

**Retailer Payment Systems:
Relative Merits of Cash and Payment Cards**

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I. EXECUTIVE SUMMARY

Some merchants do not accept credit or debit cards (“payment cards”) because they feel that it is more profitable for them to only accept cash payments. This perception has been linked to the belief that merchants do not incur costs when they accept cash payments and the commonly associated belief that merchants are not disadvantaged by a cash-only policy. However, the reasoning underlying these perceptions is flawed both because there are significant costs associated with cash transactions and because a “cash only” policy may lead to lost sales or smaller sales. As a result, a more thorough analysis of the decision not to accept payment cards is required.

This study, which reports the findings of five case studies of merchants and which reviews the existing literature, identifies and weighs the costs and benefits for merchants of different payment systems. The principle findings are: (1) that the difference in the costs a merchant incurs when accepting cash rather than payment cards typically is relatively small; (2) that merchants can expect significant increases in sales when they add payment cards to their mix of accepted forms of payment, rather than only accepting cash; and (3) that, as a result, the additional benefits that most merchants obtain from accepting payment cards are large relative to any incremental costs they incur.

As is described in more detail below, our study found (consistent with earlier economic studies) that there are significant costs to cash acceptance that should be considered by merchants when assessing the relative merits of cash and payment card acceptance. In particular, the five merchants in our study all spent considerable time processing the cash that flows through their business – collecting cash from customers, counting change, counting cash going into and out of their registers, counting cash that goes to and from their bank, and moving cash to and

from their bank. All of these activities represent costs that can be measured. For example, for the convenience store in our case study, cash processing required an average of 14 hours per week of employee time and nearly 11 hours a week of owner time. Of course, because our study participants handle cash, they also incur costs to invest in cash theft prevention, whether through the purchase of video cameras, safe technologies or otherwise. Moreover, they all incur costs associated with transporting cash to their bank. While none of our study participants was large enough to use an armored car service, they all incur time cost moving cash themselves. For example, the small independent grocery store and the gas station in our study each spent about 1.3 hours per week and the convenience store spent approximately 2.8 hours per week transporting cash to their bank.¹ Thus, cash transactions are not cost free. Given that cash transactions are typically smaller than payment card transactions, these costs add up when cash and payment card transactions are normalized by considering the cost per \$100 of sales.

As is shown in **Table I.1**, the costs of using cash per \$100 in revenues approach the costs associated with credit card transactions (and sometimes are larger). For example, for a full-service restaurant the costs associated with \$100 in revenues generated through cash sales is only \$0.30 less than that for \$100 in revenues generated through payment card sales. For the small independent grocery store, credit cards involve lower costs per \$100 in revenues than does cash (\$3.93 cash cost vs. \$3.09 credit card cost).

¹ See **Table VI.1** for details.

**Table I.1
Cash & Payment Card Cost Analysis**

Costs	Fast-Food Restaurant	Full-Service Restaurant - with Tip	Gas Station - Gas Only Purchase	Gas Station - Cashier Purchase	Convenience Store	Grocery Store
Cash Costs						
Cash: Deposit Cost per Transaction	\$0.0207	\$0.1490	\$0.0299	\$0.0279	\$0.0081	\$0.0915
Cash: Owner's Cash Handling Cost per Transaction	\$0.0083	\$0.4938	\$0.0653	\$0.0609	\$0.0473	\$0.2053
Cash: Employee's Cash Handling Cost per Transaction	\$0.0153	\$0.2739	\$0.0423	\$0.0394	\$0.0210	\$0.0000
Cash: Tender Cost per Transaction (in Employee Hourly Wage)	\$0.0530	\$0.0521	\$0.1807	\$0.0323	\$0.0428	\$0.0678
Cash: Average Transaction Size	\$7.81	\$35.18	\$21.17	\$21.16	\$5.15	\$9.27
Total Cash Cost per \$100 Revenue	<u>\$1.245</u>	<u>\$2.754</u>	<u>\$1.503</u>	<u>\$0.758</u>	<u>\$2.313</u>	<u>\$3.933</u>
Credit Costs						
Credit: Fees per Average Transaction	\$0.2581	\$2.0727	\$0.8517	\$0.7030	\$0.2475	\$0.4990
Credit: Tender Cost per Transaction (in Employee Hourly Wage)	\$0.0436	\$0.0791	\$0.0000	\$0.0646	\$0.0459	\$0.0579
Credit: Owner's Credit Reconciliation Cost per Transaction	\$0.0036	\$0.0177	\$0.0014	\$0.0124	\$0.0019	\$0.0050
Credit: Average Transaction Size	\$9.06	\$70.93	\$37.59	\$30.15	\$8.45	\$18.19
Total Credit Cost per \$100 Revenue	<u>\$3.370</u>	<u>\$3.059</u>	<u>\$2.270</u>	<u>\$2.587</u>	<u>\$3.494</u>	<u>\$3.089</u>
Credit Costs Relative To Cash Costs	\$2.12	\$0.30	\$0.77	\$1.83	\$1.18	-\$0.84

^a Total transactions per week taken from transactions data. Includes gift card and debit card transactions.

Note: A separate debit cost analysis was not included because there was only substantial, distinguishable Debit Card payment data at the Convenience Store. At most retailers, the processing of debit cards was indistinguishable from the processing of credit cards at the transaction level. "Gas Station - Gas Only Purchase" captures gasoline-only credit sales at the outdoor pump and gasoline-only cash sales in store. "Gas Station - Cashier Purchase" captures all indoor purchases.

The credit card rates and fees used are as follows: Fast-Food Restaurant: 1.75% plus \$0.10; Full-Service Restaurant: 2.78% plus \$0.10; Gas Station: 2.00% plus \$0.10; Convenience Store: 1.75% plus \$0.10; Grocery Store: 2.01% plus \$0.13. Since information was not provided by the Fast-Food Restaurant owner regarding credit card rates and fees, the Convenience Store rates and fees were used, since both are franchises. Additionally, the rate and fee for the Gas Station were estimated using the total credit card cost share of sales, which was 2.37%.

With respect to the revenue effects of shifting from a “cash only” business to one that also accepts payment cards, our study found evidence that merchants experience significant increases in revenues when they accept payment cards. This relationship is evidenced in two ways. First, we studied how a merchant’s sales changed when they shifted from only accepting cash to also accepting payment cards. Second, we studied the relative size of cash transactions and payment card transactions.

To explore how sales levels change “after” a firm starts accepting payment cards, we used sales data we obtained from a florist who switched from “cash only” to “cash and credit card” payment. This analysis found that the florist’s sales increased after credit cards were accepted. More specifically, the florist’s business grew 9.2% the first year and 19.8% in two years. As is explained in more detail below, this finding aligns with that of other studies that compared sales levels “before” and “after” the introduction of credit cards.²

² See discussion in Section V.D and Chart IV.1 below.

Our analysis that compared the size of cash purchases and payment card purchases also supports the view that merchants increase their sales when they accept credit cards. More specifically, for the retailers included in our case studies, we observed that on average payment card transactions involved larger dollar payments than cash transactions. As is shown in **Table I.2** below, at the retailers in our study, the average size of credit card transactions were always larger than the average size of cash transactions. Moreover, in some cases, the average size was much larger (e.g., roughly twice as large at the full-service restaurant and small independent grocery store). Similarly, average debit card transactions were often larger than cash purchases.

As is shown in **Table I.3**, which provides more details on relative transaction sizes, credit cards are used for the very largest transactions, as well as many smaller transactions. In contrast, while cash is sometimes used for fairly large transactions, the use of cash tops out at less than \$200 (except for car repairs that in one case involved a cash payment of around \$400). While we had less data on debit card transactions because most of the retailers processed debit cards as credit cards, the limited data we had indicated that debit cards transactions are not used on particularly small transactions and tend not to be used on the largest transactions where credit cards are preferred. Similarly, **Table I.4** shows that increased sales associated with credit card transactions more than cover the incremental transaction costs. In particular, the increased costs associated with credit cards are often less than 5% of the increased revenues that are associated with credit card sales (and never more than 20% of increased revenues). Again, these findings line up with what has been reported in earlier studies.³

³ See discussion in Section V below.

Table I.2
Average Transaction Size

Average Transaction Size	Fast Food Restaurant	Full-Service Restaurant (w/ tip)	Gas Station - Gas Only Purchase	Gas Station - Cashier Purchase	Convenience Store	Grocery Store
Cash	\$7.81	\$35.18	\$21.17	\$21.16	\$5.15	\$9.27
Credit	\$9.06	\$70.93	\$37.59	\$30.15	\$8.45	\$18.19
Debit	N/A	N/A	\$17.50	\$22.20	\$8.54	N/A

Note: "Gas Station - Gas Only Purchase" captures gasoline-only credit sales at the outdoor pump and gasoline-only cash sales in store. "Gas Station - Cashier Purchase" captures all indoor purchases.

Table I.3
Minimum, Maximum, Mean, Median Cash, Credit Card and Debit Card Transaction Sizes

Establishment	Minimum			Maximum			Mean				Median			
	Cash	Credit	Debit	Cash	Credit	Debit	Cash	Credit	Debit	All Payment Types	Cash	Credit	Debit	All Payment Types
Fast-Food Restaurant	\$0.41	\$1.04	N/A	\$40.60	\$43.25	N/A	\$7.81	\$9.06	N/A	\$8.29	\$7.09	\$7.79	N/A	\$7.36
Full-Service Restaurant	\$2.12	\$4.36	N/A	\$195.85	\$390.85	N/A	\$29.53	\$58.60	N/A	\$51.23	\$19.35	\$48.94	N/A	\$39.67
Full-Service Restaurant - with Tip	\$2.56	\$6.36	N/A	\$167.49	\$470.85	N/A	\$35.18	\$70.93	N/A	\$61.40	\$23.29	\$58.51	N/A	\$47.64
Gas Station - Pump Gas vs. In-Store Cash Gas*	\$2.00	\$1.04	\$10.00	\$100.81	\$177.99	\$25.00	\$21.17	\$37.59	\$17.50	\$30.70	\$20.00	\$36.00	\$17.50	\$25.44
Gas Station - In-Store Gas & Joint Sales	\$2.00	\$3.00	\$10.00	\$100.81	\$168.48	\$41.00	\$21.16	\$30.15	\$22.20	\$22.73	\$20.00	\$25.00	\$20.00	\$20.00
Gas Station - In-Store Non-Gas Sales	\$0.27	\$1.05	\$5.00	\$400.00	\$1,143.80	\$69.95	\$8.60	\$52.98	\$37.48	\$24.14	\$5.37	\$8.99	\$37.48	\$7.50
Convenience Store	\$0.10	\$0.99	\$0.99	\$107.04	\$102.11	\$70.28	\$5.15	\$8.45	\$8.54	\$6.05	\$3.53	\$6.89	\$6.99	\$4.22
Grocery Store	\$0.35	\$1.40	N/A	\$88.22	\$150.00	N/A	\$9.27	\$18.19	N/A	\$13.71	\$6.76	\$14.48	N/A	\$10.25

Notes: "Credit" includes all credit and debit cards that were run as "Credit." "Debit" includes all debit cards that were run as "Debit."
Gas Station - Pump Gas vs. In-Store Cash Gas captures gasoline-only credit sales at the outdoor pump and gasoline-only non-credit sales in store.

Table I.4
Difference Between Average Credit and Cash Transaction Costs
As Share of Difference Between Average Credit and Cash Transaction Size

Costs	Fast-Food Restaurant	Full-Service Restaurant - with Tip	Gas Station - Gas Only Purchase	Gas Station - Cashier Purchase	Convenience Store	Grocery Store
Time Period	7/1-7/7	6/26-7/12	6/17-6/24	6/17-6/24	6/30-7/6	6/1-6/23
Average Transaction Size						
Credit	\$9.06	\$70.93	\$37.59	\$30.15	\$8.45	\$18.19
Cash	<u>\$7.81</u>	<u>\$35.18</u>	<u>\$21.17</u>	<u>\$21.16</u>	<u>\$5.15</u>	<u>\$9.27</u>
Difference	\$1.25	\$35.75	\$16.42	\$8.99	\$3.30	\$8.92
Costs per Average Transaction Size						
Credit	\$0.31	\$2.17	\$0.85	\$0.78	\$0.30	\$0.56
Cash	<u>\$0.10</u>	<u>\$0.97</u>	<u>\$0.32</u>	<u>\$0.16</u>	<u>\$0.12</u>	<u>\$0.36</u>
Difference	\$0.21	\$1.20	\$0.53	\$0.62	\$0.18	\$0.20
Difference of Costs Per Average Transaction Size						
As a Share of Difference of Average Transaction Size, Credit vs. Cash Differences	16.59%	3.36%	3.26%	6.89%	5.34%	2.21%

Note: "Gas Station - Gas Only Purchase" captures gasoline-only credit sales at the outdoor pump and gasoline-only cash sales in store. "Gas Station - Cashier Purchase" captures all indoor purchases.

"Difference of Costs per Average Transaction Size As a Share of Difference of Average Transaction Size, Credit vs. Cash Differences" is calculated by dividing "Costs per Average Transaction Size - Difference" by "Average Transaction Size - Difference." Percentages are calculated using unrounded values, so percentages differ slightly from those obtained if rounded values shown in table are used.

There are two reasons why a merchant's sales increase when the merchant accepts payment cards. First, some customers are more likely to shop at stores that accept payment cards. Second, patrons of a store are likely to buy more if they can pay by payment card, particularly a credit card, than if they can only pay with the cash they have on hand.

The fact that consumers prefer to shop at stores that accept payment cards is attributable to a number of factors, including the convenience of payment cards, a desire to pay on credit, reduced concern about whether one will have enough cash on hand or will be taking risks by carrying large amounts of cash to cover potential transactions, a desire to track expenses, protection from some fraudulent transactions, a desire to develop a credit history, the fact that the store’s acceptance of payment cards is sometimes used by consumers as a signal of store quality, and a desire to earn rewards associated with credit card use.⁴

The observation that customers who patronize a store are likely to buy more if they pay by payment card (“ticket lift”) is attributable to two factors (both documented in the economics literature): (1) customers are not constrained by the cash in their wallets; and (2) customers feel less financially constrained when buying with a payment card than when paying with cash (both because there are psychological differences to how the transaction is perceived by consumers and because the customers have access to credit).

In sum, available evidence indicates that retailers will typically increase their profits by accepting payment cards. The reason for this is straightforward: the revenue benefits of payment card acceptance are significant, while the cost differential between payment card transactions and cash transactions is typically quite small—and in some cases, the cost of payment cards may be lower than cash.

⁴ For similar lists, see e.g., <http://money.msn.com/saving-money-tips/post.aspx?post=46f142e4-d9f0-450e-b03e-45353ed60275> and <http://www.cardhub.com/edu/top-reasons-to-use-a-credit-card/>. See also discussion in Section III.C.1 below.

II. OVERVIEW

Some retailers, particularly smaller retailers, do not accept payment cards.⁵ While some retailers may not accept payment cards because they do not meet the standards set by payment card companies, it is clear that others do not accept payment cards because they prefer cash transactions. This preference appears to be rooted in the perception that “cash transactions are costless” and payment cards require the retailer to pay a fee. This is because retailers pay a fee when they allow their customers to use payment cards and make no immediate bank payment when they accept cash. However, this view relies on an incomplete analysis of the relative costs and benefits of cash transactions. It misses numerous retailer costs associated with supporting cash transactions (*e.g.*, the time spent counting the money from the tills and going to the bank to deposit cash). Perhaps more importantly, it also ignores the likelihood that the benefits that a retailer gets from accepting payment cards (such as increased sales) more than offset any difference in costs.⁶ This study undertakes an empirical analysis of relevant costs and benefits of different payment systems, providing insights into whether merchants profit from accepting payment cards.

Section III provides a brief introduction to payment systems. The key components of both cash transactions and payment card transactions are outlined, providing the reader with a basic understanding of what is involved in these different types of transactions.

Section IV reports the results of case studies that we completed, which provide new information about the costs and benefits of different payment systems for retailers. These case

⁵ According to a report by Intuit, “55 percent of the nation’s 27 million small businesses do not accept credit cards.” <http://www.forbes.com/sites/tjmccue/2013/08/16/why-dont-more-small-businesses-accept-credit-cards/>

⁶ As one retailer pointed out: “Turning down credit cards is stupidity squared. . . . Customers sometimes don’t have cash and will invariably buy more on plastic than they will for cash. Would you rather have 100 percent of nothing, or 97 percent of \$1,000 because you took a credit card?” <http://smallbusiness.aol.com/2011/06/29/can-you-afford-to-run-a-cash-only-business/>

studies involved five retail businesses (a fast-food retailer, a full-service restaurant, a gas station, a convenience store, and a small independent grocery store).⁷ For each of these merchants, we completed on-site interviews, analyzed their financial records, and conducted time-in-motion studies of retailer transactions.

Section V provides a review of the existing empirical literature that treats the relative costs and benefits for retailers of cash transactions relative to payment card transactions. This

⁷ The five case study participants have the following characteristics:

- The fast-food restaurant is a franchised business located in a suburban strip mall. It sells custom-built sandwiches, sodas, and sides. It had a modern Point of Sale (POS) register, with a connected credit card scanner. When a customer pays by payment card, there is no need for the cashier to rekey the amount owed into the payment card system.
- The full-service restaurant is a sit-down, family-style restaurant located in a residential area. It is owner operated and has an active “bar” business, as well as selling lunches and dinners. It has three POS registers, each equipped with their own credit card scanner. When a customer pays by payment card, there is no need for the cashier to rekey the amount owed into the payment card system.
- The gas station is a franchised, full-service gas station located in a suburban area. It has islands with eight pumps, a small convenience store, and an auto repair shop. It technically has nine registers: one POS register that is manned by a cashier inside the convenience store and eight automatic credit card readers attached to each of the gasoline pumps. When a customer pays by payment card, there is no need for the cashier to rekey the amount owed into the payment card system.
- The convenience store is a franchised business located in the suburbs. It sells a limited assortment of standard grocery items, prepared foods, ice, cold beverages, lottery tickets, money orders, and prepaid phone cards. It has two modern POS registers and an acceptor safe (a smart safe that records deposits by the cashier). When a customer pays by payment card, there is no need for the cashier to rekey the amount owed into the payment card system.
- The grocery store is a small, independent grocery store located on the edge of an urban residential neighborhood. While it carries core grocery store products, it specializes in locally grown produce, cheeses, breads, and specialty foods. It also actively sells coffee, sandwiches, and other prepared foods. It has one POS cash register. When a customer pays by payment card, there is no need for the cashier to rekey the amount owed into the payment card system.

review not only identifies the types of costs and benefits that have been associated with these different payment systems, but reports empirical evidence related to these costs and benefits.

Section VI, which is the conclusion, summarizes the findings. As part of the summary, we provide estimates of the transaction costs associated with different payment systems and a comparison of those costs to the likely incremental benefits that result from accepting payment cards.

An Appendix provides information on the researchers who conducted the study and contains a bibliography.

III. INTRODUCTION TO PAYMENT SYSTEMS

When customers pay for items at a retail establishment, they might use cash, credit cards, debit cards, prepaid cards, gift cards, checks, or have the retailer add the amount owed to a running tab (that is subsequently paid using one of the other payment systems), but they most often use payment cards or cash. According to a report published by a market research firm, in 2011, payment card purchases comprised 66 percent of all in-person sales (with 31 percent being debit cards, 29 percent being credit cards, and the rest being gift cards and prepaid cards).⁸ Cash was used in 27 percent of all in-person sales, with that percentage projected to drop to 23 percent by 2017.⁹ The use of checks has been declining, representing around 7 percent of transactions in 2011 and projected to decline further in the future.¹⁰

The frequency with which payment cards are used has been observed to vary significantly across merchants.¹¹ **Table III.1**, which reports data we collected from the five merchants we studied, illustrates this variation. For example, at the full-service restaurant that was included in our study (where the average bill was around \$60, including tip), payment cards were used over 70% of the time (73% of transactions and 84% of revenue). In contrast, at the

⁸ http://www.huffingtonpost.com/2012/06/07/credit-card-payments-growth_n_1575417.html. See also Alexander Eule, *The End of Cash?* BARRONS (December 31, 2012) available at http://online.barrons.com/article/SB50001424052748704723404578199742128875044.html?mod=bol_share_tweet#articleTabs_article%3D1 (“This year [2012] greenbacks will account for an estimated 29% of U.S. retail payments, according to McKinsey & Co., down from 36% a decade ago.” “Credit cards and debit cards each make up about 30% of all retail transactions.”). For similar results, but from a 2008 Survey, see Scott Schuh and Joanna Stavins, HOW CONSUMERS PAY: ADOPTION AND USE OF PAYMENTS, Federal Reserve Bank of Boston Working Paper, No. 12-2, (2011), p. 26 available at <http://www.bos.frb.org/economic/wp/wp2012/wp1202.pdf> (24% cash, 25% Credit, 35% Debit, 16% Check, 3% Prepaid, 16% Other).

