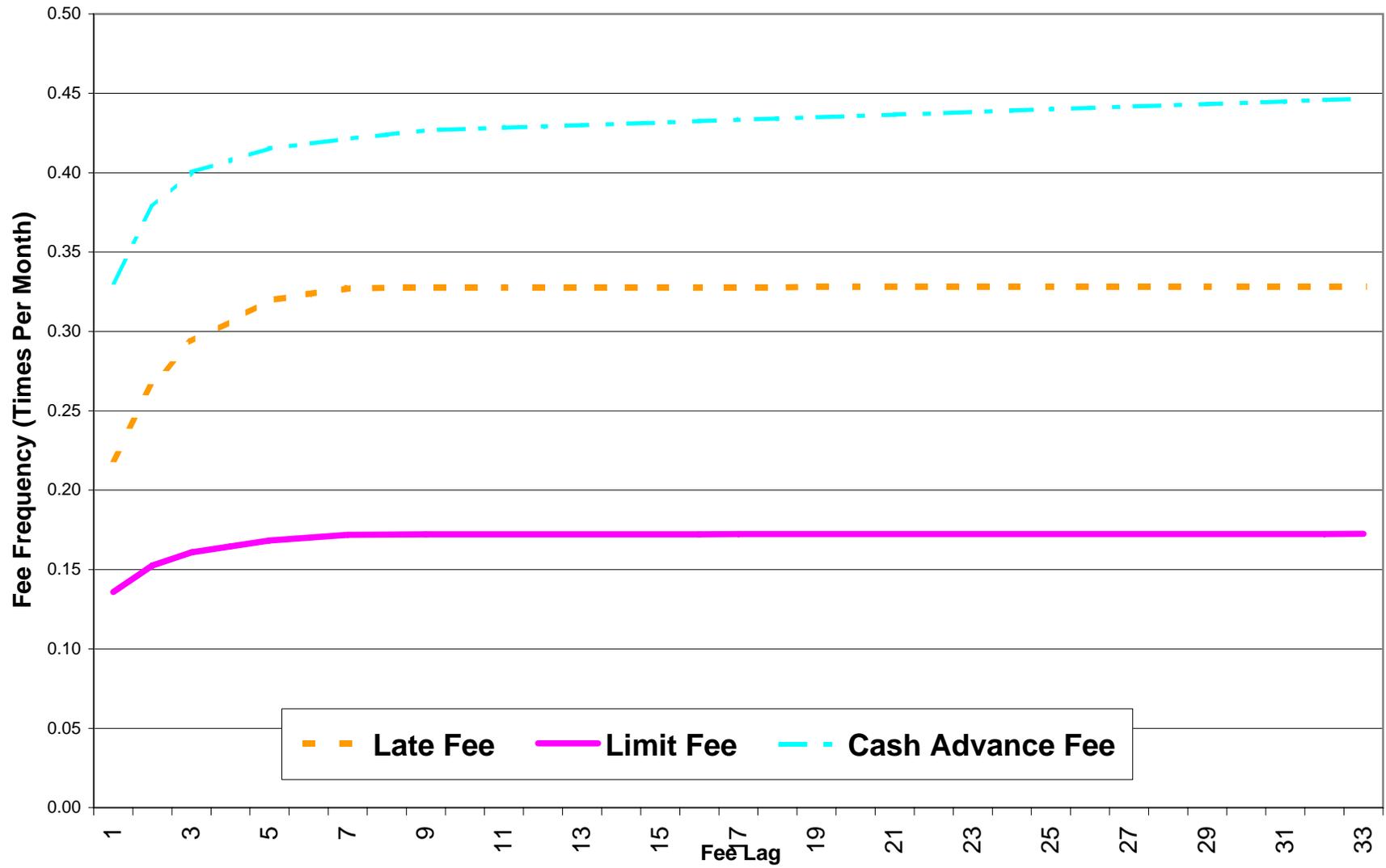


Figure 3: Fee Frequency and Time Since Last Fee Paid



### 3 Simple Model of Learning and Forgetting

- or, of Attention and Inattention
- $F_t$  : stock of negative feedback
- $f_t$ : current feedback, either 0 or 1 (dummy variable for fee payment)

$$F_t = f_t + (1 - \delta) F_{t-1}$$

- $\delta \in [0, 1]$  indexes depreciation of the stock of negative feedback.
- This includes recency biases, forgetting, and other forms of backsliding.

