Will that be Cash, Debit, or Credit? How Canadians Pay

Carlos Arango Kim P. Huynh Leonard Sabetti

Bank of Canada

Joint ECB-OeNB Conference
The future of retail payments: opportunities and challenges
Vienna, Austria
May 12, 2011

The views expressed are those of the authors. No responsibility for them should be attributed to the Bank of Canada.

Raison d'être

Currency Economic Research and Analysis Group exists to assist in answering questions such as:

- The Bank of Canada needs to anticipate changes in the demand for cash relative to alternative means of payment:
  - Where and how is cash used in the economy?
  - Impact of financial innovation(s).
  - Understand the switching patterns of households.
- Efficiency of the retail payment system.

Raison d'être

Currency Economic Research and Analysis Group exists to assist in answering questions such as:

- The Bank of Canada needs to anticipate changes in the demand for cash relative to alternative means of payment:
  - Where and how is cash used in the economy?
  - Impact of financial innovation(s).
  - Understand the switching patterns of households.
- Efficiency of the retail payment system.

$\Rightarrow$ How does it affect Currency?


IN GOD WE TRUST
ALL OTHERS MUST
SHOW DATA

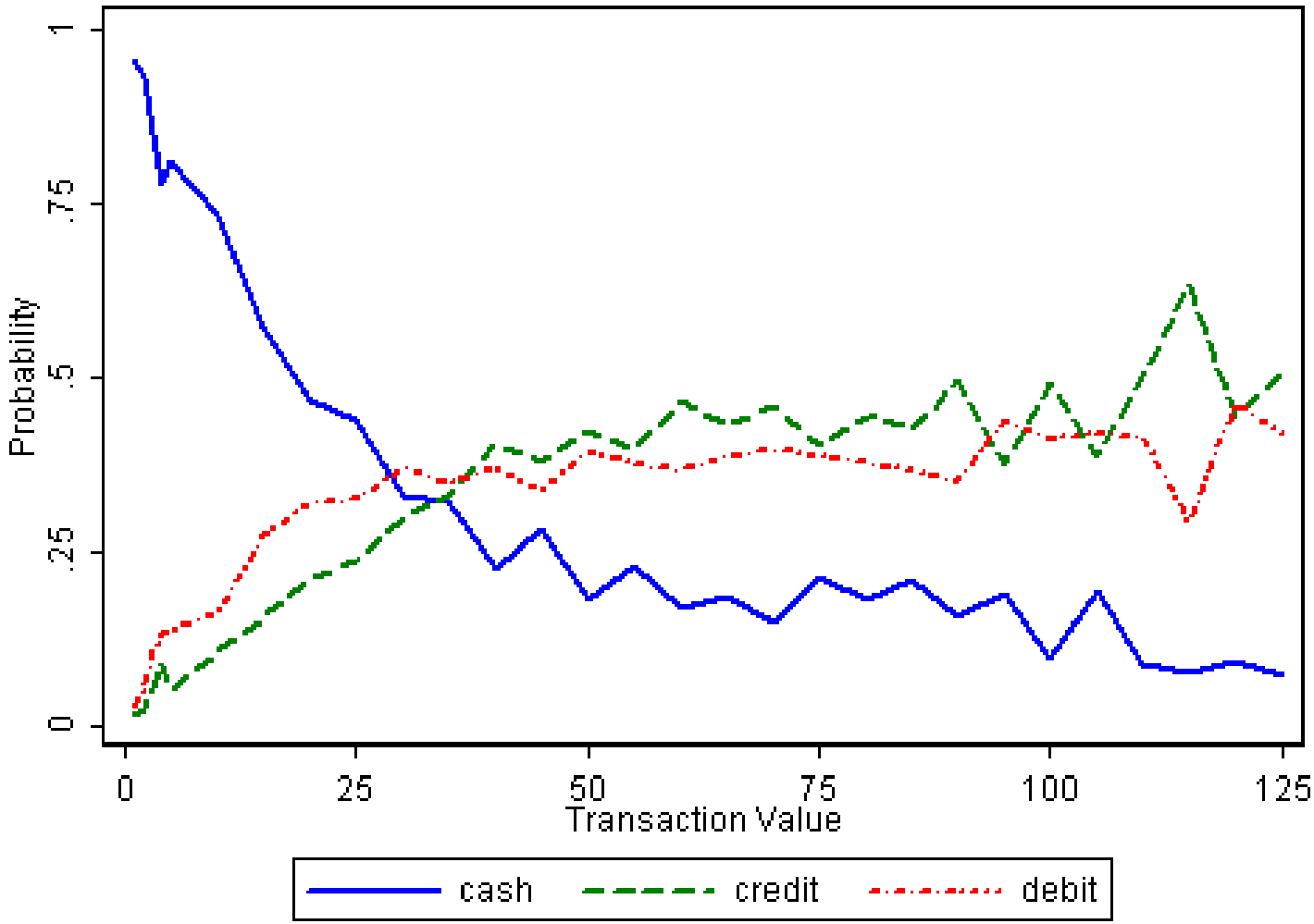
Table 1: Payment Frequency and Value

	Frequency				Total Value			
TV	<15	15-25	25-50	50+	<15	15-25	25-50	50+
Cash	73.2	40.8	26.2	17.2	59.4	37.7	21.6	8.0
Debit	17.8	32.6	39.1	35.6	24.7	32.1	36.8	31.2
Credit	9.4	26.7	35.2	48.1	15.9	30.2	41.6	60.8

2009 Method of Payments Survey

- Sampling frame was marketing research firm access panels. Participants receive financial incentives for participating.
- Survey Questionnaire (SQ) consists of 6,868 individuals:
  - Consisted of 52 questions.
- Three-day Diary Survey Instrument (DSI) consists of 3,465 individuals and about 15,000 transactions:
  - Offline (paper-based) was mandatory (1,167 individuals),
  - Online (computer-based) was optional (2,298 individuals).
- Sample weights based on the Canadian Internet Usage Survey and a random digital dialing survey with payments section.

Figure 1: Payment Frequencies



Note: This graph illustrates the choice frequency of cash, debit and credit over the transaction range of 1 to 125 dollars. These frequencies are calculated based on a sample of 10,368 transactions in diary using sample weights.