⁹ http://www.huffingtonpost.com/2012/06/07/credit-card-payments-growth_n_1575417.html. See also Alexander Eule, *The End of Cash?* BARRONS (December 31, 2012) available at http://online.barrons.com/article/SB50001424052748704723404578199742128875044.html?mod=bol_share_tweet#articleTabs_article%3D1 (“By 2020, McKinsey forecasts cash payments could drop to 26% at the ‘point of sale,’ a category that encompasses both physical stores and e-commerce.”)

¹⁰ http://www.huffingtonpost.com/2012/06/07/credit-card-payments-growth_n_1575417.html.

¹¹ For example, an Ernst & Young survey reported in 1996 found that cash transactions were dominant at some types of stores (such as convenience stores (92%) and gasoline stations (74%)) and not at other (such as major department stores (36%), electronics/appliance shops (31%), and home centers (41%)). Ernst & Young, *Survey of Retail Payment Systems*, 72 CHAIN STORE AGE (1996), p. 11A.

convenience store (where the average transaction was less than \$10.00) cash was used in most transactions (73% of transactions and 62% of revenue were cash transactions).

**Table III.1
Transaction Share
(All Transactions)**

Establishment	Transaction Share				Sales Revenue Share			
	Cash	Credit	Debit	Other	Cash	Credit	Debit	Other
Fast-Food Restaurant	60.4%	39.2%	N/A	0.4%	56.9%	42.8%	N/A	0.2%
Full-Service Restaurant - with Tip	26.0%	73.0%	N/A	1.0%	14.9%	84.3%	N/A	0.8%
Gas Station - All	49.0%	49.3%	0.2%	1.5%	28.4%	65.0%	0.2%	6.4%
Convenience Store	72.6%	14.1%	13.1%	0.2%	61.8%	19.7%	18.4%	0.1%
Grocery Store	43.0%	50.1%	N/A	6.9%	29.1%	66.5%	N/A	4.5%

Notes: "Credit" includes all credit and debit cards that were run as "Credit." "Debit" includes all debit cards run as "Debit." "Other" includes all other forms of payment, such as gift cards, checks, and accounts.

Because this study focuses on the major payment systems: cash, credit cards, and debit cards, we provide an overview of how these three payment systems work. This provides background for our analysis of the costs and benefits of these three payment systems.

A. Overview of Payment Systems

1. Cash Payment

a) Participants in Cash Payments

Cash transactions typically involve three parties: (1) Consumers, (2) Retailers, and (3) Banks (or other depository institutions). While it might appear that cash transactions only involve the customer who makes the cash payment and the retailer who makes the sale, banks play a key role in supporting cash transactions. This becomes apparent when one recognizes that, for cash transactions to occur, consumers need to have cash in their wallets and retailers need to have a place to deposit the cash that they accumulate from these transactions. Moreover, these ancillary bank interactions shape the way consumers and retailers approach cash transactions. Specifically, the costs consumers and retailers encounter in their interactions with banks (when they are withdrawing or depositing cash) influence their decision to undertake cash transactions rather than some other type of transaction.

b) Payment Flow between Participants

The cash payment flow can be thought of as starting with banks or other institutions where cash is obtained by consumers. The cash that flows to consumers is stored, typically in their wallets. Retailers then collect cash payment from the consumer, make change, provide a receipt, combine the cash with that obtained from other transactions, and then deposit the cash in a bank where the retailer has an account (perhaps using a third-party firm, such as an armored car company).

From the perspective of a merchant, cash payments involve significant time-consuming/costly activities.¹²

- To open a cash register at the beginning of the day, firms typically must ensure that there is sufficient change, which involves periodically visiting banks to obtain change, storing the change, and counting change that goes into each cash drawer.
- Before the customer pays, the clerk enters the purchases into a point of sale (POS) device that records what is being purchased and the price that is to be paid. This POS device provides the total amount owed on a screen which the clerk, and often the patron, uses to determine what is owed.
- When a customer pays cash, the clerk must count the money received from the patron, calculate the appropriate change, count out the change, and provide the change to the customer. The total transaction time may be extended by actions taken by the customer, such as slowly digging cash out of a purse or wallet.
- During the day, the till may have to be replenished with additional change. Also, tills may be cleared of larger bills or excess cash to reduce the risks associated with robberies.
- At the end of the day, the total cash that was received during the day must be counted. The value of this cash must be reconciled with the cash that was in the till at the start of the day and the transaction totals (reflected on a printed tape or in a computer file). If the values do not reconcile, the cash must be recounted and any unusual transactions that might explain the discrepancy have to be identified.

¹² For a similar list of the activities involved in handling cash, see https://financial.ucsc.edu/Pages/Cash_CashHandlingGuide.aspx.

- Periodically (often several times a week, if not daily), accumulated cash must be prepared for bank deposit. This involves counting the cash to be deposited, filling out a deposit form, and taking the cash to the bank (or having it delivered by a third-party, such as an armored car company).
- Finally, bank statements that record the cash deposits and withdrawals must be reviewed and reconciled with firm records.

In sum, merchants incur a number of costs when they accept cash payments, both directly (in the form of wages paid to employees and fees paid to service providers to perform necessary tasks) and indirectly (in the form of opportunity costs). These include: (1) the cost of the “tender time” spent completing the transaction; (2) the cost of the time spent processing the cash (*e.g.*, counting it so it can be reconciled with sales); (3) the cost of the time spent depositing the cash at the bank (including the travel time); and (4) the payments to the bank and other third parties (*e.g.*, armored car services) for processing the cash deposit and providing change, as well as associated activities. There are also costs associated with “float”¹³ and the risk of theft by employees and others.

2. Credit Card Payment

a) Participants in Credit Card Payments

Credit card transactions involve a number of key parties: customer, retailer, issuing bank, acquiring bank, and payment card networks. A consumer who pays by credit card has a contract with a bank that issued the credit card (the “issuing bank” or “issuer”). The issuing bank bears the risk that the customer will not pay the credit card bill. A retailer has a contract with a bank that processes its credit card transactions (the “acquiring bank” or “acquirer”). The issuing banks and acquiring banks have agreements with technology companies that operate electronic

¹³ Float is the time between the merchant’s acceptance of a cash payment and the depositing of this payment in an interest bearing account.

payment systems (“payment card networks”). Payment card networks operate systems through which the acquiring bank requests authorization from the issuing bank to proceed with the transaction. Assuming approval is given, the issuing bank sends an authorization code through the payment card network to the acquiring bank, which is then transmitted to the merchant’s terminal, which signals the merchant that the transaction can proceed. For Visa and MasterCard credit card transactions, all four of these parties are involved. However, American Express and Discover typically operate the payment card network, issue the cards, and approve all transactions.

The costs and revenues associated with the use of the credit card have to be split among the different parties involved in the transaction. “Payment card network assessments” are payments to cover the costs of operating the credit card network. “Interchange fees” are the payments to the issuing bank designed to compensate partially the issuing bank for the issuing bank’s role in a credit card transaction, including credit risk, fraud risk, technology costs, float cost, among other costs. The size of the interchange fee depends on the type of credit card and the way in which the transaction is processed. Together these two payments along with the charges for using the services of the acquiring bank are reflected in the “merchant discount fee,” the payment that the retailer makes to its acquiring bank for relying on the credit card system.

b) Payment Flow between Participants

Credit card transactions are more automated than cash transactions, although the extent of the automation varies. As a result, the time and effort involved in completing a credit card transaction can differ significantly across transactions. While there is this variation across transactions, credit card transactions typically include the following steps:

1. Merchant calculates the amount of purchase and asks buyer for payment (which parallels what is done for a cash transaction).

2. Buyer presents merchant with a credit card and either the customer or merchant runs (“swipes”) the credit card through the point of sale unit.¹⁴ The amount of the sale is either hand-entered or transmitted by the cash register.
3. The point-of-sale unit transmits the credit card data and sales amount with a request for authorization of the sale to their acquiring bank.
4. The acquiring bank processes the transaction, routing the authorization request through the payment card network to the issuing bank.
5. If the cardholder is in good standing with the issuing bank and has available credit, and the transaction does not appear to be fraudulent, the issuing bank authorizes the transaction.
6. An approval message is sent from the issuing bank through the payment card network to the acquiring bank. The acquiring bank then sends the approval message to the merchant’s point of-sale unit.
7. A sale draft, or credit slip, may or may not be printed out by the point of sale unit or cash register. The merchant may or may not ask the buyer to sign the sale draft.¹⁵
8. At some point after authorization (often within a day), the merchant sends all of its card-based sales transactions to its acquirer. The merchant acquirer batches and sends the payment information to the payment card network. At this point, the payment card network validates the accuracy of the transaction information submitted by the merchant acquirer in order to reconcile funds between issuers and acquirers. This reconciliation process is known as “clearing.”
9. Through a process facilitated by the payment card network, the issuing bank transfers the amount of the sales draft, minus an interchange fee to the acquiring bank. This process is known as “settlement.”¹⁶ In practice, settlement is performed on a net basis among all issuing and acquiring banks.
10. The acquiring bank then deposits the transaction sales amounts, less the merchant discount fee, into the merchant’s bank account.

¹⁴ When using newer payment form factors, such as contactless payment, it is not always necessary to physically swipe a card.

¹⁵ There are programs, such as Visa’s No Signature Required (NSR) program and MasterCard’s Quick Payment Service (QPS) program, that allow merchants to accept cards without getting a signature if the amount charged is below some amount (historically around \$50) and the card is read by a credit card reader. http://www.globalpaymentsinc.com/GPDB/AccessDOC.aspx?SubDoc_ID=211

¹⁶ The overview provided in the text describes Visa and MasterCard transactions. For American Express and Discover transactions, a single entity issues the credit card, operates the payment card network and often signs up the merchant.

With respect to the transaction costs a retailer incurs when accepting credit card payments, the key costs are the payment of fees to its acquiring bank (which shares some of this payment with the issuing bank and the payment card network) and the “tender time” costs associated with processing a credit card transaction. These costs will vary across credit cards (since processing fees differ) and across transactions (since processing times differ). Processing times vary across credit card transactions because credit card systems differ with respect to how transaction data is passed to the payment card network (passed automatically or entered by the clerk), whether the store’s clerk or the customer swipes the card, whether the customer must sign a credit card receipt, and whether a Near Field Communications (NFC) System¹⁷ is used to convey the credit card information.

Retailers negotiate a fee structure with their acquiring bank that will cover all of the fees associated with the acceptance of a credit card. The fee structure generally consists of a fee that is a percentage of the dollar volume of its transactions, which is often called the merchant *discount rate*; and may also include a flat per transaction fee, which is generally called the *transaction fee*. While an acquiring bank’s fees reflect the costs of the credit card system, they are not necessarily tied in a formulaic way to these underlying costs, since these fees can be (and are) negotiated between the retailer (or the retailer’s franchiser) and the acquiring bank. While the fees charged retailers for credit card transactions vary for all the reasons discussed above, they tend to involve a merchant discount rate of around 2% and may include a transaction fee of

¹⁷ A NFC is short-range, low power wireless link evolved from radio-frequency identification (RFID) technology that can transfer small amounts of data between two devices held a few centimeters from each other. The expectation is that this will speed data transfer allowing transactions to proceed more quickly. *See, e.g.,* <http://www.techradar.com/us/news/phone-and-communications/what-is-nfc-and-why-is-it-in-your-phone-948410>.

around \$0.03-\$0.15 for most credit cards,¹⁸ with American Express having a slightly higher fee (2.8%-3.5% discount rate and a \$0.00-\$0.10 transaction fee).¹⁹

3. Debit Card

a) Participants in Debit Card Payments

There are two basic types of debit card transactions, “PIN” or “personal identification number” transactions and “signature” transactions. In a PIN transaction, the consumer enters a PIN to authorize the transaction. In contrast, in a signature transaction, the consumer historically authenticated the transaction by signing something (like a receipt). However, increasingly cardholders authorize signature debit transactions without a signature. Moreover, the vast majority of debit cards support authentication by both PIN and signature, with the type of transaction that is actually used depending on the consumer’s preference, the nature of the transaction, and the merchant’s acceptance policy.

¹⁸ For example, the Visa consumer credit card interchange fees are around 1.15%-2.4%, with transaction fees of \$0.04-\$0.10. (<http://usa.visa.com/download/merchants/Visa-usa-interchange-reimbursement-fees-april2013.pdf>) MasterCard’s fees appear to be similar, often starting with an interchange fee between 1.15% and 2.5%, with a transaction fee of around \$0.05-\$0.10. (http://www.mastercard.com/us/merchant/pdf/MasterCard_Interchange_Rates_and_Criteria.pdf) Another source reports that the average credit card processing cost for a retail business where cards are swiped is roughly 1.95% - 2%. The average cost for card-not-present businesses, such as online shops, is estimated to be roughly 2.30% - 2.50%. (<http://www.cardfellow.com/blog/average-fees-for-credit-card-processing/#Typical>) Others report that the average discount rate is 1-3%. (<http://www.investopedia.com/terms/m/merchant-discount-rate.asp>) These sources indicate an average discount rate of around 2% and a transaction fee of \$0.05-\$0.10.

¹⁹ In the case of American Express, the credit card company plays the role of the acquiring bank. American Express offers a “discount rate plan” in which the retailer pays a percentage of the face amount of each American Express sale (“discount”). In some cases they also pay a transaction fee. For example, American Express indicates that a convenience store is often charged around 2.89%-3.20% of the transaction size, plus \$0.10 per transaction. (<https://merchant.americanexpress.com/accept-card/merchant-benefits-RLMA>). In contrast, fast-food restaurants do not have a transaction charge, but pay a 2.9%-3.5% discount (<https://merchant.americanexpress.com/accept-card/merchant-benefits-FFRMA>), while full-service restaurants pay \$0.05 per transaction as well as 2.9%-3.5% of the transaction (<https://merchant.americanexpress.com/accept-card/merchant-benefits-RMA>). In addition, retailers may be subject to various other fees and assessments. American Express explains that some fees and assessments are for special products or services, while others may be applied because of a Merchant's non-compliance with our policies and procedures. See <https://merchant.americanexpress.com/accept-card/merchant-account-rates-pricing> and https://www209.americanexpress.com/merchant/singlevoice/singlevoiceflash/USEng/pdf/merchant-policy/PDFs/US_20RefGuide.pdf.

As one would expect, debit cards involve much the same transaction participants as credit cards. In particular, the key participants are the same: cardholder (consumer), retailer, the acquiring bank, the issuing bank, and the payment card network. The cardholder provides the debit card as a method of payment to a merchant. The issuing bank holds the consumer's bank account and issues the debit card that is linked to that account to the consumer. The merchant accepts the consumer's debit card as a method of payment. The acquirer, which receives the debit card transaction information from the merchant, facilitates the authorization, clearance, and settlement of the transaction on behalf of the merchant. The payment card network provides the software and infrastructure needed to route debit transactions, transmitting account information and electronic authorization requests from the acquirer to the issuer, returning a message to the acquirer either authorizing or declining the transaction, and, based on clearing messages received during the day, calculating and communicating to each issuer and acquirer its net debit position for settlement.

Payment card networks that process debit card transactions include MasterCard and Visa and several debit-only networks such as Electron, NYCE,²⁰ Star,²¹ and Tempo.

b) Payment Flow between Participants

Debit cards involve much the same payment flow as credit cards. A key difference is that, when a debit card is processed, the customer is not taking out credit, but instead is having money deducted directly from a specific bank account (usually a checking account or a savings account).

With respect to retailers, the costs associated with transactions involving debit cards vary depending on how debit cards are used. As is explained above, debit cards typically have a

²⁰ NYCE is owned by FIS.

²¹ Star is owned by First Data Corp.

“PIN/debit” option and a “signature/credit” option.²² If a customer uses the “PIN/debit” option, the customer is asked to enter a PIN into the card terminal (or in the cash machine). The entry of the PIN adds security to the transaction and can allow the customer to obtain cash, as well as pay for an item. If a customer using a debit card opts for the “signature/credit” option, the customer’s transaction will proceed like a credit card transaction in that no PIN number will have to be entered and the card is swiped and processed in the same way as a credit card.²³ This means that the transaction time associated with the use of a debit card can differ from that associated with a credit card, if the “PIN/debit” option is selected. However, it also means that the transaction times may be identical, since the retailer’s processing of the debit cards may be the same.

For retailers, the fees associated with accepting debit cards are similar to those associated with credit cards. As with credit card payments, the “merchant discount fee” reflects the amount the acquiring bank takes out of the payment made by the customer to the merchant and reflects the markup for the acquirer and the underlying costs incurred by the acquirer. As is true of credit cards, the underlying costs include the interchange fee, which is set by the network and paid by the acquiring bank to the issuing bank. For debit card transactions, the interchange fee may be, but is not necessarily, the largest underlying cost. This fee at least partially compensates the issuing bank for several costs, including overseeing the link to the customer’s bank account, fraud risk, among other costs. In addition, the payment card network also charges acquirers and issuers switch fees to cover the network’s costs.

²² <http://learn.bankofamerica.com/articles/managing-credit/debit-cards-vs-credit-cards.html>

²³ Like credit cards, the use of a debit card may or may not require the customer’s signature.

Because of “Durbin Amendment”²⁴ regulations that became effective in the fourth quarter of 2011, the interchange fees that can be charged for most debit card transactions are constrained for “regulated institutions,”²⁵ but there are “un-regulated institutions.”²⁶ In particular, the interchange fee for regulated debit cards has been capped at \$0.21 per transaction plus 0.05% (5 basis points) of the transaction amount (with an additional \$0.01/transaction if some fraud prevention measures undertaken).²⁷ According to data that payment card networks reported to the Federal Reserve Board for 2012, the average interchange fee per transaction received by non-exempt issuers was 24 cents.²⁸ On average, the fees paid by retailers for debit cards usually are smaller than the fees paid for credit cards unless an acquirer charges a merchant a blended fee for credit card and debit card transactions.²⁹

²⁴ The Dodd-Frank Act was amended by U.S. Senator Dick Durbin of Illinois to include new clauses regulating, among other topics, debit card interchange fees. This led to the publication of “Regulation II, Debit Card Interchange Fees and Routing” in June 2011. These regulations became effective on October 1, 2011. <http://www.kansascityfed.org/publicat/econrev/pdf/12q4Hayashi.pdf>

²⁵ To be exempt from the interchange cap regulation, debit card issuers must have total worldwide banking and nonbanking assets (including assets of affiliates), other than trust assets under management, that are less than \$10 billion. <http://www.federalreserve.gov/paymentsystems/regii-average-interchange-fee.htm>. See also, <http://www.kansascityfed.org/publicat/econrev/pdf/12q4Hayashi.pdf>.

²⁶ When the regulations took effect, the regulated banks were supporting 67% of the U.S.’s signature debit transactions and 60% of the U.S.’s PIN debit transactions, and 64% of all debit card transactions. <http://www.kansascityfed.org/publicat/econrev/pdf/12q4Hayashi.pdf>

²⁷ <http://www.federalreserve.gov/paymentsystems/regii-average-interchange-fee.htm>

²⁸ <http://www.federalreserve.gov/paymentsystems/regii-average-interchange-fee.htm>. Debit card transactions sponsored by smaller financial institutions, which are exempt from this regulation, had an average interchange fee of \$0.43 in 2012. Federal Reserve Board data (for the 4th Quarter of 2011) reported average interchange fees of \$0.30, \$0.24, and \$0.43 for all, non-exempt, and exempt transactions respectively. This report shows that, particularly for exempt banks, the charges were larger for signature debit transactions than they were for PIN transactions (e.g., \$0.51 versus \$0.31). For recent interchange fee schedules for debit cards published by Visa and MasterCard, see <http://usa.Visa.com/download/merchants/Visa-usa-interchange-reimbursement-fees-june2012.pdf> and http://www.mastercard.com/us/merchant/pdf/MasterCard_Interchange_Rates_and_Criteria.pdf.

In July 2013, a district court ruled that the Federal Reserve Board’s regulations set the interchange fees for debit card rates at too high a level; however, the district court was overruled by an appellate court in March 2014. [http://www.cadc.uscourts.gov/internet/opinions.nsf/FE9EDC4B5E2C6D9E85257CA2004FB19A/\\$file/13-5270-1484753.pdf](http://www.cadc.uscourts.gov/internet/opinions.nsf/FE9EDC4B5E2C6D9E85257CA2004FB19A/$file/13-5270-1484753.pdf). The plaintiff in the case, an association of retailers, has requested a review of the appellate court’s opinion by the Supreme Court.