- We assume that past fee payments drive down future fee payments (through a reinforcement learning mechanism)

$$E_{t-1} [f_t] = a - \beta \frac{F_{t-1}}{1 + \gamma F_{t-1}}.$$

- If  $\gamma > 0$ , then  $\lim_{F \rightarrow \infty} \frac{F}{1 + \gamma F} = 1/\gamma$ , and learning saturates for large  $F$ .
- If  $\gamma = 0$ , learning does not saturate.
- $\beta$  captures the strength of learning.

## 4 Results

$$f_{i,t}^j = \alpha + \phi_i + \psi_{time} + \beta \frac{F^j(\delta)_{i,t-1}}{1 + \gamma F^j(\delta)_{i,t-1}} + Controls_{i,t} + \epsilon_{i,t}.$$

Main parameters of interest:

$\beta$ , the rate of learning

$\delta$ , the rate of forgetting

$\gamma$ , the saturation of learning

Account and time fixed effects:  $\phi_i, \psi_{time}$ .

Other controls: FICO, Behavior score, debt/limit, activity dummies.

## Model with Just Learning ( $\delta = 0$ )

- The saturation parameter  $\gamma$  is very small throughout.
- The learning coefficient ( $\beta$ ) estimates show that paying an extra late fee in the past reduces the probability of paying a late fee today by 11%.

## Model with Learning and Forgetting (Allowing for a Recency Bias)

- The estimates of the  $\beta$  learning parameters double.
  - Paying an extra late fee in the previous month reduces the current propensity of paying a late fee by 20%.
- This is offset by depreciation,  $\delta$ .
  - The estimated values imply a depreciation rate of over 15% per month for the late fee
  - So a fee paid one year ago has only 1/10 the impact on current fee payment as a fee paid last month.

## 5 Extension: Short and Long Term Memory

- We introduce two decay parameters:  $\delta_S$  (short term) and  $\delta_L$  (long term). The associated behavioral model is

$$E_{t-1} [f_t] = a - \beta_S \frac{F_{t-1}^S}{1 + \gamma_S F_{t-1}^S} - \beta_L \frac{F_{t-1}^L}{1 + \gamma_L F_{t-1}^L}.$$

- **Long Term Memory:** Having paid a fee last month reduces propensity to pay a fee next month by 3%. Long-term memory fades 2% per month.
- **Short Term Memory:** Having paid a fee last month reduces propensity to pay a fee next month by 26%. Short-term memory fades 17% per month. This is offset by depreciation,  $\delta$ .

## 6 Alternative Explanations that We Can Rule Out

- Correlation between financial distress and tenure
- Correlation between purchases and tenure
- Non-utilization of the credit card
- Negatively autocorrelated financial needs
- Negative autocorrelation induced by demeaning
- Bias due to an unbalanced panel

## 7 More Robustness Results

- We examine how fee payment frequency varies with payment of other fees
  - Paying one type of fee has a negligible effect on contemporaneous or future payment of another type of fee
  - Hence modeling fee payment individually, rather than jointly, is valid.
  - This casts further doubt on the hypothesis that fees are related to “financial distress” (that, and the fact that a fee now makes me less likely to pay a fee next month).

- Our behavioral controls—FICO score, behavior score, and utilization—do not show economically significant account tenure
  - Hence our results on the evolution of fee payment by tenure are not driven by trends in these variables.
- There is no seasonality in fee payment.
  - Fees do rise in December, but by an economically and statistically insignificant amount.

## 8 Conclusion

- Consumers learn how to avoid fees.
  - New accounts generate fees of \$16/month and plus penalty pricing.
  - Through negative feedback — paying fees — consumers learn to avoid triggering such fees in the future. Controlling for person fixed effects, fee payments fall by 75% during the first 4 years of account life.
- Consumers' hard-earned knowledge depreciates 15% per month.
  - As fee-paying lesson recedes into the past, consumers tend to backslide.
- Like rational agents, consumers learn, but like myopes, consumers respond to recent events far more than events that occurred just a few months ago.

Thank you