Additive Random Utility Models

A consumer has m-payment instrument alternatives at the point of sale. The utility of payment instrument j is :

$$U_j = V_j + \epsilon_j, \quad j = 1, 2, \ldots, m. \tag{2}$$

Let V_j be the observed utility of choice j and ϵ_j be the random choice variation. Payment instrument j is chosen:

$$\begin{aligned} \text{Prob}[\text{PMT} = j] &= \text{Prob}(U_j \geq U_k), \forall j \neq k \\ &= \text{Prob}(V_j - V_k \geq \epsilon_k - \epsilon_j). \end{aligned}$$

If $F(\epsilon_j) = e^{\epsilon_j} \exp(-e^{\epsilon_j})$ and $V_j = \mathbf{x}_j' \beta_j$ then Multinomial Logit (MNL):

$$\text{Prob}[\text{PMT} = j] = \frac{\exp(\mathbf{x}_j' \beta_j)}{\sum_l^m \exp(\mathbf{x}_l' \beta_l)}. \tag{3}$$

Model specification

- Multinomial logit (and probit).
- Consumer's choices of cash, debit and credit at the point-of-sale from diaries.
- Subsample of consumers holding all three payment instruments: cash, credit and debit (80 percent).
- Condition on transactions taking place at store (83 percent).
- Observables consumer demographics, perceptions, payment instrument and transaction characteristics.
- Final estimation sample 10,368 transactions.

Variables of interest

- Consumer demographics: income, age, education, employment, marital status, home ownership, and family size.
- Perceptions, SQ: ease of use, acceptance, record keeping, cost. DSI: risk of fraud, counterfeiting and theft.
- Payment instrument attributes:
  - Debit card features: monthly fees, free transactions,
  - Credit card features: rewards, revolver, interest rates,
  - Relative measures of perceived payment instrument attributes,
  - Cash holding at beginning of the diary.
- Transaction features:
  - Transaction value,
  - Type of good,
  - Payment instrument acceptance at the point-of-sale,
  - Top reasons for choosing the payment method used.

Summary of Results

Lots of coefficients and interactions so just report salient points:

- Demographics: Education, gender, and employment status important
  Income and age total effect.
- Perceptions: Ease of use, record keeping, cost and overspending.
- Portfolio features: DC and CC features are all important.
- POS: Acceptance, venue, and ranked stated reasons.