²⁹ A survey of on-line retailers suggests that debit cards may be somewhat less expensive than credit cards. Specifically, “Overall, 34.6% of e-retailers pay less than 2.0% to accept debit transactions, and another 42.9% pay between 2.0% and 3.0%, the survey finds. Smaller percentages of e-retailers pay more, with 14.3% paying between 3.0% and 4.0%; 3.0% paying 4.0% to 5%; and 5.3% paying more than 5.0%. On the credit side, 20.6% of

B. Payment System Costs

While many of the costs associated with payment systems are incurred when the transaction occurs, some costs are incurred before or after the transaction takes place. Below we outline these different cost categories.

1. Transaction Costs Incurred Before or After the Transaction

a) Equipment acquisition (cash register/POS terminal, vaults, surveillance equipment)

Merchants invest in equipment to support their transactions. Clearly, POS systems are a core part of their operation. For most retailers, a POS system includes a cash register (perhaps with a computer, monitor, cash drawer, receipt printer, customer display and a barcode scanner) and a debit/credit card reader. Increasingly, merchants have an integrated payment card processing system, a signature capture device, and a customer PIN pad device. The POS system is supported by software that handles different sales-related functions such as sales, returns, exchanges, layaways, and sales programs/promotions. However, the sophistication of the POS units will vary significantly across businesses, since the demands of the business, in terms of the sales volume and the types of sales that are made, differ.

Cash transactions require a cash register. In addition, merchants invest in a vault to store cash. They sometimes invest in security equipment to monitor employees' handling of cash, to deter robberies and to reduce theft of store inventory.

Payment card transactions would not appear to require investment in a vault and, since there is no cash to steal, security equipment is not needed to deter robberies (although it might

respondents say they pay less than 2.0% in credit card processing rates. 50.7% pay between 2.0% and 3.0%; 19.9% pay between 3.0% and 4.0%; 3.7% pay between 4.0% and 5.0%; 2.2% pay between 5.0% and 7.0%; 1.5% pay between 7.0% and 10.0%; and 1.5% pay more than 10.0%.” (<http://www.internetretailer.com/2012/04/01/internet-retailer-survey-online-payments>)

still be of value to deter theft of inventory). However, payment card transactions require more sophisticated point of sale terminals that can support the processing of payment cards. These POS devices range in sophistication, with the simpler equipment requiring the re-entry of sales amounts and with more sophisticated equipment automatically conveying the customer's bill to the acquiring bank.

If retailers are going to support both payment card and cash transactions, they will need this equipment. Moreover, the sophistication of the POS equipment (*e.g.*, whether equipment used to enter customer charges is linked to inventory records or communicates with other computers in the retail establishment) depends more on the businesses operations than on the relative expense of different payment systems.³⁰ For example, whether it makes sense for a restaurant to have automated communication between the server that takes the order and the kitchen that prepares the food depends on the size of the restaurant and the “capital cost/labor cost” trade off for the particular restaurant, not differences in the relative cost of different payment systems. As a result, shifting some sales from payment cards to cash (or vice versa) will not significantly alter investments in POS systems. In particular, while it is true that, if there are really significant shifts in business from one type of payment system to another, some incremental investment may be required, such significant shifts in sales are likely exceptional.

Nonetheless, we did explore the incremental cost of adding payment card scanning equipment. We found that the equipment can be acquired at relatively low cost (less than \$100), and even more sophisticated units cost less than \$1,000.

Basic Payment Card Processing Equipment: The equipment needed to scan a payment card is not particularly expensive. Portable scanning

³⁰ More sophisticated POS systems also may require software and technical support that adds costs beyond the basic equipment. However, as is the case for the equipment, these costs are incurred because of fundamental operational decisions, not by the decision to shift some sales from cash to payment card or vice versa.

equipment starts below \$20 and even fairly sophisticated equipment (such as the Verifone VX 510 Dual Modem 12MB Terminal w/Internal Pin Pad) is only around \$160, and more sophisticated models (Verifone VX520 (Dial w/ Smart Card, EMV)) cost less than \$250.³¹

Advanced Payment Card Processing Equipment: If one is interested in credit processing equipment that has a color screen that supports customer promotional videos as well as transactions data, handles on-screen signatures, and can receive transaction data from a cash register (such as VeriFone MX 880 - Touch, Signature Capture, Ethernet and Line Out), the cost is still less than \$750.³²

Obviously, larger investments may be required if the merchant implements a major overhaul of the store's payment process to save labor (such as adding payment card capabilities to gasoline pumps so that customers do not have to interact with a clerk to pay for their gasoline). However, in these cases, the fact that more expensive equipment may be required is more attributable to a desire to substitute capital for labor (and to improve customer service) than it is to the need to invest in costly equipment to handle payment cards. More specifically, the fact that labor saving transaction systems are facilitated by the use of payment cards is evidence that payment cards provide a benefit that more than offsets the cost of the associated equipment, since the retailer (e.g., gasoline station) could have retained the attendant-based system with lower-cost equipment if this was thought to be more cost effective.

Similarly, safes (which are required if a retailer is storing significant cash) come in different price levels. While simple, small safes can be acquired for less than \$500,³³ more sophisticated models can cost several thousand dollars.³⁴

³¹ <http://www.google.com/#q=point+of+sale+credit+card+terminals+price&tbm=shop>

³² <http://www.barcodesinc.com/verifone/part-m090-507-01-r.htm>

³³ For example, a small combination safe (such as the Sentry SFW123CS Fire, Water & Impact Resistant Safe with Combination Lock) costs around \$200. (http://www.google.com/shopping/product/6358477097590454926?q=security+safe&bav=on.2.or.r_qf.&biw=1266&bih=601&dpr=1&bvm=pv.xjs.s.en_US.8f7UbUMizFk.O&tch=3&ech=1&psi=rPcxUqL8BKbB4APU6YCoCA.1379006734170.1&wrapid=tlif137900673417010&sa=X&ei=GfkuUtzrOPPj4APx2oDIAw&ved=0CH8Q5Q0wAA)

While security cameras police a number of different activities, the demand for cameras is likely increased when a business handles a lot of cash, since they can deter robberies and theft by employees.³⁵ The cost of camera systems varies with the size of the store and the quality of the camera system. However, a modern high definition system with 6 high definition cameras, a hard drive to store the images, supporting software, and the ability to send images to smart phones or tablets (as well as computers) costs somewhat less than \$2,000.³⁶ This cost does not include the time cost associated with monitoring the camera, which adds significantly to the total cost of camera security operations. Even if an employee (or store owner) only spends a few minutes during the day when they are concerned about activity, the costs can be quite significant (e.g., assuming that time is valued at \$25/hour and 15 minutes a day is spent monitoring video feeds, this amounts to somewhat over \$2,000 a year in time costs). Annual charges are lower (perhaps around \$500-\$1,000 a year) if monitoring services are provided by an independent monitoring firm.³⁷

In sum, while merchants that handle significant amounts of cash have an incentive to invest in security equipment and to spend time using this equipment to monitor cash sales, there

³⁴ For example, a American Security ACF4824DS T-30 Money Manager Deposit Safe w/ Combination Lock costs around \$5,600 (http://www.gunsafes.com/American-Security-ACF4824DS-T-30-Money-Manager-Deposit-Safe-w-Combination-Lock.html?gdftrk=gdfV21882_a_7c249_a_7c7324_a_7cGSACF4824DS&gclid=CIKtxa-vxrkCFaNIogodQ2sAFw)

³⁵ One company indicates that “Internal retail losses are mainly caused by employees manipulating the POS (Point of Sales) system.” (http://www.axis.com/solutions/video/retail/loss_prevention.htm)

³⁶ Lorex Technology’s LHD182C6 model was priced at around \$1,800 dollars when we checked. <http://www.lorextechnology.com/HD-security-camera-system/HD-surveillance-camera-system-with-6-HD-cameras/prod360009.p> Systems that cost less than \$1,000 are also available. <http://www.cctvcamerapros.com/security-camera-systems-s/71.htm>

³⁷ When we checked, ADT had an offer where they would give a \$100 rebate if the store owner paid to install a wired system for around \$199 (or a wireless system for \$299) and contracted to pay a monthly monitoring and maintenance fee of \$39.99 for 36 months. However, they also offered larger systems that involved higher installation costs and a monthly monitoring and maintenance fee of \$57.99. <http://www.adt.com/about-adt/legal/small-business-terms-and-conditions>

are other reasons (unrelated to the risks of cash transactions) to invest in much of this equipment. For example, concerns about shoplifting underlie much of the investment in security cameras. As a result, our analysis does not add these security equipment costs to the cost of cash. However, this likely causes us to understate the costs of cash transactions.

b) Employee training

While employees must be trained to handle POS systems, the additional training required to handle payment card transactions as well as cash transactions is not significant. For example, online training courses with video support are available for around \$10.00 per user.³⁸ Similarly, owners regularly train employees by spending parts of a day working with them and showing them how the equipment works. While this may take parts of several days, the incremental time it takes to train someone on the credit card portion of a POS system is unlikely to be significant, since it is a one-time cost and typically involves little more than teaching the employee about which buttons to push and how to swipe the card.³⁹

c) Cash Handling

The cash that merchants keep in their cash registers has to be obtained and processed, which takes time and which is associated with risks. In particular, the merchant must maintain sufficient cash in their safe to fill the cash register at the beginning of business; the cash that is to be put in each cash register at the beginning of the day (or shift) has to be counted; the cash in the till at the end of the day (or shift) has to be counted and reconciled with the sales totals; the cash collected by the business has to be counted and organized in a way that is acceptable to a bank; accumulated cash has to be taken to the bank for deposit; and change has to be obtained

³⁸ <https://www.opensesame.com/c/computer-or-pos-system-restaurant-training-course>

³⁹ For an illustrative training program for an elaborate restaurant POS system, see https://www.opensesame.com/dashboard/validate_course/42746/preview/PRODUCTPAGE. As this training program suggests, much of the time is spent learning how to enter the order and preparing the receipt, which is unrelated to whether the customer is paying by cash or credit card.

from the bank if the retailer is short of change. While some automated equipment is used to process and count cash,⁴⁰ each of these activities nonetheless involves time-consuming, labor-intensive effort. Managing cash deposits can take several hours per deposit given the counting, recording, and reconciling that is involved.⁴¹ Specifically, some have estimated that for many establishments at least 1 hour per day is needed to reconcile the totals from each of the cashiers, and each cashier will take at least 10 minutes to close out their till.⁴² Some have estimated that cash handling costs may be around 1% of revenues.⁴³

Transporting the cash to and from the bank is time consuming and risky.⁴⁴ If a retailer uses an armored car company, the cost is likely to be around \$50 per trip.⁴⁵ While most retailers deposit the cash themselves,⁴⁶ this is not costless since the travel and waiting time at banks add up and represent a cost. In addition, when an owner or store employee takes cash to a bank, there are personal risks, which indicate that this is a type of costly activity.

d) Cash Inventory and Float Costs

Retailers hold a cash inventory both because they need to make change and because they accumulate cash from sales. Similarly, retailers may have an inventory of uncashed checks or

⁴⁰ For example, “smart safes” use bill counting and validation technologies to significantly reduce the handling of cash in the store. Specifically, employees feed bills directly into the smart safe through a note acceptor; the cash is verified, counted, secured and prepared for deposit. While this saves a lot of time, smart safes are also fairly expensive: <http://detroit.craigslist.org/mcb/ele/4049710040.html> (showing used smart safe for sale for \$6,250).

⁴¹ <http://www.dunbararmored.com/retail-cash-manager-safes-cash-manager-pos-point-of-sale-safes.php>
See also http://www.atmgurus.com/training/resources/ATMGurus_WP_Smart%20Safes_To%20Launch.pdf

⁴² <http://www.dunbararmored.com/products.php>

⁴³ For example, in Europe, “According to cash automation specialist Gunnebo, for each euro of revenue, retailers have to pay one cent for cash handling.” (http://www.planetretail.net/catalog/mkrep/6/5/sum_RTTR-Cash-Handling.pdf)

⁴⁴ These costs and risks are recognized in some discussions of the problems faced by a “cash only” business. See, e.g., <http://smallbusiness.aol.com/2011/06/29/can-you-afford-to-run-a-cash-only-business/> (which points out that a problem with running a cash-only operation is that it leaves business owners with a lot of cash in their store, making them potentially more susceptible to theft by employees or robberies than a business owner who accepts credit. At the very least, there are large quantities of bills and coins to deposit at the end of the day, which means investing in an armored car service or running the risk of getting robbed on the way to the bank.)

⁴⁵ http://www.atmgurus.com/training/resources/ATMGurus_WP_Smart%20Safes_To%20Launch.pdf

⁴⁶ One report indicates that “84 percent of merchants still take deposits to the bank themselves.” <http://www.stores.org/stores-magazine-july-2009/true-cost-cash>

payment card receipts that have not been recorded in their bank account. Holding these payment inventories is costly because merchants are losing money when payments are in their tills rather than in an account that earns interest. As a result, when analyzing the relative costs of different payment systems, it is appropriate to consider the lost interest on these payment inventories (float costs) and the costs associated with holding cash inventories to make change.

Float costs vary across payment forms and business operations. For small retailers who do not visit the bank every day, there can be a several day lag between when cash or a check is received as payment and when it is deposited.⁴⁷ Moreover, while cash may be added immediately to a merchant's account when it is deposited so that it is immediately available for investment,⁴⁸ banks sometimes wait until the next business day,⁴⁹ which is particularly true when cash is left with the bank at night.

When customers pay a merchant by payment card, there is a one or two business day lag before the payment shows up in the merchant's bank account. When the merchant's bank account is held by the same bank that processes its payment cards (acquiring bank/merchant processor), there typically is next business day recognition of payment card payments. However, when different banks are involved, it can add a second business day.⁵⁰

⁴⁷ For checks, there are now remote depositing systems in which a check can be scanned and deposited without visiting the bank. However, banks charge a fee for this remote deposit service. *See, e.g.*, <https://www.bankofamerica.com/smallbusiness/online-banking/cash-management.go>. Similarly, there are some "smart safe" systems that credit the retailer with cash deposits when the retailer places the cash in its safe. However, companies that provide supporting services (such as armored car companies) charge for this service.

⁴⁸ https://www.suntrust.com/portal/server.pt/gateway/PTARGS_0_0_232_303_0_43/http%3B/portlet-ice.suntrust.com/Portlets/iwcc/IWCCDisplay.aspx?gid=SEECfKNjRHYPd9Fk83Q5HI752L4vAv77v67gnpQwIDEH3FQF685IL9Rdxsi9ERBMU ("Funds from the following deposits are considered collected immediately and available for withdrawal on the day we receive the deposit: cash deposits, wire transfer deposits, and electronic direct deposits.") Checks are not credited immediately, but on the first business day after deposit. (Ibid.)

⁴⁹ <http://www.federalreserve.gov/pubs/regcc/regcc.htm> ("The following types of deposits must be made available on the first business day following the banking day of deposit ('next-day availability'): Cash deposited in person to one of [the bank's] employees . . .")

⁵⁰ <http://www.merchantprocessingresource.com/2011/08/6698302-i-want-my-credit-card-sales-now-why-the-delay/>. One reason that there may be a delay is that some acquiring banks delay settlement and pay merchants

In sum, all transactions require stores to incur float costs. Cash transactions differ in that they require the store owner to both incur “float costs” and the costs of holding a cash inventory to make change. These financial inventories have costs. While economists who have studied the relative costs of different payment systems sometimes factor in these costs, they differ with respect to whether these costs are larger for cash than for payment cards or vice versa.⁵¹ As is explained more fully below, we did not find evidence that the float costs are significantly different for cash and payment cards, since the faster bank processing of cash is offset by the fact that typically cash is not deposited by the retailer every day. Moreover, even if one considers float costs, they are unlikely to be large for most retailers, since these costs are a very small percentage of the costs associated with any particular transaction.⁵² As a result, we have not factored float costs into our analysis.

e) Cash deposit fees

Banks sometimes have identifiable charges for processing a retailer’s cash.⁵³ However, even when there is no separate charge for processing cash, the bank incurs costs when it processes cash. Since banks need to cover these costs to remain in business, these costs will be passed on to the retailer in some form, likely in the form of higher monthly fees or lower interest

one day after receiving the funds from the issuing bank because they want time to perform fraud reviews. (http://www.fdic.gov/regulations/examinations/credit_card/pdf_version/ch19.pdf)

⁵¹ See, e.g., Garcia, Swartz, Hahn & Layne-Farrar (2004), Arango & Taylor (2008) and Layne-Farrar (2011).

⁵² For example, assuming that there is a two day delay in depositing a payment of \$30 and the store’s cost of capital is 10%, lost interest from two days’ float is less than a fraction of a cent for that transaction.

⁵³ “BofA [Bank of America], for example, says some of its business accounts levy a fee of 20 cents for every \$100 in cash deposited after an initial \$10,000. Citibank charges 10 cents for every \$100 in cash deposited after an initial amount ranging from \$5,000 to \$20,000, depending on the type of business account. Chase bank charges 40 cents for every \$1,000 in cash deposited beyond an initial \$7,500.” <http://articles.latimes.com/2011/nov/18/business/la-fi-lazarus-20111118>. Similarly, “At one major bank, there’s no fee for the first \$10,000 deposited. After that, you’ll pay 20 cents per \$100.” <http://www.foxbusiness.com/personal-finance/2012/11/05/five-sneaky-bank-fees-and-how-to-catch-them/>

rates paid on corporate bank accounts, even if there is no identifiable cash processing charge. As a result, it is appropriate to include bank cash processing costs in an analysis of retailer costs of different payment systems. However, none of our retailers reported significant bank charges. Based on reported bank charges used in other studies, this is not surprising, since retailers are only paying (either explicitly or implicitly) around 0.03%-0.20% of sales revenues to banks for taking cash.⁵⁴ As a result, because bank cash processing costs do not appear to be particularly significant, we did not include these costs in our cash cost calculation that is reported below.

2. Costs Incurred During Transaction

During a transaction, in addition to the payment card fees that may be incurred,⁵⁵ there are two primary costs that merchants incur. One is the cost of the cashier's time. The other is the risk the merchant takes that a payment is fraudulent, so the merchant will not receive the expected compensation.

a) Cashier time

If cashiers can process transactions faster, merchants may be able to lower their labor costs.⁵⁶ Labor costs can be lower both because fewer cashiers have to be hired and/or because cashiers can undertake other cost-saving activities using the time that is saved.

Given that cash payments involve different steps than credit card or debit card payments, the time spent completing a transaction ("tender time") differs. However, because there is significant variation across transactions, one cannot state categorically that all cash transactions are faster than all credit/debit card transactions (or vice versa). For example, payment card transactions can be significantly faster than cash transactions when customers swipe their credit

⁵⁴ This is based on the bank cash processing fees reported above, with the low end percentage reduced to reflect the fact that no fee is charged for the first several thousand dollars of deposits.

⁵⁵ See Section III.A.2 and III.A.3 for a discussion of these costs.

⁵⁶ As is explained below in the discussion of revenue enhancement, a reduction in tender time may also allow retailers to increase their revenues, since a large queue may discourage customers from patronizing a store.

card while the clerk is entering the charges into the POS terminal and the customer does not have to sign a receipt. In this situation, the customer can walk away as soon as the clerk determines the total bill. In contrast, most cash transactions require the cashier to handle the cash provided by the customer, count it, and determine the correct change.⁵⁷ On the other hand, while they are becoming less frequent, there can be payment card transactions that require the cashier to re-enter the total charges in a separate credit card system, print out a payment card receipt, hand the customer a pen, wait for the customer to sign the credit card receipt, and then return a copy of the receipt to the customer. In these cases where payment cards require more effort by the cashier, cash transactions are likely to take somewhat less time than credit card transactions (although lags involving the counting of cash by the customer and the clerk may narrow the difference).

With the advent of increasingly mechanized payment card transactions (including the recent development of “Near Field Communication”⁵⁸ systems), retailers have come to realize that in certain contexts it may be a lot faster to complete a payment card transaction than a cash transaction.⁵⁹ In the extreme, some retailers have reported shifting to a “cashless” system, even when their average transaction sizes are quite small, because they believe that a credit/debit card payment system will allow them to reduce transaction times (tender times). For example, one

⁵⁷ Some cash transactions do not require counting change. For example, customers may buy \$20 of gasoline when paying cash.

⁵⁸ “Near Field Communication (NFC) is a wireless technology that allows data to be exchanged between two different devices -- say, a credit card or a cell phone and a credit card terminal -- from a short distance away. If your phone has NFC, when you hold it near a properly equipped terminal, the phone and the terminal communicate, and the terminal communicates with a remote computer to approve payment.” (<http://www.creditcards.com/glossary/term-near-field-communication.php>) For the discussion of a study that argues that transactions will increasingly move to NFC, see http://www.computerworld.com/s/article/9226268/Smartphone_payments_to_outpace_credit_cards_by_2020 and <http://ckoop.atspace.cc/myblog/nfc-near-field-communication/>.

⁵⁹ Layne-Farrar (2011), p. 10 (citing “industry reports” that indicate that cash transactions take 8-10 seconds to complete whereas card transactions below \$25 take 4-5 seconds). See also Lauri Giesen, *Fast Food Cooks up a Winning Card Recipe*, DIGITAL TRANSACTIONS, 16 (2005), available at <http://www.docstoc.com/docs/43869014/Fast-Food-Cooks-up-a-Winning-Card-Recipe> (“Card transactions that once took 20 seconds or more just to get an authorization and then needed a few more seconds to get a signature now can be completed in their entirety in less than five seconds.”)

store owner commented: “For Standard Market, which opened in November, going cashless was part of its business plan. ‘We thought since we’re new, we’ll just skip the cash,’ . . . This has led to shorter checkout lines and savings in operational expenses.”⁶⁰

In Section IV below, we report the results of five detailed case studies that were designed to measure transaction times for cash transactions and credit card transactions. As is explained below, our findings indicate that in some circumstances (such as at gasoline stations), significant time can be saved by using technology that is only workable with credit card payment systems.

b) Risk of Fraudulent Payment

Merchants face the risk that the payment offered by customers in exchange for their goods and services is fraudulent. This is true whether the payment is made by cash or payment card, since there is both counterfeit money and fraudulent use of payment cards.⁶¹

When a merchant accepts counterfeit money, the merchant may be unable to deposit the money in its bank account, since banks screen cash deposits for counterfeit money and will not accept counterfeit money. As a result, some merchants have invested in equipment that scans higher denomination currency to determine if it is counterfeit. However, based on our interviews with merchants, it is more common to review the money by eye or assume that it is legal tender.

Under Regulation Z of the Truth in Lending Act and Regulation E of the Electronic Fund Transfer Act, consumers that use credit cards and debit cards (respectively) have the right to reverse the charges in some circumstances. In particular, a consumer can reverse charges if they think there has been fraudulent use of their card or, for credit cards, if they believe that a

⁶⁰ http://www.huffingtonpost.com/2012/06/07/credit-card-payments-growth_n_1575417.html

⁶¹ “The global card brands—Visa, MasterCard, American Express, UnionPay, Diners Club, and JCB—averaged fraud losses of 6.13 cents for every \$100 in total volume.” http://cardnotpresent.com/news/cnp-news-aug13/Global_Card_Fraud_up_14_6_ ,_but_Still_Historically_Low_- _Aug_26_2013/. This appears to be lower than the industry average in earlier years. “Credit card and debit card fraud losses accounted for roughly 9¢ per \$100 in transactions made in the United States during 2006.” <http://www.cardhub.com/edu/credit-debit-card-fraud-statistics/>

merchant did not provide the quality service or product that they were promised. Focusing on the fraudulent use of payment cards, while merchants bear some of this fraud risk when they accept payment cards, banks bear much of this risk and the costs associated with this risk. Specifically, issuing banks undertake costly efforts to police the fraudulent use of credit and debit cards, which helps protect merchants from costly chargebacks. In addition, in a typical retailer transaction (where the merchant is interacting face-to-face with the consumer and the card is present), if the merchant follows the credit card acceptance policies prescribed by the payment card networks, it is the issuing bank (not the merchant) that bears the risk associated with fraudulent use of credit and debit cards.⁶² As a result, for the typical “bricks and mortar” retail payment card transaction, the risk of non-payment is borne by the card issuer, not the retailer. This makes the acceptance of payment cards less risky than the acceptance of checks (where the retailer bears all of the risk) and allows the retailer to avoid the risk of counterfeit cash.

3. Other Potential Cost Differences

Using third-party credit card companies, rather than offering “store credit,” may lower the retailer’s costs of providing credit to its customers. If a retailer decides to offer credit to some customers who have a strong preference for buying on credit (so that they can make sales to these customers), the retailer could allow the customer to “run a tab” or offer its own credit card. Indeed, many of the early credit cards were retailer-specific cards introduced by large retailers. However, it is costly and risky to offer credit. Most obviously, there is the risk that a

⁶² <http://www.mrketplace.com/11128/preventing-credit-card-fraud/> . However, if the card is not present (as is the case with many Internet, over the phone, or via mail transactions) the merchant is liable. “The majority of transactions are still face-to-face, with the card present. Visa says such transactions accounted for 77% of its business in 2004, vs. 23% that were card-not-present.” <http://www.businessweek.com/stories/2005-06-20/the-truth-about-credit-card-fraud>. For debit cards, in the 4th Quarter of 2011, card-not-present debit transactions represented about 11% of all debit card transactions by number of transactions and 21% in value of transactions. http://www.federalreserve.gov/paymentsystems/files/debitfees_costs_2011.pdf

customer will not pay their debt, which leads firms that issue credit cards to engage in costly monitoring of the financial circumstances of their cardholders and of card usage.

By relying on third-party credit card networks, retailers shift the costs associated with these risks onto someone else. Given likely economies of scale in the operation of credit networks, this shifting lowers the costs merchants incur when they allow customers to buy on credit relative to what they would incur if they offered their own credit.⁶³

C. Potential Retailer Benefits from Payment Forms

While it is important to understand how costs vary across different payment systems, this is only one factor that merchants must consider when assessing whether it is profitable to accept compensation using a particular payment system. Retailers also need to consider how their sales will be affected, since their profits depend on both their revenues and costs. As is explained below, acceptance of credit and debit cards (in addition to cash) may lead to both increased store patronage and increased sales to customers that patronize the store.⁶⁴

⁶³ A GAO report identifies this type of benefit when it comments:

Accepting credit cards also allows merchants to make sales on credit at a generally lower cost than operating their own credit program. As noted previously, individual merchants originally offered credit cards that could be used only at their stores, but many such merchant programs have been discontinued now that cards issued by third parties—banks, credit unions, and thrifts—are available. Card network and issuer staff told us that credit cards allow merchants to obtain sales from customers that want to finance their purchases over time without the merchants having to incur the costs involved with offering credit. For example, they said merchants avoid the costs of credit losses, debt collection, credit quality assessment, card production, and statement preparation. (Government Accounting Office, CREDIT CARDS: RISING INTERCHANGE FEES HAVE INCREASED COST FOR MERCHANTS BUT OPTIONS FOR REDUCING FEES POSE CHALLENGES, 30 (November, 2009) available at <http://www.gao.gov/assets/300/298664.pdf>.)

⁶⁴ There may be other benefits from payment card transactions that are not reflected in our analysis. Specifically, some researchers have also indicated that payment cards can increase merchant revenue by allowing retailers to track their customers in ways that allow them to promote their offerings more effectively. For example, Layne-Farrar (2011) points out that debit cards (and presumably credit cards as well) “provide retailers with information about their customers that cash cannot: the cards can be linked to zip codes and demographic factors, which can help retailers improve their inventory and marketing practices.” Layne-Farrar (2011), p. 14.

1. Increased Patronage

Establishments that accept payment cards will attract customers that, but for the acceptance of cards, would have patronized another store. There are several reasons that customers may prefer a store that accepts payment cards: (1) They may not regularly carry significant cash or do not happen to have cash on hand to cover potential transactions (because of the convenience of credit card transactions, they know that they will be able to pay without carrying large amounts of cash if they have a credit card, and because they do not want to take the risks of carrying large amounts of cash).⁶⁵ (2) They want to buy on credit. (3) They get benefits (such as frequent flier miles) from the use of their credit cards. (4) They prefer the record keeping that comes from the use of a payment card. (5) They believe the acceptance of

A GAO report identifies this type of benefit when they comment:

Representatives of the card networks also told us that they also are able to increase merchant sales by providing merchants with customer information to enhance their marketing efforts. For example, representatives from one card network told us that they have specific staff tasked with organizing marketing campaigns targeted to particular merchants to increase the sales these merchants make from this network's cardholders. For example, if cardholders purchased particular items, their next billing statement would include offers for additional discounts on future purchases at specific merchants that accept their card that also sell such items. The networks reported that through their respective databases, they help merchants identify and better understand their prospective, current, and lapsed customers and employ a variety of niche marketing approaches that ultimately serve to increase sales. (Government Accounting Office, CREDIT CARDS: RISING INTERCHANGE FEES HAVE INCREASED COST FOR MERCHANTS BUT OPTIONS FOR REDUCING FEES POSE CHALLENGES, 30 (November, 2009) available at <http://www.gao.gov/assets/300/298664.pdf>.)

Similarly, Shampine (2012) comments that "electronic payment methods may allow merchants to more precisely track their customers' identities and purchase patterns, and potentially to obtain other data on the customer that might allow, say, targeting marketing." Shampine (2012), p. 8.

⁶⁵ People who follow the use of payment systems indicate that there is a "consistent trend of consumers carrying less cash and making more transactions with credit cards. 'The Millennials, especially, operate in a digital world, and that applies to almost everything they do.'" <http://www.lowcards.com/shoppers-prefer-credit-cards-businesses-prefer-cash-13753>

payment cards is a signal of store quality.⁶⁶ (6) They want to establish a credit history. (7) They want protection from some fraudulent transactions.⁶⁷ In addition, customers may be attracted to a store that accepts debit cards because they want to get some cash back.⁶⁸ All these factors indicate that store patronage may increase when a store indicates that it accepts payment cards (which stores often signal by placing the logos of the payment card systems it accepts on or near the door to the store).⁶⁹

Whatever the specific reason, there is evidence that consumers prefer to patronize stores that accept credit/debit cards, and this preference appears to be inversely related to a person's age. For example, WePay's⁷⁰ 2013 Small Business Payment Survey reported that:

Consumers that will *only* shop at businesses that take multiple forms of payment (categorized by age) are as follows:
69% of consumers 18-34
58% of consumers 35-44

⁶⁶ “[C]redit cards can actually make a company more attractive to potential customers for other reasons. According to one analyst, ‘Customers feel they can trust businesses that accept credit cards, as it gives them a sense of legitimacy,’ ‘And customers shopping around will be more drawn to companies that accept credit cards, even if they aren't the cheapest.’” <http://smallbusiness.aol.com/2011/06/29/can-you-afford-to-run-a-cash-only-business/> This view is echoed by others: “By accepting credit cards, you and your company gain valuable creditability in the eyes of both current and potential customers. Once you start accepting electronic payments, you can state that you accept credit cards and include the appropriate card logos and decals at your place of business or on your business cards, brochures, or website.” (<http://www.monerisusa.com/payment-processing-services/benefits-of-credit-cards.aspx>)

⁶⁷ For many of these points, see e.g., <http://money.msn.com/saving-money-tips/post.aspx?post=46f142e4-d9f0-450e-b03e-45353ed60275> and <http://www.cardhub.com/edu/top-reasons-to-use-a-credit-card/>.

⁶⁸ A 2009 US study found that, “About one in 10 consumers (9.9%) got cash most often as cash back from payments they made at a retail or grocery store.” Kevin Foster, Erik Meijer, Scott Schuh, and Michael Zabek, *The 2009 Survey of Consumer Payment Choice*, Federal Reserve Bank of Boston, Public Policy Discussion Paper No. 11-1, April 2011, p. 40.

⁶⁹ Others have recognized that customers may prefer to shop at stores that carry credit cards are the following comments: “Not accepting credit and debit card payments can hamper small businesses' efforts to increase revenue due to the fact that consumers are sometimes unwilling to go to an ATM for cash - which may involve additional charges - and elect instead to take their patronage elsewhere, particularly if they are members of the younger generation.” (<http://www.gopromos.com/Article/How+small+businesses+can+increase+revenue+by+accepting+plastic+payments/800601616/Default.aspx>) This phenomenon is not limited to the United States. Studies of foreign markets have found that store patronage is increased by a willingness to accept credit payments. See for example discussion in available at Nejd et Delener, Israel Nebenzahi, and Juan Meng, *Determinants of retail patronage: a cross cultural experiment* 12 INTERNATIONAL JOURNAL OF BUSINESS RESEARCH 43 (2012) available at <http://www.freepatentsonline.com/article/International-Journal-Business-Research/312171901.html>.

⁷⁰ WePay is a firm that offers an online payment mechanism to accept credit cards.

52% of consumers 45-54
48% of consumers 55+⁷¹

WePay also reports that a survey found that “58 percent of small businesses are regularly asked by their customers to accept credit cards.”⁷² The popularity of payment cards is also reflected in the fact that most point-of-sale purchases are not cash transactions and in the fact that cash sales are declining in popularity.⁷³

Store patronage may also increase when the use of a payment card allows the store to handle more customers. This can occur when the use of a payment card is automated in a way that allows the store to complete transactions more quickly than a comparable cash transaction. As is explained above, while the relative speed of payment card and cash transactions varies depending on the structure of the transaction and the equipment that the merchant is using, there are situations (such as at some fast-food restaurants) where the transaction may be processed more quickly if the customer swipes their payment card while the clerk is processing the order. Also, as is observed at gasoline stations, the acceptance of payment cards may facilitate the opening of additional checkout lines because these lines do not have to be staffed. This will shorten the length of lines and associated waiting times, making it less likely that potential customers will patronize another store where the lines are shorter. For example, as Layne-Farrar (2011) points out:

The notion here is that for every second a fast-food restaurant [or other similar retailer that faces capacity constraints] is able to shave off of its

⁷¹ <http://www.marketwired.com/press-release/wepays-small-business-payments-survey-data-suggests-the-death-of-checks-1804103.htm>. WePay indicates that “To conduct these surveys, WePay worked with third-party market research companies, Ipsos and Harris Interactive, to survey more than 1,000 small business owners and 2,000 consumers.” See also <http://www.marketwired.com/press-release/-1804103.htm>.

⁷² <http://www.forbes.com/sites/tjmccue/2013/08/16/why-dont-more-small-businesses-accept-credit-cards/>

⁷³ See discussion above in Section III. See also <http://www.forbes.com/sites/tjmccue/2013/08/16/why-dont-more-small-businesses-accept-credit-cards/> (“only 27% of purchases are made with cash” and that “66 percent of all point-of-sales (POS) transactions are done with plastic – credit, debit, or gift cards.” Moreover, cash sales are declining.”)

POS time, the more customers that QSR [Quick Serve Restaurant] will be able to serve during its peak lunch and dinner rush hours. Not only will the restaurant be able to get to the next order faster, lines will be shorter both at the counter and in the drive-through, lines that could deter potential customers from even stopping at the restaurant.⁷⁴

This view is supported by a QSR Magazine study which found that for every 10 seconds that an outlet can cut from the process of serving a customer, there is a gain of \$1,000 per month in revenue.⁷⁵

2. Increased Sales to Customers That Patronize the Store

The willingness of a merchant to accept payment cards may also affect the size of a customer's purchases.⁷⁶ This phenomenon is sometimes referred to as "ticket lift," since it reflects an increase in the charges on the customer's receipt ticket.

There are two principal reasons that the acceptance of payment cards can lead to "ticket lift." First, customers may buy more if they can use a payment card because they are not constrained by the amount of cash they have with them (or even by the cash in their bank

⁷⁴ Layne-Farrar (2011), p. 15.

⁷⁵ Lauri Giesen, *Fast Food Cooks up a Winning Card Recipe*, DIGITAL TRANSACTIONS, 16 (2005), available at <http://www.docstoc.com/docs/43869014/Fast-Food-Cooks-up-a-Winning-Card-Recipe>

⁷⁶ For example, Scott Burke states:

Increases Your Average Sales Order - Were you aware that you're [sic] AVERAGE SALE AMOUNT GOES UP when you accept credit cards? Studies prove (and I am sure it's true of most of us) that when we are ready to make a purchase and we are paying with a credit card we are more inclined to purchase the "upgrade" product or service. Human nature seems to cause most of us to be inclined to purchase the "better model or service upgrade" when we can finance the purchase with a credit card.

Impulse Purchases Go Up - Did you also know that your willingness to accept credit cards also causes impulse purchases to go up? Customers are more likely to purchase when they can use a credit card versus paying with cash or a check. For some reason human nature - especially in the US - causes us to think paying on credit is easier. (Scott Burke, *Accepting Credit Cards - Positives vs. Negatives* (2005) (available at http://www.smallbusinessbrief.com/articles/merchant_accounts/003644.html)

See also <http://www.womenssupportteam.com/documents/SiegelIncrseSaleswCreditCards10-06.pdf> and <http://www.c2m2a.com/2012/02/Increase-Your-Sales-Accept-Credit-Cards/>

account, when a credit card is being used).⁷⁷ Second, consumers may be psychologically inclined to make larger purchases when they are paying by payment card than when they are paying cash.⁷⁸ The empirical support for these two facts is discussed below in Section V, which reviews the relevant literature, and in Section IV, which reports the findings of our case studies.

⁷⁷ According to Robert Livingstone, president of Ideal Cost, a small- and midsize business credit-consulting firm based in West Palm Beach, Fla., “Customers spend up to 50 percent more with a card rather than cash, as they aren’t limited by what they have in their wallet.” <http://smallbusiness.aol.com/2011/06/29/can-you-afford-to-run-a-cash-only-business/> Similarly, it has been argued that “Giving your customers another way to pay for their purchases helps boost the average sale. In fact, customers paying with credit cards typically spend about 20 percent more than when paying with cash or check. Consumers generally feel greater financial freedom with their credit card.” (<http://www.monerisusa.com/payment-processing-services/benefits-of-credit-cards.aspx>)

⁷⁸ As is pointed out in more detail below (see Section V), this point is not only made in the psychology literature that is reviewed below, but is recognized in the popular press. See also <http://smallbusiness.aol.com/2011/06/29/can-you-afford-to-run-a-cash-only-business/> (“With cash, the consumer tends to feel the pain of paying, whereas a credit card can feel more like Monopoly money -- when using credit cards, people tend to be more frivolous and focused on what they're getting instead of what they're losing.”) and <http://www.gopromos.com/Article/How+small+businesses+can+increase+revenue+by+accepting+plastic+payments/800601616/Default.aspx> (“According to the infographic, a study of grocery store transactions found that consumers who use credit cards to pay for groceries racked up an average bill of \$67.60, compared to \$60.10 for debit purchases and \$37.90 for cash purchases. The ‘buy now, pay later’ nature of credit card transactions facilitates higher spending, which could boost small business revenue in a time of continuing economic instability.”)

IV. RETAILER CASE STUDIES

A. Objective of Retailer Case Studies

Because differences in transactional environments are likely to affect the relative costs and benefits of different payment methods, this study undertakes detailed case studies of five merchants' transacting processes. For each of these case studies, we undertook detailed interviews of the owner, we reviewed financial data that captured the sales revenues and costs associated with transactions undertaken with different payment systems, and we visited their retail operations to see first-hand how they operated and to measure transaction times. We believe this allowed us to develop a more complete and accurate understanding of how different payment systems support the retailer's sales and what it costs the retailer to obtain this support.

The five retailers included in our case studies were selected with an eye towards obtaining a range of different institutional environments. The specific types of retail establishments that were included in our case studies are: fast-food restaurant, full-service restaurant, gas station, convenience store, and small independent grocery store.

We focused on on-premise consumer transactions, since these are common retail transactions. This means that most business-to-business and business-to-government transactions are excluded. It also means that home delivery transactions and most vending machine transactions are excluded. However, in the case of the gasoline station, we undertook a study of the use of payment cards at automated gasoline pumps.

B. Study Design

Our study started with a telephone survey that was designed to identify retailers who would be willing to participate in detailed case studies of their establishment's cash and payment card transactions. Specifically, a third-party survey company called more than a hundred retail establishments in the greater Washington, D.C./Baltimore area (basically stores that were within

an hour drive from our offices in Washington DC). The phone survey involved a short interview of the establishment's owner (or some other individual who could authorize access to the establishment and the store's financial records). The respondents were told that we would pay them for participating in the study (although they did not find out the exact amount (\$500) until later).

While we were hopeful that we would be able to get five establishments of the type that ultimately participated in the study, we also surveyed other types of retail establishment (such as jewelry stores, gift shops, and drug stores). Using a list of "interested merchants" that was provided by the initial phone survey, EI personnel called retailers to learn more about their operation and to determine whether they were seriously interested in participating in the study. These interviews led to the selection of the five case study participants, along with the identification of a sixth merchant that provided data on how sales changed when there was a shift from a "cash only" policy to one that also allowed payment by payment card (see Section IV.D.2 for a discussion of these data).

As is indicated above, we interviewed each owner and obtained financial data from the owner. We also visited each store three times to collect transaction data. The resulting data led to the findings reported below.

C. Retailer Transaction Costs

1. Cash Handling Costs

Interviews with the five merchants consistently revealed that there were significant costs associated with cash transactions. All of the retailers spent considerable time processing the cash that flows through their businesses. Not surprisingly, they counted the cash going into and out of their POS devices when cashiers changed, they counted the cash that went to and came from

their bank, they incurred costs moving the cash to and from their bank, they experienced theft of money, and they invested in various security measures to protect their cash.

With respect to the security measures, all had some type of security equipment. This typically included a safe and security cameras. In some cases, this security equipment was provided by their franchisor, but non-franchisees also had equipment.