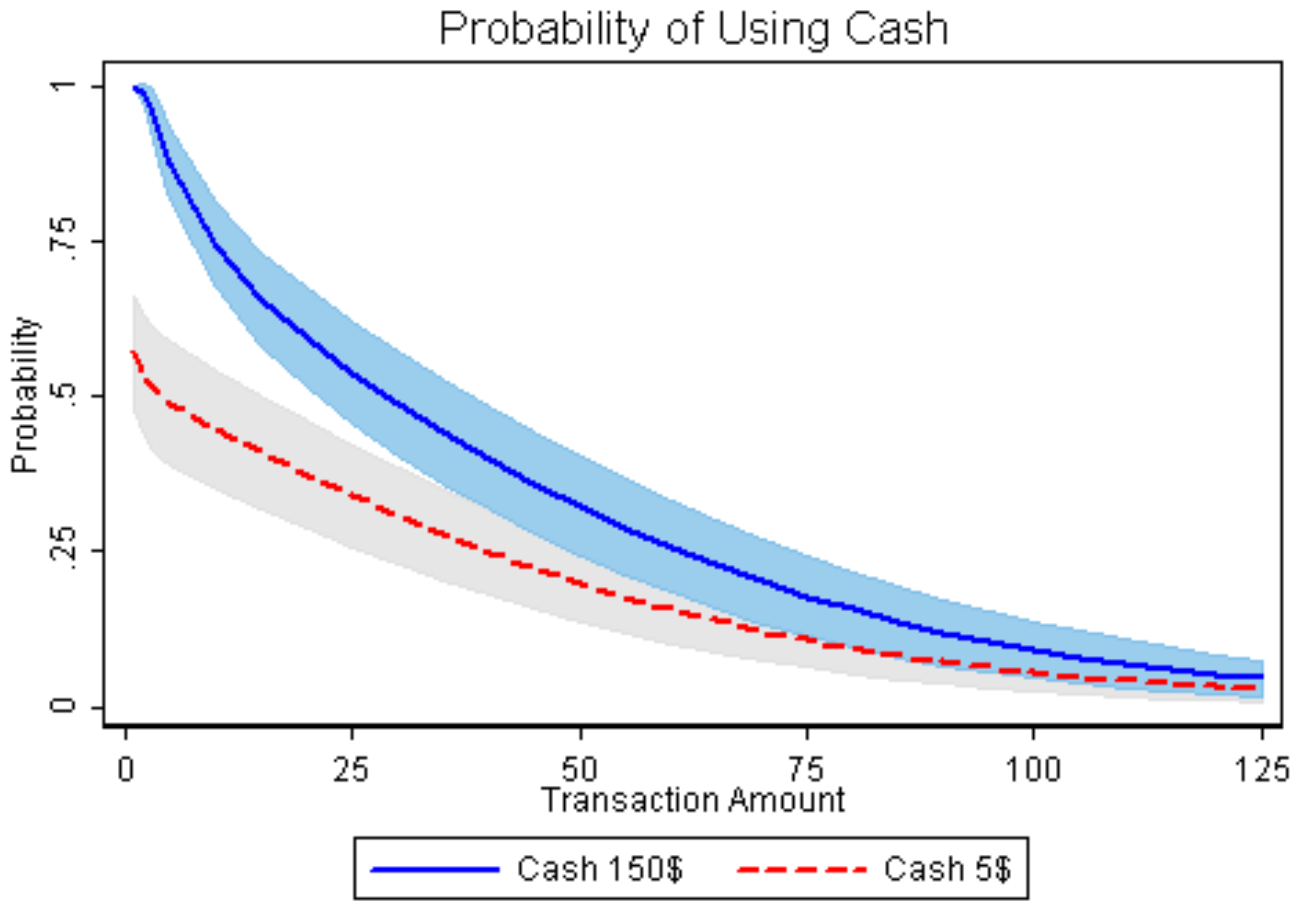
Predicted Probabilities

- Visualization method to compare characteristics.
- Probability of choice j conditional on a set of covariates ($\mathbf{x}_g$) evaluated at group g:

$$\widehat{P}_{gj} = \frac{\exp(\mathbf{x}_g' \hat{\beta}_j)}{\sum_{l=1}^{m} \exp(\mathbf{x}_g' \hat{\beta}_l)}. \tag{6}$$

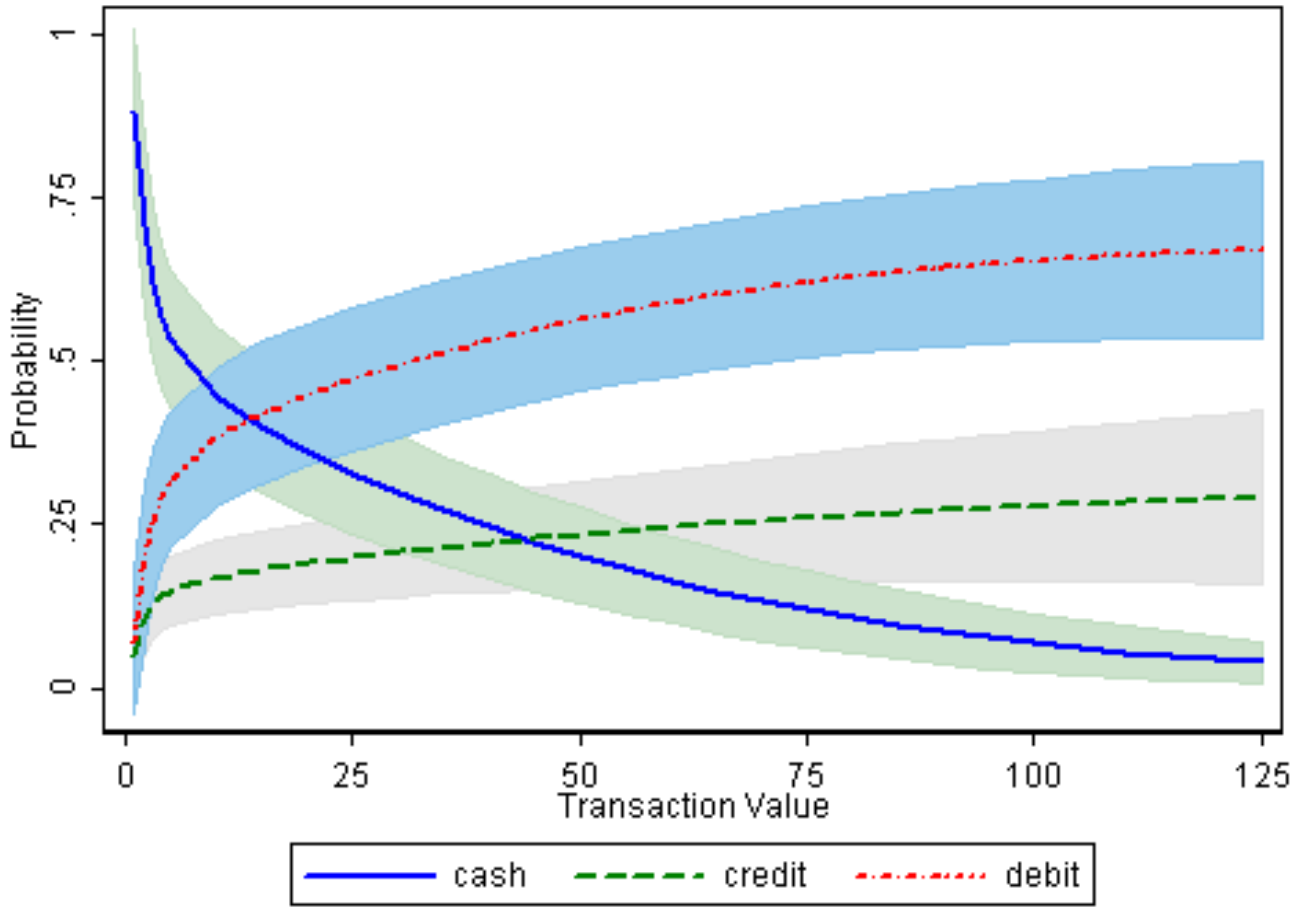
$\widehat{P}_{gj}$, could be computed over a range of possibilities. For the remainder of the exercise, we consider a typical demographic described by an urban, married, Canadian, male, employed, homeowner in Ontario, earning 30-50K/year, with average perceptions.

Figure 2: Cash is Queen!