The convenience store and gas station were particularly concerned about potential robberies. In the case of the convenience store, the franchisor supplied a “smart safe” that allowed cashiers to immediately place large bills (\$20 or larger) in the safe. Moreover, cashiers were told that they should never maintain more than \$30 in cash in their till (and were sent home if they violated this policy). Similarly, while the gasoline station did not have a “smart safe,” the cashiers regularly deposited cash into a safe for which they did not have a combination. In addition, they were behind bullet proof glass.

All five of the retailers handled the transport of their cash to and from the bank themselves, rather than hiring an armored car company. These trips to their banks were viewed as risky, leading them to adopt strategies to reduce the chance that a robber would know when the owner (or a trusted employee/spouse) was taking cash to and from the bank.

Only the convenience store visited their bank daily, and this was because of a franchisor requirement. The others visited their bank 2-4 times a week. Individually, these trips to the bank were not too time consuming because the merchants’ banks were typically near their stores (often within a few minutes’ drive, and walking distance in a few cases), because they could either drop their deposits off in a secure safe, or because they rarely encountered sizeable lines at their bank.

However, this time adds up over the numerous visits. More specifically, the case study participants reported the following amounts of time per week taking cash to their banks:

- Fast-Food Restaurant: Reported 10-15 minutes/visit and 3-4 visits per week. We used 12.5 minutes and 3.5 trips, which implies 0.7 hours per week (43.75/60).
- Full-Service Restaurant: Reported three visits per week at 15 minutes each, which implies 45 minutes/week, or 0.8 hours per week (45/60).
- Gas Station: Reported four visits per week at 20 minutes each, which implies 1.3 hours per week (80/60).
- Convenience Store: Reported daily visits to deposit cash payments (at 12 minutes each) and trips three times a week to get change (at 27.5 minutes each). These trips together average around 2.8 hours per week $((12 \times 7) + (27.5 \times 3))/60$.
- Small Independent Grocery Store: Reported two visits per week. These visits involved a 10 minute walk (each way) and 10-30 minutes at the bank (which we averaged to 20 minutes). This implies 80 minutes per week or 1.3 hours per week $((2 \times 2 \times 10) + (2 \times 20))/60$.

The five case study participants did not perceive that their banks were charging them for processing the cash they deposited. Most reported that there was no incremental charge by the bank for processing the store's cash,⁷⁹ although study participants did recognize that the bank imposed certain requirements, such as minimum balances, which allowed the bank to profit from its activities. Our analysis assumes these bank charges are small and does not include them in the cost analysis.⁸⁰

⁷⁹ Only one participant reported fees, and these only applied if the store was involved in transactions that exceeded a threshold that they didn't expect to exceed.

⁸⁰ While none of our merchants' banks had transaction fees, there were some fees associated with using the bank. For instance, the grocery store owner mentioned a \$35 per month maintenance fee for using the bank's services. Additionally, the fast-food restaurant owner cited often dipping below his bank's minimum balance requirement, for which he incurred fees.

Typically, the case study participants spent substantial time processing cash to get it ready for the bank and controlling its flow to and from the cashiers. Specifically, the case study participants reported the following time spent handling the cash:

- **Fast-Food Restaurant:** The cashiers spend at least 10 minutes at the end of each day removing cash and setting up the till for the next day. In addition, there are periodic deposits into the safe during the day that require counting of cash and labeling envelopes, which adds at least another 5 minutes per day of cashier time. Finally, there is some checking and summation of these envelopes for deposit in the bank by the owner, which adds at least another 5 minutes per deposit (and there are 3-4 deposits per week). In total, this implies in-store processing time of 105 minutes per week of cashier time (7×15 minutes) and 17.5 minutes per week of owner time (3.5×5). This is equal to 1.8 hours/week and 0.3 hours/week respectively).
- **Full-Service Restaurant:** The restaurant owner spends approximately 8 minutes every morning and evening counting the three cash drawers, as well as a little more than 5 minutes to check them during the day (this is roughly 21.3 minutes a day), or about 2.5 hours per week ($(21.3/60) \times 7$). Additionally, the servers spend approximately 5 minutes per day counting their drawers. At around 7 servers per day, this amounts to 4.1 hours per week ($(5/60) \times 7 \times 7$).
- **Gas Station:** To process cash, the owner reconciles his employees' shift sheets, which takes 20 minutes per day, as well as counts the previous day's cash via a cash counting machine, which takes 5 minutes per day. Together, this amounts to 2.9 hours per week ($((20+5)/60) \times 7$). It takes each employee 15 minutes per day to fill out a shift sheet and prepare the tills at the beginning and end of each shift. With 3 employees per day, this amounts to 5.3 hours of cashier time per week ($(15/60) \times 3 \times 7$).
- **Convenience Store:** Clerks spend about 2 hours per day handling cash. There are 4 shifts per day, and the employees on each shift spend 30 minutes handling cash per shift ($(30/60) \times 4 \times 7$). The owner spends about 1.3 hours per day processing the store's cash. On days the owner picks up change from the bank (which is 3 times per week), his processing time is increased by 30 minutes per day. This implies 14 hours per week of employee time and 10.7 hours per week of owner time ($(1.3 \times 7) + (0.5 \times 3)$).
- **Small Independent Grocery Store:** The owner spends 10 to 15 minutes every morning and 5 to 10 minutes every evening (which we approximated at 20 minutes) to count the cash within the register. Additionally, once or twice a day she has to replenish the cash within the drawer, which takes 5 minutes. As a result, the owner spends roughly 25 minutes a day handling cash in the store, or 2.9 hours per week ($(25/60) \times 7$).

The time that it takes to process cash turned out to be hard to measure, since much of the time was hidden in small activities (such as periodically emptying a cash drawer). As a result, there is a real possibility that the times we report for processing cash are somewhat understated. Nonetheless, it is clear that substantial time is involved. Moreover, it is also clear that this time increases as the amount of cash processed by the merchant increases (rather than this being a fixed cost that does not vary with the amount of cash business). Indeed, the fact that the time spent processing cash increases with growth in the cash sales is reflected in the “fixed costs” that some of the higher cash-volume businesses incurred. For example, the gasoline station invested in a cash counter. Similarly, as is mentioned above, the convenience store invested in a smart safe that allowed cashiers to remove cash from the POS register throughout the day and store it in an organized way in a safe place.

2. Payment Card Costs

As indicated above, merchants pay fees when transactions are completed using payment cards. We sought data on the specific fees paid by the five case study participants. For the two non-franchise participants (Full-Service Restaurant and Small Independent Grocery Store), we were able to get complete payment card cost information for a month of transactions (August 2013 and May 2013, respectively). Obtaining this data for the franchisees (Gasoline Station, Fast-Food Restaurant, and Convenience Store) proved to be more difficult than we expected. Because the franchisees were not directly involved in negotiating the credit card arrangements (since this is done by the franchisor), they did not have first-hand knowledge of how the fees were set. Moreover, because the fees were passed through the franchisor, they did not have direct access to the bills submitted by the acquiring banks. Indeed, the fast-food owner was not sure how to access this information.

From the Gas Station we received gross charges and discounts/fees by card type and brand for May 2013. The transaction fees and discount rates are not separately reported to the franchisee in ways that would allow us to calculate Average Transactions Fees, Average Discount Rates or Average Card Costs Per Transaction by card. The data do allow us to calculate the overall Total Payment Card Costs for particular payment card networks as a share of sales. The values for the most common card types are reported in **Table IV.1**. As can be seen, credit card fees average around 2.4%, while Debit Card costs are lower (around 1.4%).⁸¹

Table IV.1
Gas Station Payment Card Costs

Payment Card	Share of Charges	Total Costs/ Sales
Discover	3.33%	2.34%
MasterCard	12.21%	2.32%
Visa	23.63%	2.24%
AmEx	7.52%	2.91%
Credit Card Total	46.69%	2.37%
MasterCard Signature Debit	16.83%	1.37%
Visa Signature Debit	30.97%	1.42%
Other Debit	0.33%	1.59%
Debit Card Total	48.13%	1.40%
Fuel Card Total	4.41%	2.77%
Store Card Total	0.77%	0.00%
Overall Total	100.00%	1.91%

Note: All debit cards used at the pump are run as "Signature Debit." Debit cards used inside at the PIN pad, use "Other Debit."

⁸¹ The figures in the table do not include some costs (such as foreign card fees, chargeback fees, fixed access fees, and declined authorization fees) that do not vary by transaction since these costs could not be allocated to credit or debit cards and were not large enough to have a significant effect on the results.

For the Convenience Store, we received only rate information for the various payment card brands for December 2011. The Discount Rates and Transaction Fees are shown in **Table IV.2**.

Table IV.2
Convenience Store Payment Card Costs

	Rate	Fee
Credit Card		
AmEx	2.46%	\$0.00
MasterCard	1.73%	\$0.10
Visa	1.76%	\$0.10
Discover	1.49%	\$0.10
Debit Card		
Debit	1.19%	\$0.10

The fast-food restaurant did not provide data that would allow us to calculate the fees that it paid. However, based on interviews with the owner and our review of publicly available information, we determined that its rates are likely to align with those paid by the convenience store.

We did obtain detailed data for the full-service restaurant and the small independent grocery store, since they were independent operations and were thus more involved in negotiating the fees. The costs are summarized in **Table IV.3** and **Table IV.4** below. As with the other merchants, debit cards involved somewhat lower fees than credit cards, which have discount rates of around 2-3% and transaction fees of around \$0.10-\$0.20.

**Table IV.3
Credit & Debit Rates/Fees
Full-Service Restaurant**

	Credit		Debit	
	Rate	Fee	Rate	Fee
MasterCard	2.40%	\$0.11	0.49%	\$0.22
Visa	2.47%	\$0.12	0.40%	\$0.23
AmEx	3.51%	\$0.05	N/A	N/A
Discover	2.30%	\$0.12	N/A	N/A

Note: Includes settlement discount rates, access rates, and credit surcharges. Includes all per-transaction fees and non-transaction fees (such as foreign card fees, chargeback fees, fixed access fees, and declined authorization fees).

**Table IV.4
Credit & Debit Card Rates/Fees
Small Independent Grocery Store**

	Credit		Debit	
	Rate	Fee	Rate	Fee
MasterCard	2.14%	\$0.09	0.31%	\$0.28
Visa	1.90%	\$0.14	0.39%	\$0.27
AmEx	2.89%	\$0.20	N/A	N/A
Discover	2.10%	\$0.16	N/A	N/A

Note: Includes settlement discount rates, access rates, and credit surcharges. Includes all per-transaction fees and non-transaction fees (such as foreign card fees, chargeback fees, fixed access fees, and declined authorization fees).

The payment card fee data we collected for the five case study participants are summarized in **Table IV.5**. While there is variation in charges across different payment cards (even within card type and brand), the fees do not vary so dramatically that one would be misled by using average values. This is particularly true since it typically was the case that a high percentage of the credit card sales were associated with a few types of cards, which had terms close to the average value.

**Table IV.5
Payment Card Fees**

	Fast-Food Restaurant	Full-Service Restaurant	Gas Station	Convenience Store	Grocery Store
Credit Card					
Average Discount Rate	1.75% ^a	2.78%	2.00% ^b	1.75% ^c	2.01%
Average Transaction Fee	\$0.10 ^a	\$0.10	\$0.10 ^b	\$0.10 ^c	\$0.13
Debit Card					
Average Discount Rate	N/A	0.37%	N/A	1.19%	0.37%
Average Transaction Fee	N/A	\$0.22	N/A	\$0.10	\$0.27

Notes:

^a Since information was not provided by the Fast-Food Restaurant owner regarding credit card rates and fees, the Convenience Store rates and fees were used, since both are franchises.

^b The average Gas Station payment card cost as a share of transaction size was 2.37%. Based on data from other study participants, this average suggests a discount rate of roughly 2% and a transaction fee of around \$0.10.

^c An average of the Visa and MasterCard rates is used, since these are the most often used cards.

As is shown in **Table IV.5**, while payment card fees vary, Average credit card payments involve the payment of a per transaction fee of around \$0.10-\$0.13 and a discount rate of 1.75% to 2.8%. In contrast, debit cards had a larger per transaction fee (around \$0.10-\$0.27), but a smaller discount rate (around 0.4%-1.2%). The results generally line up with the fees we found in the publicly available information reported above (see Section III.A).

3. Relative Transaction Times: Time in Motion Analysis

EI undertook detailed analyses of transaction times at each of the five stores included in the case study. Specifically, time-in-motion studies were undertaken that were designed to measure the difference in transaction time for cash transactions and payment card transactions. EI researchers stood near the cash registers with stop watches. They measured and recorded transaction times. Generally, the stopwatch was started when the cashier had rung up the total on the POS machine (since the time before this would be the same for cash and credit card transactions) and stopped the watch when the cashier was prepared to provide the receipt. However, measuring transaction times at two of the retailers was somewhat more complicated. It was more complicated at the gasoline station because we measured both transaction times

involving purchases at the pump and transaction times involving purchases at the cashier.⁸² It was more complicated at the full service restaurant because we distinguished transactions involving a tip from other transactions.⁸³

⁸² For the gasoline station, we measured the transaction times for gas sales at the outdoor pumps and for purchases at the cashier. If the customer paid for gas outside at the pump with a credit card, the transaction time began when the customer got out of the car and ended when the customer placed the gasoline nozzle in the car. Similarly, if the customer paid for gas inside the convenience store, either with a credit card or cash, the transaction time began when the customer got out of the car and ended when the customer placed the gasoline nozzle in the car. This transaction time included the time it took the customer to walk to and from the store, as well as the time paying inside the store. It did not include the time associated with returning to the store to get change, since this rarely occurred.

For the gasoline station, we also measured transaction times directly at the cashier. This was done in the same way that we measured other cashier transactions. Specifically, for pure gasoline purchases at the cashier we measured the period between the time the customer announces how much he or she wants at his gas pump, and the time the cashier hands the customer the change. For purchases at the cashier that did not involve the purchase of gasoline, the transaction time was the period between the time the cashier rings up the total amount owed and announces it to the customer and the time the cashier hands the customer change and/or a receipt. If the customer is offered a receipt, but turns down the offer, the clock stops at the time when the customer turns down the offered receipt. For “joint transactions” (which involved the purchase of gasoline along with something else), the transaction time was measured as the period between the time the cashier rings up the total amount owed and announces it to the customer and the time the cashier hands the customer change and/or a receipt. If the customer is offered a receipt, but turns down the offer, the clock stops at the time when the customer turns down the offered receipt.

This allowed us to record comparable times for (1) people who bought gas on a payment card at the pump and people who bought their gasoline by cash inside; (2) people who bought gasoline (perhaps with other items) inside the store using cash and those who made a comparable payment card transaction; and (3) people who made non-gasoline purchases inside the store with cash or payment cards.

⁸³ For the restaurant, the measurement of the transaction times was somewhat more complicated because there were several different types of payment for both cash and credit card payments.

For cash transactions, we calculated times in somewhat different ways depending on whether the customer required change or whether the customer let the server keep the change. For a “please keep the change cash transaction,” we measured the time it takes to process a cash-containing leather folder at the POS terminal. The stop watch was started when the server started to enter numbers into the POS terminal to record the cash transaction (which may involve the opening of the leather folder to identify the values to enter into the terminal). The watch was stopped when the server had completed the computer transaction which recorded the cash payment, pocketed the cash, and was ready to return to other duties. These “keep the change” transactions were identifiable because, for these transactions, servers would not put any change in the leather folders or undertake other actions that involved the return of the leather folders to the customer’s table.

For a “please make change cash transaction,” we calculated the sum of two time periods that we measured separately:

- The time period during which the server prepared the leather folder for return to the customer with the change and receipt. This first time period included both the time required to make change and the time required to enter the cash transaction into the POS system. This time period was measured by starting the stop watch when the server started the process to enter data into the computer (perhaps by counting the cash that had been provided in the folder) and by stopping the stop watch when they had completed making change, completed entering data into the POS system, and were free to return the folder to the table (or turn to other tasks).

Each of the five retailers was visited for major portions of three days.⁸⁴ These visits were staggered both with respect to the time of day and the day of the week so that data could be obtained from both peak periods and off-peak periods.

The results from these time-in-motion studies are summarized in **Table IV.4**.⁸⁵ As is reported in the table, we observed circumstances where credit cards transactions are faster than

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- The time it took to empty the leather folder that contained the tip. This time was estimated by assigning the few seconds it takes servers on average to remove cash from the leather folder and to put it in their cash pocket, since servers typically pick up the folders on the way to another task or are not busy at the time they pick up the tip money. However, we did not record this time since we observed that it took only 1-2 seconds for them to pick up the cash and pocket it.

For a restaurant's payment card transactions, we calculated the sum of two time periods that we measured separately:

- The time period during which the server prepared the leather folder for return to the customer with the credit card receipt for signing. This first time period mostly included the time required to record the credit card number in the POS system, since the meal charge was already there. This time period was measured by starting the stop watch when the server started to enter data into the computer (perhaps by picking up the credit card to swipe it) and by stopping the stop watch when they had completed entering data into the POS system, had put the credit card and credit card receipt in the leather folder, and were free to return the folder to the table (or turn to other tasks).
- The time it took to enter the tip that was added to the credit card receipt by the patron into the POS system so that the tip would be added to the credit card bill and the server would get credit for tip. This time period was measured by starting the stop watch when the server looked at the credit card slip to enter credit card tip into the computer and by stopping the stop watch when they had completed entering data into the POS system, had stored their copy of the credit card receipt, and were free to turn to other tasks.

⁸⁴ The full-service restaurant was visited four times, since the first visit was unexpectedly shortened when a thunder storm caused the restaurant to lose power. We report the limited data we collected on July 10th, as well as the data from the three other visits (July 13, 15, and 16).

⁸⁵ Our time-in-motion studies indicate the variation in transaction times across transactions, even for the same store and the same mode of payment. Nonetheless, like others we use average transaction times in our calculations. Our averages are similar to some of the values reported by others. For example others have used 19 seconds for cash, 26 seconds for debit cards, and 28 seconds for credit cards. (Working Group on Costs of POS Payment Products, SURVEY OF THE COSTS INVOLVED IN POS PAYMENT PRODUCTS (2004), pp. 6-7.) As is shown in **Table V.1**, others have used 16.9-28.5 seconds for cash, 17.9-46.6 seconds for debit cards, and 28-46.6 seconds for credit cards. As a result, our transaction time observations lie within the range identified in other studies.

cash transactions and vice versa. Not surprisingly, credit cards are at a significant advantage when they allow the customer to make a purchase without interacting with a clerk (such as the purchase of gasoline at an outdoor pump). Credit cards can also have a time advantage when customers can swipe their card while the cashier is running up the total and the customer does not have to sign a receipt (which is often the situation for the fast-food restaurant). However, it is interesting that this advantage did not show up as clearly at the convenience store.⁸⁶ EI personnel observing these transactions at the convenience store and the fast-food restaurant attributed the difference to the fact that the convenience store clerks appeared to be motivated to handle cash transactions quickly (perhaps because it was more common to have a queue of customers at the convenience store).

We were only able to identify PIN debit transactions at one location (the convenience store). Based on the data we obtained at this store, it appears that PIN debit transactions are more time consuming than credit card transactions. Specifically, we observed that, on average, PIN debit card transactions took around 5 seconds longer to complete than credit card transactions. In one extreme case the transaction took almost a minute longer.⁸⁷

⁸⁶ There was a small advantage for credit cards at the grocery store. The advantage was not larger because some credit card customers had to sign receipts, rather than being able to avoid this time consuming step. Specifically, because the owner requires individuals to sign a receipt for their purchases exceeding \$15 and because the owner required customers who requested a receipt to sign, credit card transactions often required a signature. Because this entire process does not take much longer than the time associated with counting out change in a cash transaction and because some credit card transactions did not require a signature, there was a small gap between the cash and credit card transaction times at the grocery store.

⁸⁷ Often, we observed that customers were not paying attention to the directions on the card scanner, so they did not type in their PIN until the cashier prompted them to do so. This lull and the subsequent time it took to type in the PIN were the primary causes of the slower times recorded for PIN debit card transactions.

Table IV.4
Transaction Times
(Minutes: Seconds. Fraction of Second)

Establishment	Minimum		Maximum		Mean			Median		
	Cash	Credit	Cash	Credit	Cash	Credit	Credit to Cash Ratio	Cash	Credit	Credit to Cash Ratio
Fast-Food Restaurant	3.31	6.71	1:35.22	56.25	23.43	19.26	0.8	21.56	17.1	0.8
Full-Service Restaurant	6.46	3.09	44.46	1:10.12	20.40	19.59	1.0	17.77	16.47	0.9
Full-Service Restaurant - with Tip	6.46	3.09	44.46	1:42.71	21.01	31.91	1.5	21.75	24.31	1.1
Gas Station - Pump Gas vs. In-Store Cash Gas*	15.56	15.13	3:08.85	1:38.41	1:08.49	37.97	0.6	1:01.40	35.19	0.6
Gas Station - In-Store Gas & Joint Sales	1.41	6.57	1:02.60	46.71	12.23	24.47	2.0	9.82	26.16	2.7
Gas Station - In-Store Non-Gas Sales	3.19	6.69	1:43.75	1:25.97	21.35	28.27	1.3	15.66	23.75	1.5
Convenience Store	3.5	4.22	1:11.18	43.62	17.10	18.36	1.1	14.75	17.35	1.2
Grocery Store	6.6	4.27	1:01.69	52.12	23.23	19.86	0.9	21.095	19.35	0.9

Notes: "Credit" includes all credit and debit cards that were run as "Credit."

*"Gas Station - Pump Gas vs. In-Store Cash Gas" captures gasoline-only credit sales at the outdoor pump and gasoline-only cash sales in store.

While cash transactions can be faster than credit card transactions and vice versa, typically, the difference in average transaction times is not that large. Except for gasoline stations (where credit cards are about 30 seconds faster for outdoor transactions and where cash was around 10 seconds faster for indoor transactions), the average transaction times were typically within about 5 seconds of each other. The advantages of allowing customers to swipe their credit cards at gasoline pumps are obvious, since it saves the time associated with walking from the car to the store and it saves cashier time because no cashier is involved in an “at-the-pump” transaction. However, the fact that credit cards were so much slower for gasoline station cashier purchases was somewhat surprising. Here, based on our observations of the process, it appears that customers felt free to leave cash on the counter for the gasoline station cashier to enter in the terminal that controlled gas flows through the pumps and walk away, while they had longer interactions with the cashier when they paid by payment card. The longest transactions, which were typically credit card transactions, involved payments for automotive repairs.

However, this is because of the qualitatively different nature of these transactions (*e.g.*, automotive repairs require an additional signature on the invoice).

Our case studies made it clear that characteristics of the transaction are important in determining transaction times. For example, at the full-service restaurant, while credit cards had a smaller minimum time compared to cash transactions, they had significantly higher maximum times. This is due mostly to the fact that small credit card transactions can be very fast, but large bills involving a group that is splitting the check and paying by multiple credit cards can take a lot more time. Also, the presence of tips may affect relative transaction times, since it is often faster to let a server “keep the change” (as in cash transaction) than to have the server enter a tip into the POS system (as is the case for payment card transactions). However, we found it difficult to track the time it took to process cash tips, so we were not able to fully test this proposition.⁸⁸

D. Relative Benefits of Different Payment Systems

1. Overview of Benefits of Accepting Credit Cards

There was a consensus among store owners that if they did not accept payment cards they would lose significant amounts of business. They perceived that numerous customers had a strong preference for being able to use payment cards and that they would lose sales to these

⁸⁸ As indicated above, at the full-service restaurant, we tried to measure the time it took to process tips separately. However, it was extremely difficult to capture a “tip time” for cash transactions. Often a customer would simply leave cash at the bar or on their table and leave. When the server/bartender had a free moment, they would collect the tip, which would be fractions of a second. However, it took considerably more time to process times on credit cards, since it forced the server to go back to the POS system and enter the time amount into the computer. While visiting the restaurant, we successfully captured one cash tip where the server returned cash and was then left with some portion of the cash for a tip; this took approximately 12 seconds. In contrast, the average time for processing a tip on a credit card was 24 seconds (but this average was increased by the fact that some of these tips involved the allocation of a bill (and tips) across multiple credit cards).

customers if they stopped accepting payment cards. Moreover, there was a perception that individuals who used payment cards tended to buy more than customers who paid cash.⁸⁹

Some owners provided anecdotes to support their views. For example, the owner of the fast-food restaurant pointed out that during periods when his Internet is “down” and he cannot accept payment cards, his business drops. Also evidencing a strong preference for the use of cards were stories involving power outages during which customers left their payment card information with the owner so he could charge them later for their purchases, rather than taking the more secure route of paying cash.

The owners’ views are supported by the fact that at all stores a significant, and in some cases majority, share of purchases were made using credit cards. As is shown in **Table III.1**, there is variation across establishments, which is to some extent associated with average transaction size. For example, it is not surprising that the full-service restaurant is highly dependent on credit card transactions (84% of revenues) given that these transactions tend to be larger.⁹⁰ Similarly, it is not surprising that the cash revenues at the fast-food restaurant (56.9%) and convenience store (61.8%) are still significant, since the transactions are smaller.

While most of the owners we interviewed did not feel comfortable providing estimates of how much their sales would fall if they stopped accepting credit cards, the owner of the full-service restaurant estimated that his business would drop between 10% and 20% if he stopped

⁸⁹ The owner of the convenience store even indicated that he read in a trade magazine that “people with credit cards pay 20-40% more than those with cash.”

⁹⁰ The average transaction revenues are: fast-food restaurant (\$8.29), \$61.40 (full-service restaurant, with tip); gas station, gasoline only (\$30.70), convenience store (\$6.05), and grocery store (\$13.71). Generally, a higher percentage of credit card transactions are associated with larger size transactions. This is not as true for the fast-food store, where both cash and credit card transactions are typically less than \$10.00. However, even here, we observed that there was a tendency to pay by cash for the smallest transactions and to pay by credit card for larger transactions (see discussion of transaction sizes below).

accepting credit cards.⁹¹ This roughly aligns with some estimates discussed in the literature reviewed in Section V.D, particularly values used by Layne-Farrar (2011).⁹²

2. Ticket Lift: Sales Increase When Stores Start Accepting Payment Cards

As is discussed below in Section V, there have been a number of reports of how sales levels changed over time when merchants started accepting payment cards. There appears to be a consensus that sales increase after a merchant starts accepting credit cards. Based on a review of many of these examples, Layne-Farrar (2011) concluded that there was at least a 10% increase in sales.⁹³

As part of the interview process we used to identify merchants who were willing to participate in our study, we asked merchants if they had changed their payment policy by shifting from a “cash/check only” policy to a policy where they would accept credit and/or debit cards. Only one case was found where a merchant undertook such a change in recent years. This merchant sold flowers (but was not a florist that was part of a floral network that delivered flowers based on Internet or telephone orders).

⁹¹ The owner also commented that, while he knows of some “top dog” restaurants that can afford to only accept cash, they are few and far between.

⁹² In her analysis, Layne-Farrar (2011) assumes both 10% and 20% ticket lifts. For quick service restaurants (QSRs), she justifies this by referring to various studies of ticket lift at fast-food restaurants. Specifically, she states:

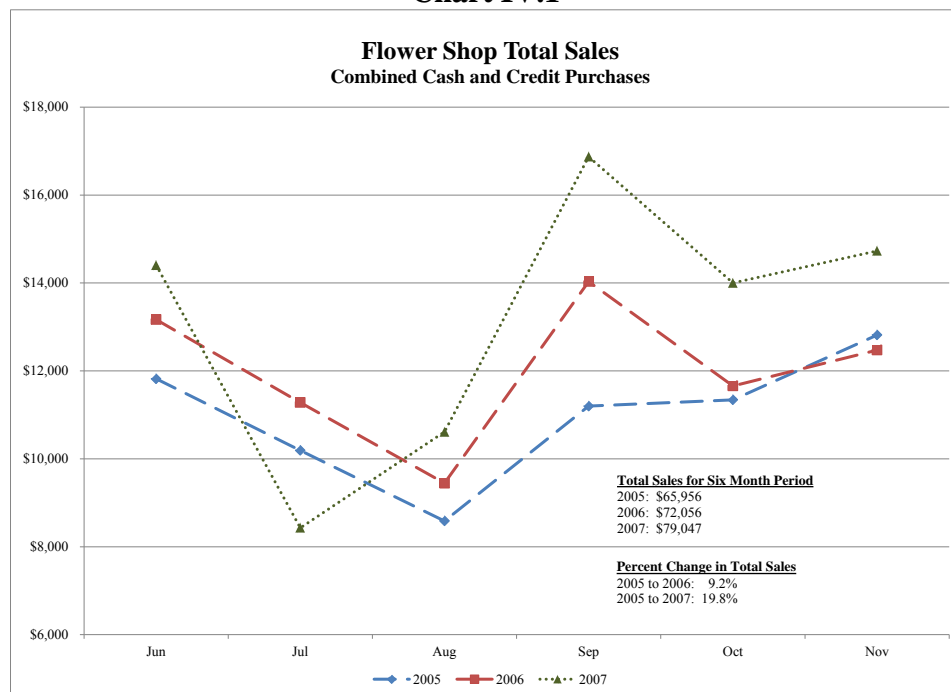
As noted earlier, ticket lift is the increased per transaction revenues that QSR merchants have reported when their customers pay with cards instead of cash. Sonic, one of the first QSRs to accept payment cards, found that its order tickets paid by card were 80 percent higher than cash tickets. Later QSR adopters reported more modest, but still sizable, gains on the order of 20-30 percent higher than cash transactions. (Layne-Farrar (2011), p. 14)

For discount stores she justifies the use of at least a 10% ticket lift by noting that an incremental purchase, even a magazine, would lead to a 10% ticket lift. (Layne-Farrar (2011), p. 23) For supermarkets, she justifies a 10% ticket lift by point to the fact that debit card purchases are more than 10% larger than cash purchases. (Layne-Farrar (2011), p. 25) She uses a 22%-34% ticket lift for gasoline stations, (Layne-Farrar (2011), p. 28) referencing a survey that “showed that customers purchased 45 percent more fuel when using a credit card.” (Layne-Farrar (2011), pp. 27-28, citing “Gasoline Service Station, SIC 5541”, Highbeam Business, <http://business.highbeam.com/industry-reports/retail/gasoline-service-stations>). She uses a 10% and 20% ticket lift for convenience stores and travel retail stores. (Layne-Farrar (2011), pp. 30, 36)

⁹³ Ibid.

While the flower merchant made the switch to payment cards several years ago, we were able to obtain some records that had been kept that showed monthly sales before and after the decision to accept credit cards. **Chart IV.1** plots the data we were able to obtain, showing sales levels for several months the year before the switch (in blue) and for comparable months after the switch (in red and green).⁹⁴ As the table shows, there was an increase in store sales after the change in policy. Averaging across the months, sales the first year after the switch in policies were 9.2% higher than they were the year before the switch and even higher in the second year (19.8% higher than before the shift). Moreover, consistent with this finding is the fact that 23% of the merchant’s sales the year after the change in policy were credit card sales (see **Chart IV.2**). This finding aligns with those reported by others who have reported comparable “before and after” results (See Section V.D.2).

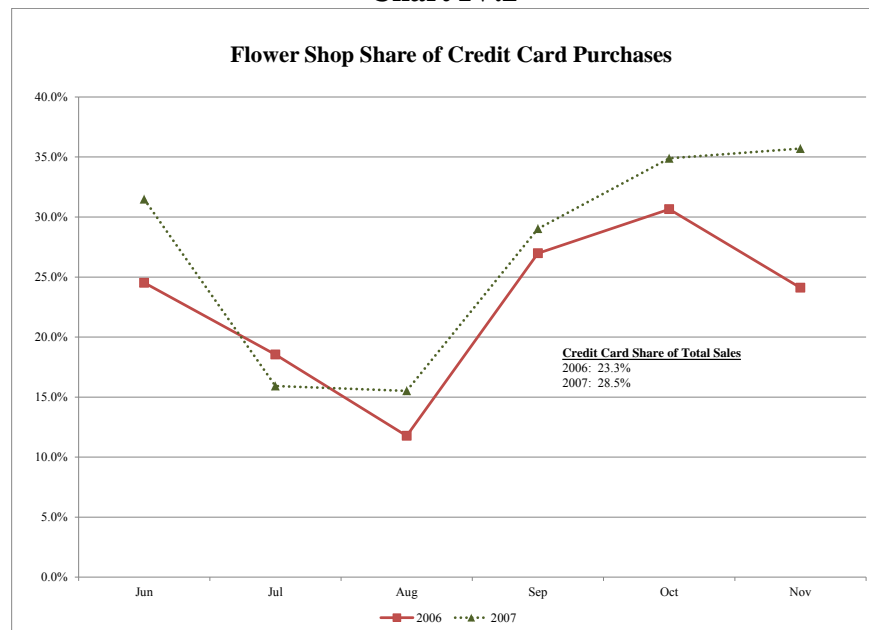
Chart IV.1



⁹⁴ Unfortunately, we were unable to get transaction-specific data that would have allowed us to explore whether the number of large dollar value transactions increased.

While it would have been helpful to get data from more years before the switch, so that any trend in sales growth could be identified, our discussions with the owner led us to believe that most of the growth in sales was due to change in credit card policies. However, it is less clear whether the continued sales growth in the second year after the change in credit card policy is attributable to the change in policy, although it is interesting (as is shown in **Chart IV.2**) that a growing percentage of the sales are credit card sales (e.g., growing from 23.3% in 2006 to 28.5% in 2007).

Chart IV.2



As part of our five case studies, we both asked owners about their impression of what the impact of accepting credit cards was on their business and looked for more transient shifts from accepting credit cards to not accepting credit cards to see if one could observe changes in sales levels. As is indicated above, all of the owners thought that the acceptance of credit cards increased their sales. Moreover, a few of them had “natural experiments” that they could report that confirmed these beliefs. For example, as is described above, the fast-food restaurant

reported that it made fewer sales when it was unable to process credit cards (such as during periods when it lost the Internet service it needed to support credit card sales).

In sum, available data from our study and earlier studies indicate that retailers experience a significant (likely double digit) increase in sales when they shift from a “cash/check only” policy to a policy of accepting credit cards. Moreover, retailers appear to believe that this relationship exists. While the size of this increase is likely to vary across businesses, probably being largest for businesses where average sales tickets are largest, it is even observed in businesses (such as fast-food restaurants) where the average ticket price is not that large.

3. Ticket Lift: Customers Who Pay With Credit Cards Buy More

As part of our five case studies, we collected financial data on the merchants’ transactions that allowed us to distinguish payment card sales from cash sales by individual transaction.⁹⁵ We collected and analyzed one week’s worth of data for each of the five establishments.⁹⁶ The results of this analysis are summarized in **Table IV.5**, below.

As is reported in **Table IV.5**, average and median credit card payments were always larger than cash payments. In some cases, they were noticeably larger (*e.g.*, more than twice as large at the full-service restaurant (with tip), nearly twice as large at the gasoline station, and about twice as large at the small independent grocery store). Moreover, when one looks at the maximum size purchases, one sees that, with the exception of the convenience store (where the

⁹⁵ There were almost no check sales, but these were recorded when observed. We also distinguished PIN debit card sales from credit card sales where we could, but most debit card sales were processed as credit card sales. In seven days’ worth of transactions, the gas station only had seven check payments. Three of these were for gas (average price: \$25.70), and the remaining four were made for auto repairs (average price: \$448.68). Additionally, there were only seven debit card purchases in this same period. The grocery store data only included one check transaction. The owner of the grocery store only accepts checks from customers she knows on a personal basis; likewise, she runs all cards as credit.

⁹⁶ Seventeen days’ worth and twenty-three days’ worth of transaction data were collected from the full-service restaurant and grocery store, respectively. These longer data collection periods were required to make the transaction volume comparable to the other three establishments studied. However, in our cost analyses, all merchant data was normalized to a one-week period.

largest purchase was only \$107), the largest purchases are made using credit cards (e.g., repair bills, which were sometimes over \$1,000, were paid by credit card at the gasoline station). This aligns both with the observation that customers prefer to use their credit card, rather than cash, when making large purchases and that customers will buy more when they can make their purchases with credit cards. The first of these observations suggests that store patronage will increase when a store accepts credit cards and the latter suggests that there will be ticket lift.

**Table IV.5
Transaction Payments**

Establishment	Minimum		Maximum		Mean			Median		
	Cash	Credit	Cash	Credit	Cash	Credit	All Payment Types	Cash	Credit	All Payment Types
Fast-Food Restaurant	\$0.41	\$1.04	\$40.60	\$43.25	\$7.81	\$9.06	\$8.29	\$7.09	\$7.79	\$7.36
Full-Service Restaurant	\$2.12	\$4.36	\$195.85	\$390.85	\$29.53	\$58.60	\$51.23	\$19.35	\$48.94	\$39.67
Full-Service Restaurant - with Tip	\$2.56	\$6.36	\$167.49	\$470.85	\$35.18	\$70.93	\$61.40	\$23.29	\$58.51	\$47.64
Gas Station - Pump Gas vs. In-Store Cash Gas*	\$2.00	\$1.04	\$100.81	\$177.99	\$21.17	\$37.59	\$30.70	\$20.00	\$36.00	\$25.44
Gas Station - In-Store Gas & Joint Sales	\$2.00	\$3.00	\$100.81	\$168.48	\$21.16	\$30.15	\$22.73	\$20.00	\$25.00	\$20.00
Gas Station - In-Store Non-Gas Sales	\$0.27	\$1.05	\$400.00	\$1,143.80	\$8.60	\$52.98	\$24.14	\$5.37	\$8.99	\$7.50
Convenience Store	\$0.10	\$0.99	\$107.04	\$102.11	\$5.15	\$8.45	\$6.05	\$3.53	\$6.89	\$4.22
Grocery Store	\$0.35	\$1.40	\$88.22	\$150.00	\$9.27	\$18.19	\$13.71	\$6.76	\$14.48	\$10.25

Notes: "Credit" includes all credit and debit cards that were run as "Credit."

*"Gas Station - Pump Gas vs. In-Store Cash Gas" captures gasoline-only credit sales at the outdoor pump and gasoline-only non-credit sales in store.

The observation that cash transactions tend to be smaller is also reflected in some direct observations we made when we were in the stores.

- At the fast-food restaurant, the transactions data indicate that 15.4% of cash transactions are below \$4, whereas only 6.3% of credit card transactions are below this threshold. Additionally, 8.6% of credit card transactions are between \$14 and \$18, while only 4.1% of all cash transactions fit into these boundaries. When we were at the fast-food restaurant, we observed that it was not uncommon for a customer, who had purchased their meal and who had sat down to eat, to realize they wanted to add a soda, bag of chips, or cookie to their order. They would then go up to the register and purchase these add-ons with cash, even if they had purchased the sandwich with a credit card. Additionally, customers who entered the store to just buy a beverage (perhaps in order to get change) would pay with cash. In contrast, if a customer bought several sandwiches (say, for a family), they were likely to pay with a credit card.

- For the full-service restaurant, we observed that most of the cash transactions occurred at the bar, where customers would pay for their drinks in cash, rather than credit card. This explains the difference in average costs, with the mean credit card sale equating to \$70.93, compared to an average of \$35.18 for cash sales, which is roughly the cost of four drinks (or a bottle of wine) at the bar. These smaller bar transactions purchases push up the overall number of cash transactions to 26%, but the higher dinner purchases are generally paid with credit cards.
- At the gasoline station, we observed that, while a sizeable number of customers who purchased gasoline paid for it with cash, cash customers tended to purchase smaller amounts of gasoline than credit card paying customers. For instance, 75.9% of cash customers purchase \$25 or less of gas, whereas only 29.5% of credit card customers spend less than \$25 on gas. For non-gas purchases, we noticed that around 75% were cash transactions, but these cash transactions were largely small food purchases within the convenience store. Moreover, the more expensive auto repair services were paid with a credit card.
- At the convenience store, we observed that cash was regularly used for the numerous very small purchases, while the largest purchases tended to be paid for using credit cards.
- At the small independent grocery store, the cash transactions often were sales of sandwiches sold through the popular sandwich shop at the back of the store. Similarly, we observed that individuals who came to pick up a few vegetables from the store's selection of organic, locally-grown vegetables tended to pay in cash. However, when customers came in for much bigger grocery purchases, they were observed to use credit cards. This accounts for the mean cash purchase being \$21.17 (roughly two sandwiches) and \$37.59 for credit cards.

While credit card purchases are on average larger than cash purchases, retailers are allowing customers to make quite small purchases using credit cards. For example, all of the retailers in the sample report credit card transactions that are below \$5.00 (*e.g.*, Fast-Food Restaurant (\$1.04), Full-Service Restaurant (\$4.36), Gas Station (\$1.04), Convenience Store (\$0.99), and Small Independent Grocery Store (\$1.40)). One of the case study participants explained this willingness to accept credit cards for small purchases as a desire to present themselves as a convenient place to shop. Moreover, while there was some concern that the payment of the credit card fee might eliminate the profit, it must be remembered that the transaction fee is typically around \$0.05-\$0.10 for most credit cards and that the discount rate is

often around 2%, so that the retailer may still be earning an incremental profit on a \$1.00 sale, if the retailer's gross profit margin on the item exceeds 7%-12%, which it usually does.⁹⁷

⁹⁷ Based on Census data, gross margins typically are around 30%. Specifically, retail grocery stores have gross margins of around 25-28%, food and beverage stores have gross margins of 25%-29%, and gasoline stations earn gross margins of around 15-23%. <http://interstratics.com/interstratics-home/2010/3/13/retail-gross-margin-comparison.html>. The gross margin of restaurants is reported to be around 37%. http://csimarket.com/Industry/industry_Profitability_Ratios.php?ind=914. Other sources report that "most major retailers only have a gross profit margin in the 20 to 30 percent ranges." The "average independent restaurant has a gross profit margin of around 58 percent, and the average grocery store gross profit margin is 20 percent." (http://www.ehow.com/info_7906425_good-gross-profit-margin.html) An exception to this would be if the retailer sells items at cost, such as stamps (sold by the convenience store).