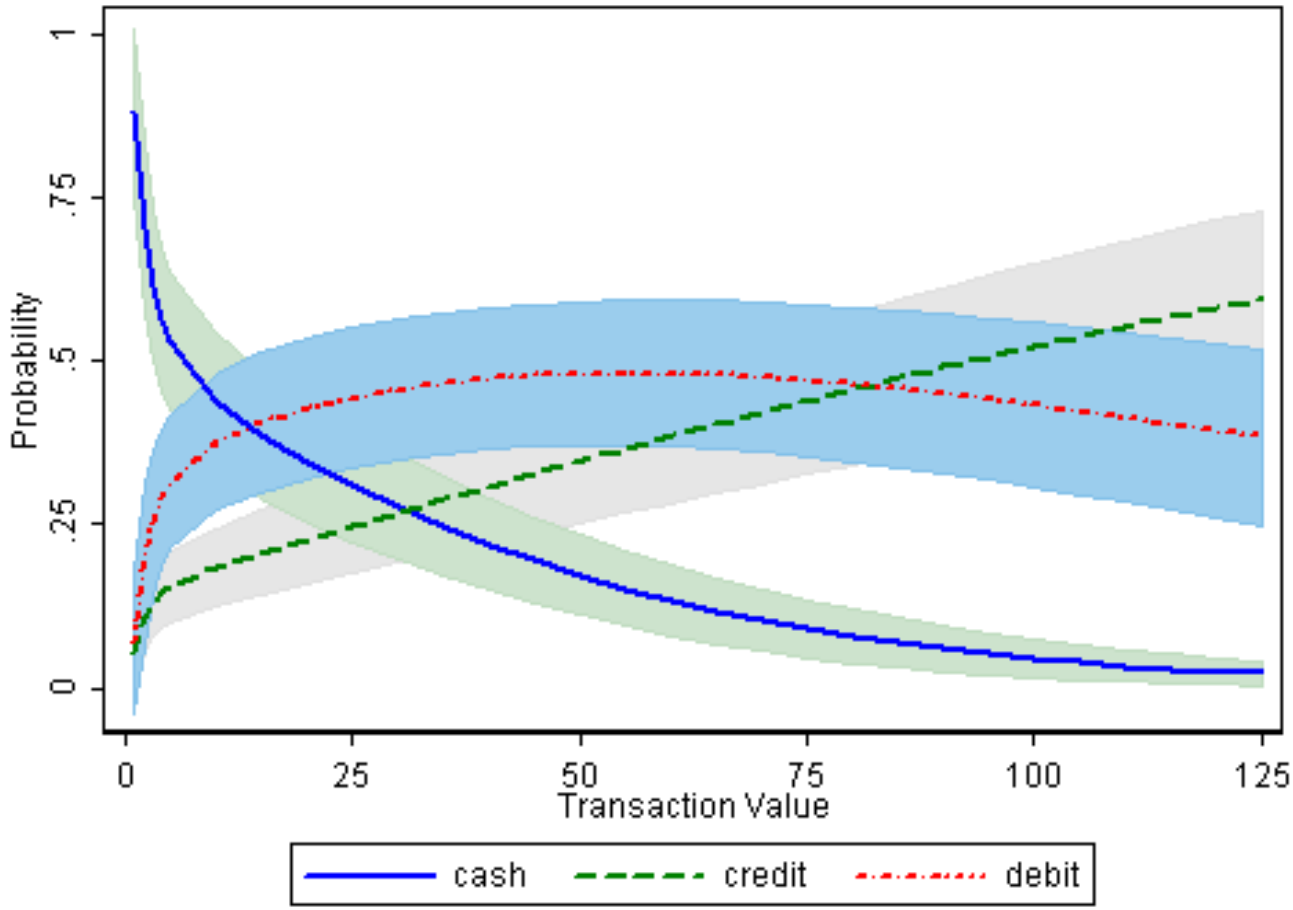
Calculated for a typical demographic profile. Earns rewards, no DC free transactions, no DC monthly fee, no CC annual fee, and not CC revolver. Shaded areas represent 95 percent confidence intervals.

Figure 3: Baseline Consumer



Note: Calculated for a typical demographic profile but with no rewards, no DC free transactions, no DC monthly fee, no CC annual fee, and not CC revolver. Shaded areas represent 95 percent confidence intervals.

Figure 4: Baseline Consumer with Rewards



Note: Calculated for a typical demographic profile but **earns rewards**, no DC free transactions, no DC monthly fee, no CC annual fee, and not CC revolver. Shaded areas represent 95 percent confidence intervals.

Table 9: Substitution Patterns Decomposition

	Extensive			Intensive		
TV	Cash	DC	CC	Cash	DC	CC
5	-0.42	-0.26	0.67	-0.08	-0.06	0.14
10	-0.84	-0.57	1.41	-0.08	-0.07	0.16
15	-1.26	-0.95	2.21	-0.08	-0.08	0.17
20	-1.67	-1.40	3.07	-0.08	-0.10	0.18
25	-2.07	-1.92	3.99	-0.08	-0.11	0.19
50	-3.55	-5.54	9.10	-0.04	-0.18	0.21
75	-3.98	-10.37	14.35	0.00	-0.20	0.20
100	-3.60	-15.43	19.03	0.03	-0.19	0.17
125	-2.87	-19.94	22.81	0.03	-0.16	0.13