V. THE COSTS AND BENEFITS TO RETAILERS OF CASH TRANSACTIONS RELATIVE TO CREDIT CARD TRANSACTIONS: A REVIEW OF THE LITERATURE

A. Introduction

A number of earlier studies have tried to quantify the costs associated with different payment systems. Many of these studies focus on “social costs,”⁹⁸ rather than a merchant’s costs. Social costs include the costs borne by all the participants in the financial system, not just merchants. However, some of the earlier studies attempted to estimate the costs retailers incur when using different payment methods. This section reviews the latter studies. As is explained below, many of the findings of this report confirm and extend the findings of these earlier studies.

B. Measurement Issue: Cost per Dollar versus Cost per Transaction

When quantifying the relative costs of different types of payments, it is important to recognize that there is variation in transaction size across payment types. Specifically, as is shown in Section V.D.2, credit card transactions are typically larger than cash transactions (although there is an overlap in transaction sizes). As a result, one can get different relationships if one uses “cost per transaction” than if one uses a “cost per dollar transacted.”⁹⁹ Moreover, if

⁹⁸ Shampine (2012) provides a review of many of these studies, including a table that summarizes the results of these studies. Results of studies done in Australia, Belgium, Netherlands, and Norway are summarized in Fumiko Hayashi and William Keeton, *Measuring the Costs of Retail Payment Methods*, *ECONOMIC REVIEW OF THE FEDERAL RESERVE OF KANSAS CITY*, (2012), pp. 37-77. A similar study conducted by the Bank of Portugal, where cash use is still much more prevalent, found that societal costs would be lowered if consumers would switch to card-based payments for larger purchases, *RETAIL PAYMENT INSTRUMENTS IN PORTUGAL, COSTS AND BENEFITS*, Banco de Portugal (2007). The European Central Bank found that in over one third of countries cash was not the lowest cost payment method. Schmiedel et. al., *THE SOCIAL AND PRIVATE COSTS OF RETAIL PAYMENT INSTRUMENTS, A EUROPEAN PERSPECTIVE*, Occasional Paper Series No. 137, (2012).

⁹⁹ For example, a 2000 Food Marketing Institute study concluded that, on a per-transaction basis, cash was the lowest cost payment method for grocery stores, but that the cost per \$100 of sales was comparable between cash and debit cards. David Humphrey, *Retail Payments: New Contributions, empirical results, and unanswered questions*, *JOURNAL OF BANKING AND FINANCE*, 34 (2010), p. 163. Also, the perceptions of retailers about the relative costs of different payment systems may be affected by the perspective that they have.

one is assessing what costs would be incurred if a specific transaction was shifted from one payment system to another, one might get yet a third relationship.

Since we are focusing on how much of a retailer's revenue is attributable to payment costs, a comparison that is based on the costs per dollar transacted (or costs per \$100 transacted) is appropriate. However, since transaction cost analyses start with actual transactions, it is conventional to report the costs per average transaction, indicating how the average and median sizes of transactions vary across different payment systems. One can then adjust these figures to determine how much it costs to generate a specified level of revenues, which is what we do.

Garcia Swartz, Hahn, & Layne-Farrar (2004) is illustrative of this approach. Specifically, they compute the cost per transaction of typical transactions for a particular payment system and then multiply these values by the number of such transactions that would be required to generate \$100 in revenue. Specifically, in their study of small independent grocery store transaction costs they observe that grocery stores had to make 8 to 9 cash transactions to generate \$100 in revenues, but only had to complete about 2 credit transactions to generate \$100 in revenues. As a result, costs such as tender time can be much higher for \$100 in cash transactions than \$100 in credit card transactions, even when those costs do not seem to differ much per transaction because many more cash transactions are required to generate the \$100 in revenues.

C. Relative Costs of Different Payment Systems

1. Review of Studies

The key North American retailer-cost studies that we have identified are Garcia Swartz, Hahn, & Layne-Farrar (2004, 2006), Arango & Taylor (2008), and Layne-Farrar (2011). There are other studies involving foreign firms (*e.g.*, Schwartz, Fabo, Bailey, & Carter (2007), and

Segendorf & Jansson (2012)), but these involve different market environments.¹⁰⁰ In addition, there have been some surveys of retailers that ask for general opinions about the relative costs of cash and payment cards.¹⁰¹

Table V.1 provides a summary of the key cost estimates provided by the three most applicable cost studies. Specifically, it reports estimates of the following cost items: tender time, deposit reconciliation time,¹⁰² deposit preparation time, deposit time at bank, payment processing fees, cash deposit fees, coin ordering, theft/counterfeit costs, chargebacks, float costs, fraud prevention costs, theft prevention costs, and equipment acquisition costs. However, to understand the results reported in the table, it is helpful to have some background on the three studies summarized in the table.

¹⁰⁰ These two foreign studies report tender times that are comparable to those reported in the U.S. studies (*e.g.*, 20-26 seconds for cash; 25-50 seconds for credit). However, the valuation of labor costs and other institutional considerations led us to focus on the U.S. studies. Nonetheless, these studies do find that on average credit card transactions are larger than cash transactions, that the cost differential shrinks when one recognizes that it takes several cash transactions to generate the same revenue as a credit card transaction, and that there are costs to using cash that at least partially offset the credit card fees that retailers incur. Schwartz, Fabo, Bailey, & Carter (2007), and Segendorf & Jansson (2012)

¹⁰¹ *See, e.g.*, Curtin (1983) and the use of these study results in Humphrey & Berger (1990). The Curtin (1983) study relied on a telephone survey of retailers. If the retailer agreed to participate in the survey, the surveyor attempted to speak with the most knowledgeable person they could find on the question of costs. This person was asked to estimate the average dollar amount of a typical cash transaction and then asked, “[t]hinking of all costs to your business for accepting payment by cash – what would you say is the average cost for this typical size transaction?” Responses were roughly 2.0% cost for cash, 2.5% for checks and 4.0% for credit cards. For a critical discussion of survey results and the failure to report confidence intervals, see Allan Shampine AN EVALUATION OF THE SOCIAL COSTS OF PAYMENTS LITERATURE, January 2012, Working Paper available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1984248.

¹⁰² This captures the time it takes to count cash in the till and reconcile with cash register receipts.

Table V.1
Cost by Type of Payment: Literature Review

Cost Item	Garcia Swartz, Hahn, Layne-Farrar (2004)						Arango & Taylor (2008)			Layne-Farrar (2011)			
	US dollars 2003 Grocery Stores (Members of FMI)						Canadian dollars 2006 Retail Nationwide			US dollars 2010 Wal-Mart, Costco, Target			
	Cash	Check	Verif. Check	Credit	Sign. Debit	PIN Debit	Cash	Debit	Credit	Cash	Check	Sign. Debit	PIN Debit
Transaction size:	\$11.52	\$54.24	\$54.24	\$44.50	\$33.00	\$41.05	\$36.50	\$36.50	\$36.50	49.38†	\$54.32	\$54.32	\$54.32
Tender time (seconds)*	28.5	67.4	62.2	46.6	46.6	44.0	19.0	26.0	28.0	16.9	57.0	19.4	17.9
Tender time cost	\$0.110	\$0.260	\$0.240	\$0.180	\$0.180	\$0.170	\$0.051	\$0.070	\$0.080	\$0.041	\$0.136	\$0.046	\$0.043
Deposit reconciliation time							\$0.033						
Deposit preparation time	\$0.004	\$0.030	\$0.030				\$0.033			\$0.027			
Deposit time at the bank							\$0.025						
Armored car										\$0.001			
Payment processing fees		\$0.060	\$0.160	\$0.940	\$0.560	\$0.410		\$0.120	\$0.730		\$0.080	\$0.538	\$0.376
Cash deposit fees	\$0.004						\$0.078			\$0.059			
Coin ordering							\$0.006						
Theft/counterfeit**	\$0.190	\$0.270	\$0.030				\$0.025			\$0.041	\$0.489	\$0.022	\$0.022
Chargebacks				\$0.020					\$0.016				
Fraud prevention										\$0.094			
Float	\$0.001	\$0.010	\$0.010	\$0.010	\$0.010	\$0.004	\$0.006	\$0.001	\$0.001	\$0.001	\$0.001	\$0.002	\$0.000
Totals for transaction size	\$0.31	\$0.63	\$0.47	\$1.15	\$0.75	\$0.58	\$0.26	\$0.19	\$0.83	\$0.26	\$0.71	\$0.61	\$0.44
Scaled to \$100 of sales	\$2.68	\$1.16	\$0.87	\$2.58	\$2.27	\$1.42	\$0.70	\$0.52	\$2.27	\$0.53	\$1.30	\$1.12	\$0.81

*GSHLF (2004) reported time only for cash; the others were derived using tender time cost.

**GSHLF (2004) combines other categories (check losses & collection fees, credit card chargebacks, armored car)

† She does not use average cash transaction size but instead computes cash transaction size assuming 10% ticket lift from debit cards. According to GSHLF (2004), discount stores in 1994 had cash transactions averaging \$15.49, checks averaging \$43.93, credit cards averaging from \$37.60 to 48.43, depending on the card system. She also assumes the same transaction size for checks and debit.

Garcia Swartz, Hahn, & Layne-Farrar (2004, 2006): These authors have published several studies that provide insights into the costs and benefits of different payment systems. Much of their analysis evaluates the social costs and benefits of different payment systems, rather than focusing on the merchant's perspective. However, their report includes information on the costs small independent grocery stores incur when accepting payment in different forms. **Table V.1** summarizes the information that they provide related to these costs. Key variables reported in **Table V.1** were obtained as follows:

- Tender Time/Tender Costs are based on tender time cost estimates that were derived from a Food Marketing Institute (FMI) study, where tender time measures the time that register attendants spend to process payment for a transaction, not including the time to ring up individual items. They then multiply these tender times by a wage of \$13.89/hour to get the tender time costs.¹⁰³ These are reported on a tender cost/transaction basis by type of transaction (with the size of transaction varying across payment methods).
- Deposit preparation time measures the time associated with preparing a typical paper bank deposit for a merchant's bank account, such as counting cash and reconciling the register drawer. These are reported on a deposit preparation time cost/transaction basis for cash and check transactions.
- Bank charges are explicit fees, such as a deposit fee for cash and checks. These are reported on a cost/transaction basis for check and cash transactions, with the size of the transaction varying.
- Payment processing fees reflect the charges for payment cards. These are reported for credit card and debit card transactions on a cost per transaction basis (with the size of the transactions varying).
- Other Direct Costs/Counterfeit/Theft reflects miscellaneous costs incurred (including collection fees and theft) on a transaction basis. For cash transactions, it adds \$0.16/transaction in other direct costs from their Table A1 to \$0.03/transaction cash theft costs reported in Table A3. No theft costs are added for other payment systems.

¹⁰³ This wage rate was derived from their tables using the fact that they reported both a cost of \$0.11 and a time of 28.5 seconds for cash sales. The seconds reported in **Table V.1**, other than the one for cash, are derived from the transaction costs reported by Garcia Swartz, Hahn, Layne-Farrar (2004) assuming this wage rate (\$13.89/hour).

- Charge backs are deductions of disputed amounts from payments by credit card companies to retailers because the retailer was unable to provide evidence that they were owed the disputed amount. These are reported for credit cards on a cost per transaction basis, for a specified transaction size.
- Float represents the money the retailer loses because the payment it receives is not transferred to its interest bearing account immediately. Because the losses from float are proportional to the size of the payment, one must adjust the values for differences in the size of the transactions. While the report only provides float estimates for \$11.52 and \$52.24 transactions, it is possible to estimate values for the other transaction sizes using this proportionality and the values reported.

As is shown in **Table V.1**, Garcia Swartz, Hahn, & Layne-Farrar (2004) report that because credit card transactions are about four times larger than cash transactions, (\$44.50 versus \$11.52), the costs per \$100 of generated revenue are comparable for cash and credit card transactions (\$2.68 versus \$2.58). This holds true even though they use tender times from almost a decade ago that, given changes in credit card processing, likely overstate the time it takes to complete credit card transactions relative to cash transactions (46.6 seconds versus 28.5 seconds).¹⁰⁴ However, again one must recognize that because credit card transactions are nearly four times larger than cash transactions, it takes about four cash transactions (or about 110 seconds) to generate the same amount of revenue as is generated by the average credit card transaction.

Arango & Taylor (2008): This study uses a blend of U.S. and Canadian data to estimate variable transaction costs for cash, debit cards, and credit cards payments for Canadian merchants. The focus is on determining how a merchant's profits would be changed if a marginal sale is shifted from credit card to cash (or vice versa), rather than on evaluating the

¹⁰⁴ Our data report less than a 5 second difference in transaction times for the grocery store in our study, which is mostly attributable to a decline in the time associated with processing credit cards (since we report a 23.23 second transaction time for cash transactions, which is comparable to the 28.5 second time that is reported by Garcia Swartz, Hahn, & Layne-Farrar (2004).

profitability of accepting credit cards. As a result, the authors focus on the costs associated with the median cash transaction (\$36.50) when that transaction is completed using the three different payment systems.

While the focus of the Arango & Taylor (2008)¹⁰⁵ paper differs somewhat from our focus, it does provide insights into the relative costs of different payment systems. Specifically, they provide estimates of the following costs: tender time, deposit reconciliation time, deposit preparation time, deposit time at bank, payment processing fees, cash deposit fees, coin ordering fees, theft/counterfeit costs, chargebacks, and float costs. These retailer costs are measured in the ways described below:

- Tender time costs are based on the multiplication of estimated tender times and labor costs (estimated to be \$9.60/hour based on the cashier wage rate from a Canadian national survey). The tender times, which are derived from a Dutch National Bank study,¹⁰⁶ are 19 seconds for cash, 26 seconds for debit cards, and 28 seconds for credit cards. The authors report that these values are similar to those observed in a proprietary study of U.S. retailers to which they had access.¹⁰⁷
- Deposit reconciliation time reflects the labor costs associated with reconciling the cash on a per transaction basis. The associated times were obtained from interviews with 35 merchants. On average, a merchant takes around 24 seconds per transaction to prepare and reconcile cash payments. Faster merchants are reported to be able to do this in as little as 12 seconds.¹⁰⁸
- Deposit preparation time reflects the labor costs associated with preparing the cash for deposit on a per transaction basis. The associated times were obtained from interviews with 35 merchants.

¹⁰⁵ This paper is available at <http://www.econstor.eu/bitstream/10419/66925/1/618936777.pdf>. See also summary of this paper in Arango & Taylor (2008-2009) available at http://www.bankofcanada.ca/wp-content/uploads/2010/06/arango_taylor.pdf

¹⁰⁶ De Nederlandsche Bank, Working Group on Costs of POS Payment Products, National Forum on the Payment System, THE COSTS OF PAYMENTS: SURVEY ON THE COSTS INVOLVED IN POS PAYMENT PRODUCTS (2004), (no longer available at <http://epso.intrasoft.lu/papers/DNB-cost-of-payments.pdf>).

¹⁰⁷ See note 10 in Arango & Taylor (2008-2009) http://www.bankofcanada.ca/wp-content/uploads/2010/06/arango_taylor.pdf

¹⁰⁸ See note 11 in Arango & Taylor (2008-2009) http://www.bankofcanada.ca/wp-content/uploads/2010/06/arango_taylor.pdf

- Deposit time at bank was assumed to be 20 minutes per deposit. No armored car fees were included because of lack of information.
- Payment processing fees were based on the median per transaction fees obtained in their survey (2% for credit cards (which is in the middle of the 1.75%-2.5% range that was observed) and \$0.12/transaction for debit cards (which ranged from \$0.07 in the lower quartile to \$0.25 in the upper quartile).
- Cash deposit fees were taken from a major Canadian bank's brochure that reported a fee schedule.
- Coin ordering fees were taken from a major Canadian bank's brochure that reported a fee schedule.
- Theft/counterfeit costs combine cash theft costs (derived from a 2007 Retail Loss Prevention Survey, conducted by the Retail Council of Canada and the Royal Bank of Canada) and counterfeiting costs (derived from the annual average counterfeits passed in 2004-2006 divided by average total cash sales in the same period). Employee theft was believed to occur at 35% of the merchants/year and intrusions were believed to occur at 23% of the merchants/year. This leads them to use a 29% annual frequency of theft and a 75% cash-sale loss per event to estimate theft costs.
- Chargebacks were derived from Garcia Swartz, Hahn, & Layne-Farrar (2004).
- Float costs were calculated separately for each type of payment. For cash, float costs were derived based on a recognition of both the time it takes before the cash payment is deposited by the retailer and the time it takes the bank to credit the deposit in the retailer's account. Frequency of depositing cash in banks varied: daily (18%), once a week (27%), twice a week (22%), and 3-6 times a week (33%).

Arango & Taylor (2008) find that debit cards involve lower retailer costs than cash for the \$36.50 median transaction they study, while credit cards are more costly. This finding is largely attributable to the relatively low debit card cost (\$0.12/transaction) they assign, which does not align with the values used in other studies. The cash costs that are reported (\$0.26/transaction) are comparable to those observed in other studies, although this transaction cost is assigned to a larger cash transaction than is observed in some other studies.

While differences in cash and card tender times do not appear to drive the results, one should recognize that the tender times used in the Arango & Taylor (2008) study are much lower

than those reported by Garcia Swartz, Hahn, & Layne-Farrar (2004), but not as low as those reported by Layne-Farrar (2011), which is discussed below.

Layne-Farrar (2011): The author estimates the transaction costs associated with different payment systems at a number of different types of retailer, including quick serve retailers, big box discount stores, supermarkets, gasoline stations (fuel and convenience store purchases), and travel retail stores (which are retailers located in travel centers, such as airports). For each type of retailer, Layne-Farrar (2011) reports the costs per transaction associated with point of sale (POS) time, Back Office Costs, Bank Costs, Float Costs, Theft/Robbery/Fraud Costs, Counterfeit Costs, Fraud Prevention, and Other Direct Costs. Layne-Farrar (2011) reports costs for cash, signature debit, and PIN debit transactions for all five types of retailer. They do not report credit card costs.

While Layne-Farrar (2011) uses much the same cost categories as the other authors, there are differences. The basic definitions she uses are as follows:

- POS Costs are estimated by multiplying a wage times a transaction time. Transaction times were multiplied by an hourly wage of \$8.37/hour for food service and \$9.61/hour for department stores. She reports the following times for the different types of retail establishment:
 - QSR: 4.5 seconds for cards and 9 seconds for cash, which reflects the fact that QSR transactions are low-price transactions that can be paid by swiping cards and not providing a signature or PIN.
 - Discount stores and supermarkets: 19.39 for signature debit, 17.89 seconds for PIN debit, 16.94 seconds for cash.
 - In her analysis, she focuses on an individual transaction, so she does not reflect the fact that it may take two or more cash transactions to generate the same sales value as a single card transaction. This means that she does not multiply the cash transaction times by a number that reflects the smaller average size of cash transactions.
- Back Office Costs are based on the FMI study of supermarket costs. It was assumed that there was an average deposit preparation time of 36.5 minutes and that the

- number of deposits prepared per day was 1 for QSRs and 2.7 for discount stores and supermarkets. This time was multiplied by \$14.58 for QSRs, \$13.03 for discount stores. The total daily value was divided by the total daily cash transactions to get the average back office costs per transaction.
- Bank Costs reflect the costs a retailer incurs from having a bank process their cash deposits or credit cards.
 - For cash deposits, it was assumed that there was a deposit fee of \$0.0012/dollar deposited, which is Wells Fargo Bank's charge at the time.
 - For card transactions, the cost (payment processing fee) was estimated by multiplying the relevant merchant discount by the transaction size. The discount rates were estimated using a variety of publicly available information.
 - Float Costs reflect the cost of the delay between purchase and when the payment is deposited in the retailer's interest bearing bank account. It was estimated by multiplying the relevant transaction amount by the number of days for the transaction to clear (1.46 for signature debit, 1.00 for cash, and 1.07 for check) and then by the interest earned each day (0.74%/365). PIN debit transactions are assumed to clear within a day and thus there is no float cost.
 - Theft/Robbery/Fraud Costs are based on three different estimates.
 - Fraud costs are based on the values reported in the FMI 2003 study on fraud losses at supermarkets using the assumption that fraud costs are proportional to sales. For example, for debit transactions fraud costs are assumed to be 0.04% of revenues.
 - Robbery costs were estimated based on supermarket losses from robberies (about \$2,592/store per year). These sales were divided by annual sales to get an estimated loss per dollar sold.
 - Employee theft costs are based on the FMI study's finding that there were 3.47 incidents per store/year and \$450.49 was recovered per incident. Adjusting for undetected incidents, it is assumed that there are \$766/year in employee theft per store. This amount is divided by annual cash sales for the employee theft losses per dollar sold.
 - Counterfeit Costs, which only apply to cash transactions, are estimated (using data from the Federal Reserve Board of Chicago), to be \$0.80 per \$10,000 of transaction, which implies a cost of \$0.8/10,000 per dollar sold.
 - Fraud Prevention costs are estimated from the FMI study. The FMI study reported that the average supermarket incurred \$28,356/year in loss prevention costs. There is an assumption that 25% of loss prevention costs can be allocated towards cash loss

prevention. The resulting amount is divided by sales to determine the fraud prevention cost per dollar sold.