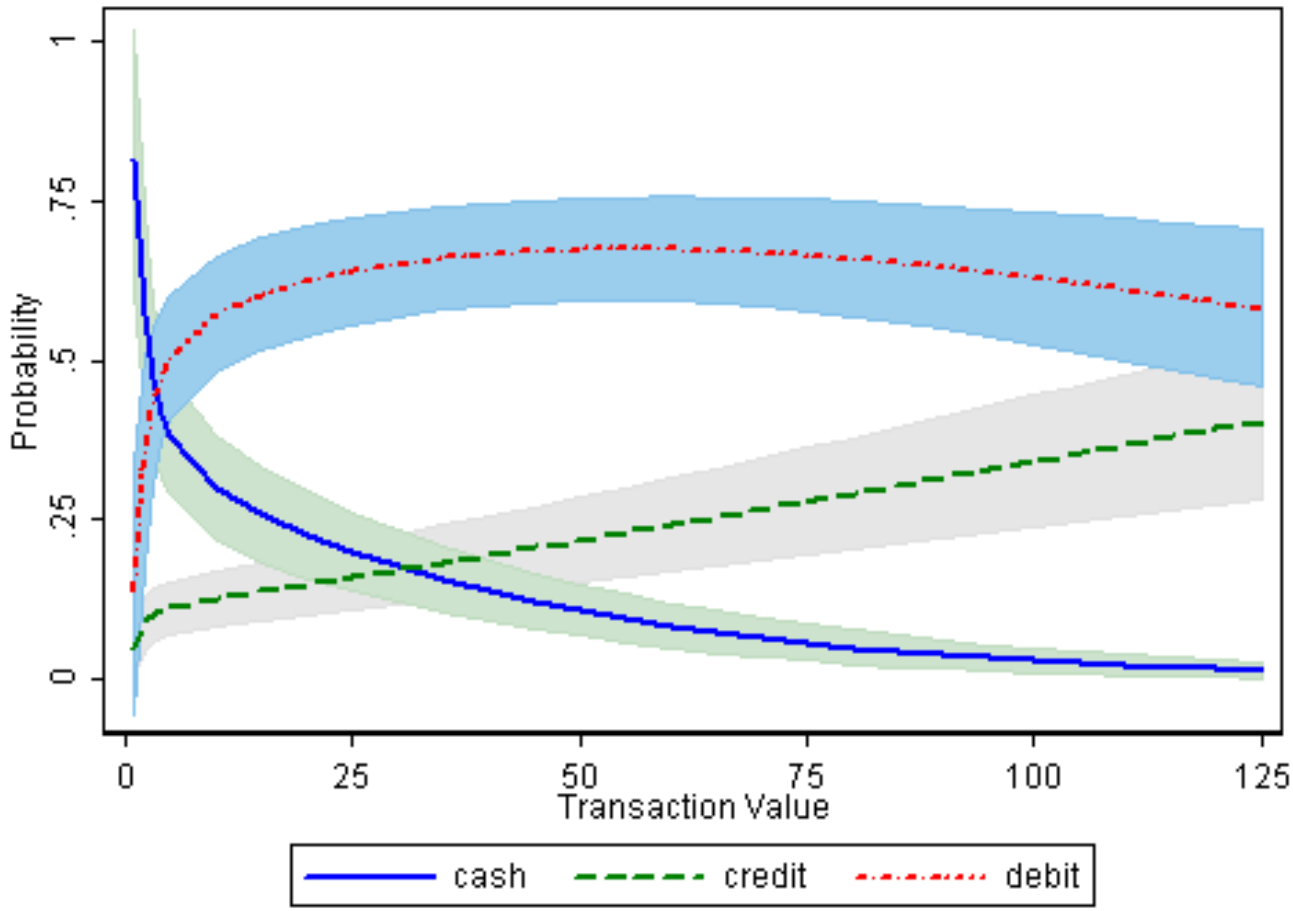
Note: The numbers displayed are in percentage terms. The extensive margin is defined as:

$$EXT[I(R), TV = Q, \bar{x}_g] = \widehat{P}_{gj}(I(R) = 1, TV = Q, \bar{x}_g) - \widehat{P}_{gj}(I(R) = 0, TV = Q, \bar{x}_g), \quad (8)$$

Let $I(R)$ denote a binary variable that is one if the consumer has a rewards plan and zero otherwise and TV_i denotes the transaction value. Transaction value is set at Q-dollars and $\bar{x}_g$ is the typical profile of the consumer. The intensive margin is defined as:

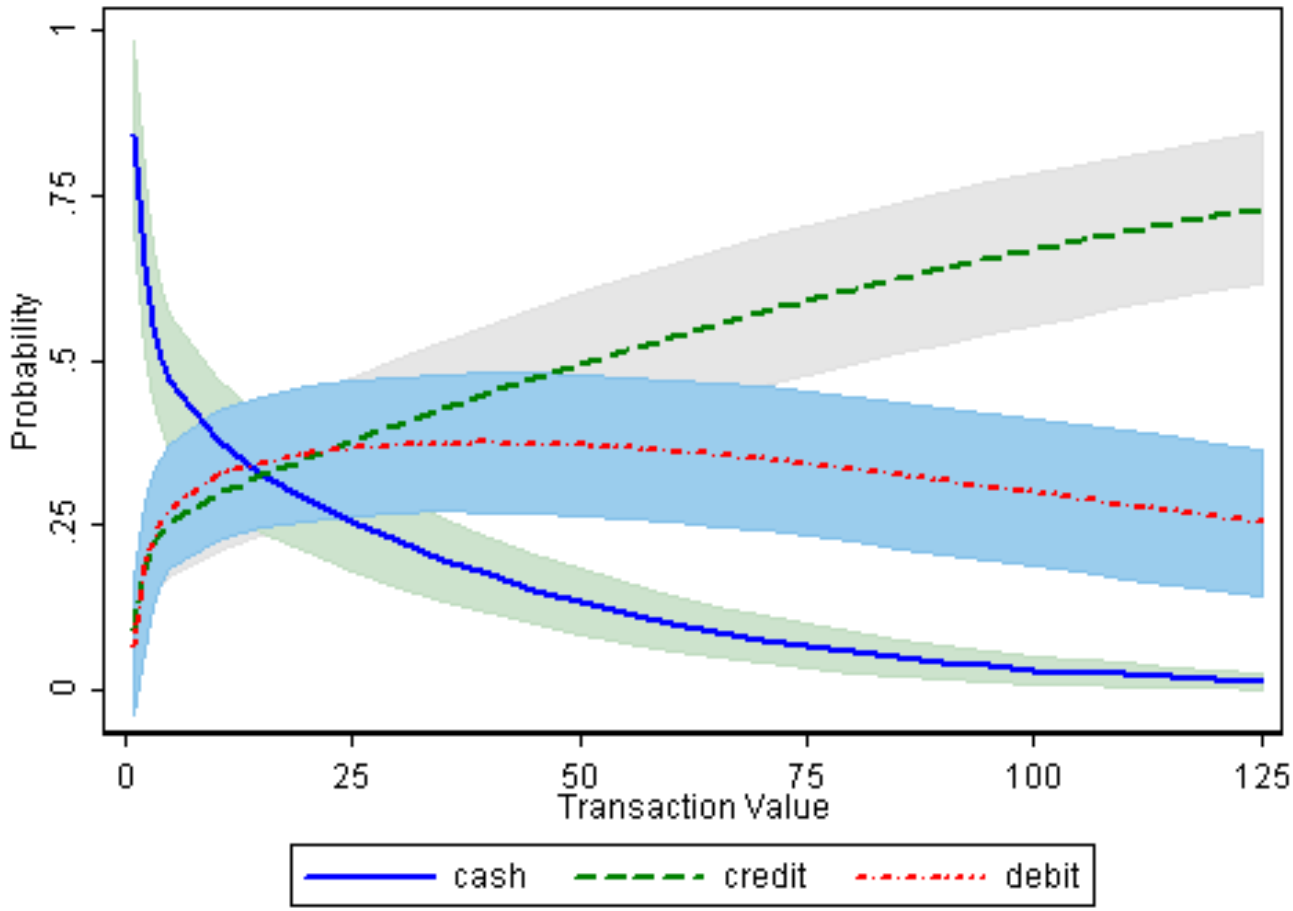
$$INT = EXT[I(R), TV = Q + \epsilon, \bar{x}_g] - EXT[I(R), TV = Q, \bar{x}_g]. \quad (9)$$

Figure 5: Debit Card Committed User



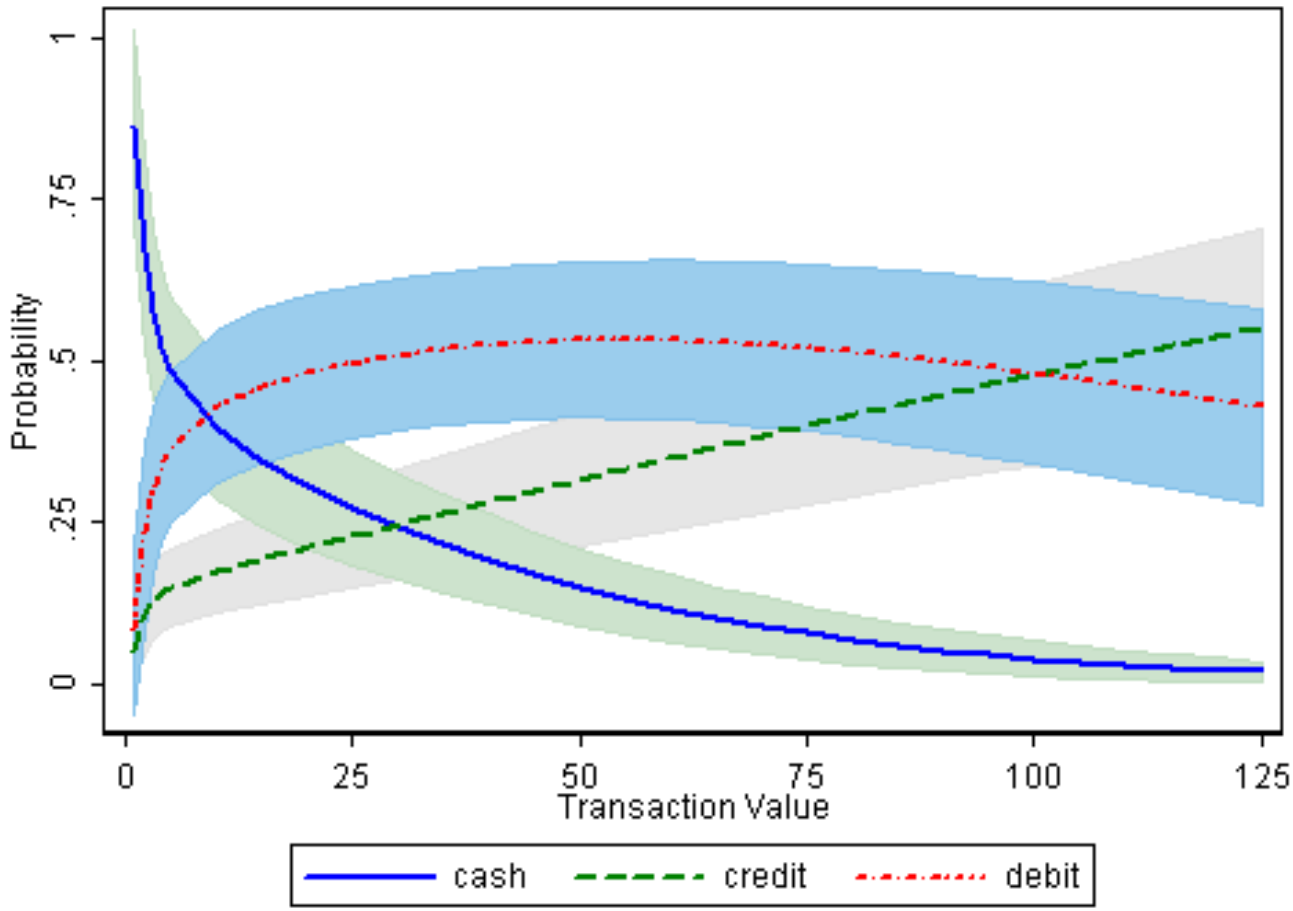
Note: **Debit Card User with rewards**, free DC transactions, pays debit monthly fee, no CC annual fee, not CC revolving. Calculated for average demographic profile. Shaded areas represent 95 percent confidence intervals.

Figure 6: Credit Card Committed User



Note: **Credit card intensive user with rewards**, no free DC transactions, no debit monthly fee, pays CC annual fee, not CC revolving. Calculated for average demographic profile. Shaded areas represent 95 percent confidence intervals.

Figure 7: Credit Card Committed User & Revolving



Note: Credit card intensive user with rewards, no free DC transactions, no debit monthly fee, pays CC annual fee, and **CC revolvers**. Calculated for average demographic profile. Shaded areas represent 95 percent confidence intervals.

Rewards Elasticity

Rewards is specified in the following fashion:

$$\beta_1 RW_i + \beta_2 RW_i \times TV_i. \tag{7}$$

$RW_i = \alpha_i \times I(R_i) \times TV_i$, where $\alpha_i = 0.01$

Carbó & Linares-Zegarra (2009) and Agarwal et al. (2010) used similar numbers.

Effect of rewards on the probability of credit card (P_{CC}):

$$E_{P_{CC},RW} = \frac{\partial P_{CC}}{\partial RW} \frac{\widehat{RW}}{\widehat{P}_{CC}}. \tag{10}$$

Computation of $E_{P_{CC},RW} \approx 0.12$ (s.e. is about 0.021).

Conclusion

- Cash is used mostly in low value transactions ($<$25 dollars). Acceptance and Ease of Use.
- Increase debit and credit usage as transaction value increases.

  i.e. low value note denominations.

- Portfolio features play an important role in substitution patterns.
- Rewards: consumers shift towards credit at the expense of debit.

  Contribute to discussion regarding interchange fees...
  Australia, UK, and US: Hayashi & Weiner (2006).
  US: Prager, Manuszak, Kiser, & Borzekowski (2009).

Thanks for your time!