- Other Direct Costs are assumed to only include armored car costs. Using the FMI study data, it is assumed that supermarkets have 2.7 deposits per day and that the annual costs are \$2,357. For QSRs it is assumed that there is only one deposit per day, which is assumed to cost \$2,357/2.7. The annual costs are divided by annual sales to get an armored car cost per dollar sold.

A key difference between the Layne-Farrar (2011) study and other studies (including ours) is that she is trying to address the question of what are the profit implications for the retailer if a particular cash transaction becomes a credit card transaction assuming that this shift causes some “ticket lift” that increases the transaction size. As a result, she provides some information that can be applied to the question we are analyzing. As an example, we have included her analysis of big box discount stores in **Table V.1**.

With respect to big box discount stores, Layne-Farrar (2011) focuses on a situation where she assumes that debit card transactions are 10% higher than cash transactions, which leads her to set the transactions sizes at \$49.38 and \$54.32 respectively. This means that the transaction sizes she reports (and that are reflected in **Table V.1**) are not as different for cash and debit cards as they likely would be if average transaction sizes were used (since cash transactions are reported to have averaged around \$15.49).

As is shown in **Table V.1**, she assumes that tender times for cash and debit cards are about the same (roughly 17-19 seconds). However, she recognizes that for QSRs both cash and debit card transaction times may be faster than they are for big box retailers, with debit card transactions being about 5 seconds faster than cash transactions (4.5 seconds for cards and 9 seconds for cash). These transaction times are faster than are reported by the other two studies.

While the other costs used by Layne-Farrar (2011) are similar to those used by Garcia Swartz, Hahn, & Layne-Farrar (2011), she does report higher “back office” cash handling costs

(\$0.027 vs. \$.004). Layne-Farrar (2011) differs from Arango & Taylor (2008) with respect to the theft/counterfeit costs as these examples suggest (\$0.041 vs. \$0.025). However, as these examples suggest, the differences are not particularly large.

2. Lessons Learned From Historical Studies

As is evident from the values in **Table V.1**, and as is discussed above, cash transactions are not free. Cash handling costs and other costs associated with managing the flow of cash to and from banks are present, even if they are sometimes ignored by retailers when they are asked about the costs involved in cash transactions.¹⁰⁹ Totaling the various cash costs indicates that merchants incur at least \$0.25 in transaction costs when making most cash transactions.

As is reflected in **Table V.1**, the size of the various retailer transaction costs differs across payment methods. For payment cards, the major cost is payment processing fees which is not present for cash transactions. For cash, costs associated with managing the flow of cash within the store and between the store and the bank are key costs. Other costs, such as “tender time,” are not particularly large components of retailer transaction costs when one looks at an individual transaction.¹¹⁰ However, this does not mean that tender time can be ignored. When one realizes that cash transactions are smaller, one becomes aware that it takes numerous “average size” cash transactions to generate the same revenue as an “average size” credit card transaction. As is pointed out above, this implies that the tender time transaction costs retailers

¹⁰⁹ In surveys, many retailers do not recognize the costs of handling cash. For example, in the Bank of Portugal study, “only 24% of retailers who accept cash mentioned that they had costs involved with handling notes and coins.” Banco de Portugal (2007), p. 95.

¹¹⁰ An Australian study found that cash transactions took 20 to 25 seconds, while electronic point of sale terminals took around 35 to 40 seconds and credit cards about 45 to 50 seconds. Payments System Review Conference (2007), p. 108. A 2010 Polish study found that while PIN and Signature cards required more time than cash (in an economy still dominated by cash transactions), contactless cards and RFID cards had comparable times as cash. Michal Polasik et. al., “Time Efficiency of Point-Of-Sale Payment Methods: Preliminary Results,” *Journal of Internet Banking and Commerce*, 15(3), (2010), p. 7.

incur per dollar revenue may be larger for cash transactions, especially when compared to credit cards that involve little or no processing by the sales clerk.¹¹¹

Also, in circumstances where the acceptance of credit cards allows retailers to automate payment processing in ways that significantly reduces labor costs, retailer costs may be lowered significantly. As the Government Accounting Office (GAO) points out,

Card acceptance also can reduce the time merchants' customers spend at checkout and can reduce labor costs. For example, representatives of one large merchant told us that their analyses indicated that processing a check payment takes them an average of 70 seconds, processing a cash payment averages 51 seconds, and a credit card payment 32 seconds. Staff from card networks and card issuers told us that the efficiency of card payments has allowed merchants to reduce their staffing, thus saving on labor costs. For example, they noted that credit card customers at gas stations and other retail stores often can pay for purchases without necessarily interacting with an employee.¹¹²

Moreover, as Garcia Swartz, Hahn, & Layne-Farrar (2004) shows, even if one concludes that transaction costs are somewhat lower per transaction for cash transaction, this does not mean that it costs less to generate \$100 in revenues from cash transactions. Specifically, while they find that the transaction costs for the \$11.52 average cash transaction are only \$0.31 and that they are \$1.15 for a \$44.50 average credit card transaction, one finds that the relationship is reversed when one normalizes by asking what the costs are incurred to generate \$100 in revenues (\$2.68 for cash and \$2.58 for credit cards). One of the key reasons for this is that one has to incur tender time costs on more transactions to generate \$100 in revenue when all of the transactions are cash transactions.

¹¹¹ The prevalence of contactless card use may increase the relative difference in tender time. "In 2009, nearly one in four consumers (24.0%) had a contactless payment card or similar device." Foster et. al. (2011), p. 42.

¹¹² (Government Accounting Office, CREDIT CARDS: RISING INTERCHANGE FEES HAVE INCREASED COST FOR MERCHANTS BUT OPTIONS FOR REDUCING FEES POSE CHALLENGES, 31 (November, 2009) available at <http://www.gao.gov/assets/300/298664.pdf>.)

More generally, to the extent there is a difference (either looking at it in terms of a typical transaction sizes or on a scaled basis that considers the number of transactions that are required to reach a specific revenue level), the differences are not large. They are typically less than \$1.00 per transaction. This implies that small differences in revenue generation may offset any cost differences that exist. The following section explores the findings of earlier studies that provide insights into whether a merchant's acceptance of cards may lead to sufficiently large increases in revenues that any transaction cost advantage that cash might have is offset by revenue disadvantages.

D. Relative Benefits of Different Payment Systems

Previous studies recognize that retailers receive a variety of benefits from the use of payment cards.¹¹³ While many of these studies focus on social benefits (rather than the benefits to retailers),¹¹⁴ some have tried to identify the benefits to retailers, which are the studies on which we will focus.

1. Increased Patronage When Merchants Accept Payment Cards

As was pointed out above, one of the benefits that retailers might get from accepting payment cards is increased patronage.¹¹⁵ This benefit appears likely because there is evidence

¹¹³ Stavins (1997) was one of the first studies to recognize benefits associated with different transactional methods, but she focused on checks.

¹¹⁴ See, e.g., Garcia Swartz, Hahn, & Layne-Farrar (2006).

¹¹⁵ Some have stated that: "Accepting credit cards will often double . . . even triple your current sales. Studies show businesses that accept credit cards can see a huge increase in volume . . . almost overnight." http://www.merchantexpress.com/top_10_benefits.htm# See also "You probably already know that accepting alternative forms of payment like credit and debit cards helps make it more convenient for people to pay you. This will increase your sales and profits. Some studies say by 30 -100% or more (Visa International)." "I bet you didn't know that the mere presence of credit card logos at your business location increases CASH sales. A fascinating study was explained in the book INFLUENCE by Robert Cialdini. This scientific experiment documented that the mere presence of Master Card/ Visa logos will increase cash sales by as much as 29% in controlled studies - even though credit cards were not used! If your business accepts cash, this is an extra bonus of accepting credit cards and advertising that you do." http://www.smallbusinessbrief.com/articles/merchant_accounts/003644.html. Similarly, a survey of consumer found that "63% of customers said they would visit a QSR that accepts cards more often than

that a substantial number of consumers want to pay for their items using a debit card or a credit card.¹¹⁶ Indeed, other researchers have concluded that accepting payment cards will increase sales by increasing store traffic.¹¹⁷

2. Increased Sales to Customers That Patronize the Store When Merchant Accepts Payment Cards

As was also pointed out above, retailers may also benefit from accepting credit cards because of “ticket lift.” Again, this potential benefit appears likely. First, behavioral studies point out that consumers are likely to buy more when they make purchases with credit cards, rather than cash. Second, there are reports indicating that a merchant’s sales increase when the merchant switches from “cash only” payment to allowing the use of credit and/or debit cards. Third, there are studies that show that transactions tend to be larger when customers pay by credit card than when they pay by cash. These relationships are recognized by the GAO:

Merchants can receive a variety of benefits—primarily, increased sales—from accepting credit card payments. Increased sales can occur for several reasons. First, a customer without sufficient cash can make a purchase

those that accept cash only.” Lauri Giesen, *Fast Food Cooks up a Winning Card Recipe*, DIGITAL TRANSACTIONS, 16 (2005), available at <http://www.docstoc.com/docs/43869014/Fast-Food-Cooks-up-a-Winning-Card-Recipe>

¹¹⁶ “We did a lot of consumer testing and found that consumers made it clear that they wanted to be able to use their credit and debit cards to pay for purchases at our restaurants,” says Julian Gomez, director of operations, services, and programs for Miami-based Burger King.” Lauri Giesen, *Fast Food Cooks up a Winning Card Recipe*, DIGITAL TRANSACTIONS, 16 (2005), available at <http://www.docstoc.com/docs/43869014/Fast-Food-Cooks-up-a-Winning-Card-Recipe>.

¹¹⁷ Layne-Farrar (2011) pp. 7-8, 15, 32, 38. See also Simes, Lancy, and Harper (2006), which reports that a survey of merchants found that “Three-quarters of merchants surveyed felt that accepting credit cards contributed positively to the growth in their business.” (Ric Simes, Annette Lancy, and Ian Harper, *Costs and Benefits of Alternative Payments Instruments in Australia*, Paper prepared for the Payments Systems Conference 2006, April 2006, available at <http://www.mbs.edu/index.cfm?objectid=271413BC-D60E-CDD8-8D44651EDEC63A89>.)

There are also numerous general statements that indicate that store sales will increase if firms accept credit cards. For example, “Industry research indicates that the ability to accept credit cards increases revenue by as much as 23 percent.” <http://www.monerisusa.com/payment-processing-services/benefits-of-credit-cards.aspx> Similarly, it is reported that “Intuit estimates that each business that does not accept plastic misses out on approximately \$7,000 in sales annually.” Ned Smith, *How America's Small Businesses Could Make an Extra \$100 Billion a Year*, available at <http://www.businessnewsdaily.com/2566-accepting-credit-cards-increases-profit.html>. CreditorWeb published a study that “found that by not accepting credit cards companies are losing as much as 70% of their potential revenue.” <http://www.choicemerchantservices.com/blog/2012/02/13/study-accept-credit-cards-increase-sales-by-70/>

immediately using a credit card, resulting in a sale that the merchant otherwise would not have made. In addition, some research has shown that, when not paying with cash, some customers may purchase more than they would have otherwise. These researchers say the additional spending occurs because paying with a card can feel less like true spending to some consumers than paying with cash. Representatives of card networks and issuers also report that consumers with rewards cards spend more because they factor in the price of the rewards they receive from their issuing institution, which also results in greater sales than the merchants would otherwise have made. One researcher noted that the amount of additional sales merchants receive from accepting credit cards can be greater for certain businesses. Customers more commonly use credit cards for large purchases and for purchases that they might not be able to pay off right away. Several of the merchants we interviewed have seen some evidence that accepting credit cards has increased their sales. For example, representatives from a national discount store and a small home improvement store told us that customers paying with credit cards spent more than customers paying with cash or debit cards. A dentist told us that his patients spent more on procedures because of the credit that their cards provided.¹¹⁸

a) Behavioral and Market Studies Provide a Basis for Expecting Increased Sales with Credit Cards

Behavioral studies have found that consumers tend to buy more when they use payment cards than when they use cash (other things held constant). Moreover, analysis has been undertaken to explain this behavioral observation. Findings include the following:

- Consumer surveys have found that consumers believe they spend less when they are restricted to cash payment.¹¹⁹
- One study points out that “a credit card is a convenient payment mode that allows people to defer and spread out payments and, thus, consumers differ in how they treat credit card and cash purchases.” *See, e.g., Tokunaga (1993).* Consumer surveys that

¹¹⁸ Government Accounting Office, CREDIT CARDS: RISING INTERCHANGE FEES HAVE INCREASED COST FOR MERCHANTS BUT OPTIONS FOR REDUCING FEES POSE CHALLENGES, 30 (November, 2009) available at <http://www.gao.gov/assets/300/298664.pdf>.

¹¹⁹ “In 2002 Visa USA conducted a poll and found that 32 percent of customers admitted that they had limited their drive-through orders because they did not have enough cash to pay for what they wanted. The ability to use credit cards eliminates that obstacle.” “A Visa study of 100,000 restaurant transactions found that customers spent, on average, 30 percent more than those who paid with cash.” Another Visa study reports that “77 percent say they can buy exactly what they want because they are not limited by the cash they have available.” Tamara E. Holmes, *Credit cards can make you fat available at* http://www.bankrate.com/brm/news/cc/20070704_credit_cards_fat_al.asp

were undertaken suggest a consumer preference for using credit cards based on the perception that the use of credit cards is more convenient. (*See, e.g.,* Raghurir & Srivastava (2008)). Even with access to ATMs, the use of cash involves some inconvenience. Moreover, very large purchases may be too large to pay by cash withdrawn from an ATM given limits on ATM withdrawals.

- Some behavioral analyses have emphasized the concept of “Payment Coupling,” when explaining why consumers tend to buy more when they use payment cards, rather than cash. The concept of payment coupling captures the importance of temporal simultaneity or separation (decoupling) of the purchase decision and the actual payment. In particular, when a consumer pays with cash, there is thought to be more immediate pain, which reduces purchases. *See, e.g.,* Prelec & Loewenstein (1998) Tokunaga (1993), Loewenstein & Prelec (1992), Thaler (1999), and Raghurir & Srivastava (2008)]
 - Some analysts have emphasized that consumers are more likely to underestimate the pain when it is deferred to the future, so consumers are likely to spend more when they use payment cards. *See, e.g.,* Srivastava & Raghurir (2002).
 - Some analysts have emphasized that payment modes differ in transparency (vividness with which people feel the outflow of money), with cash payment being most transparent. According to this reasoning, the more transparent and more obvious transactions, the higher the pain of paying and thus the smaller the transaction. *See, e.g.,* Raghurir & Srivastava (2008),¹²⁰ Prelec & Loewenstein (1998), Soman (2003),¹²¹ and Thaler (1999).¹²²
- Studies have also suggested that “Payment Form” may affect the size of purchases. Specifically, one study argues that differences between physical appearance of payment forms matters (*e.g.,* a gift certificate may lead to higher expenditures than a similar-sized cash gift). The influence of payment form on consumer expenditures is thought to be related to differences in the “vividness” or “transparency” of payment. *See, e.g.,* Raghurir & Srivastava (2008).

¹²⁰ Raghurir and Srivastava (2008) report a laboratory experiment in which participants were asked to estimate the budget for a hypothetical Thanksgiving party that was to be paid for by cash in one condition and by credit card in another condition. They found that more was spent when credit cards could be used.

¹²¹ Soman (2003) reports a field study involving the collection and analysis of shopper receipts to see if more “flexible” (discretionary) purchases were made using credit cards. He found that more flexible items were purchased using credit cards, leading him to conclude that there is a negative relationship between payment transparency and spending. However, it could also be due to liquidity constraints or self-selection into credit card use.

¹²² Some studies have asked consumers about their purchasing habits, finding that consumers report that “I spend less when I shop with cash/I control my expenses better when I pay by card.” Raghurir & Srivastava (2008). See also comment summarizing this perspective: “When you pay in cash, you can “feel” the money leaving you. This is not true with credit cards. Flipping a card up on a counter registers nothing emotionally. If you use plastic instead of cash you will spend 12 percent to 18 percent more. This is money you could have saved.”). (See <http://www.getrichslowly.org/blog/2008/09/23/research-reveals-credit-cards-encourage-spending/>)

- Others have explored the extent to which consumers underestimate interest costs, encouraging them to make larger purchases using a credit card. In particular, Ausubel (1991) identified the possibility that some consumers may use a credit card under the incorrect expectation that they will pay off the amount before an interest charge is assessed. For these consumers, they underestimate the cost of the purchase, leading them to buy more than they would otherwise have purchased. Ausubel (1999) reports some support for this underestimation hypothesis, observing that people pay interest they didn't expect to pay. Later papers by DellaVigna and Malmendier (2004) and Hafalir (2008) predict that naïve consumers with access to credit cards will consume more than they anticipate they will consume and Gross and Souleles (2000) finds that consumers increase purchases on cards when the credit limit is increased (even for consumers who do not carry balances on their cards), which is consistent with the observation that credit cards promote spending (although these papers do not deal directly with this issue).

Market observations support the behavioral analysis that suggests consumers buy more when they can make their purchase using a credit card.¹²³ Specifically, studies have found increased spending using credit cards in contexts that are consistent with the behavioral studies.¹²⁴

- People who own credit cards have been observed to make larger purchases per department store visit. Hirschman interviewed customers in 1977 as they exited several branches of a department store chain about their purchases, their method of payment, and demographic variables.¹²⁵ This study finds that people who use credit cards (store card or general purpose) spend more in the store. (Hirschman (1979))
- An experimental study found that a consumer's stated willingness to purchase could be increased by 50-200% by displaying the paraphernalia needed to complete a credit card transaction. (Feinberg (1986))

¹²³ Some have suggested that the larger credit card sales are due to consumer preferences to charge large purchases, rather than an overall increase in consumer purchases. Lauri Giesen, *Fast Food Cooks up a Winning Card Recipe*, DIGITAL TRANSACTIONS, 16 (2005), available at <http://www.docstoc.com/docs/43869014/Fast-Food-Cooks-up-a-Winning-Card-Recipe>. However, this publication also reports that ““Because there is a corresponding lift in total sales at those outlets that accept cards, we have to conclude that at least some of the customers with higher tickets are actually buying more,” says Anthony Gracia, vice president of retail small ticket markets for MasterCard. Additionally, a consumer study conducted by First Data Corp. found that 36% of customers said they would purchase more with electronic payments than they would with cash.”

¹²⁴ Not all studies have found that the option of using a credit card increased spending. For example, a field experiment that studied spending in a cafeteria found that changes in the payment medium from cash to credit cards did not lead to increased spending. (Hafalir (2009))

¹²⁵ Elizabeth Hirschman, “Differences in Consumer Purchase Behavior by Credit Card Payment System,” *Journal of Consumer Research*, Vol. 6, No. 1, June 1979, pp. 58-66.

- An experimental study using MBA students that was designed to elicit the willingness-to-pay for sporting events found a large premium (more than 100%) associated with the ability to pay by credit card versus requiring payment in cash. (Prelec & Simester (2001))
- Analysis of shopping behavior of 1,000 households over a period of six months found that shopping baskets had a larger proportion of impulse food items when shoppers used credit or debit cards, rather than cash, to pay for their purchases. (Thomas, Desai & Seenivasan (2010))

b) Studies Showing Larger Sales to Credit Card Customers

Cash transactions tend to be substantially smaller than credit transactions, although there clearly is an overlap in transaction sizes.¹²⁶ Studies supporting this conclusion include:

- Visa Study: “The average spend per Visa purchase is consistently more than cash. While the average cash transaction is \$17, credit card purchases average \$66 and debit card purchases average \$42.”¹²⁷ Hancock et al., (1998) reports that the average value of a cash transaction is around \$5.00. In contrast, the average credit card transaction is around \$53 (with debit cards averaging around \$41).¹²⁸
- Garcia Swartz, Hahn, & Layne-Farrar (2006) report transaction sizes for cash and other payment instruments for several types of retail establishments. The cash transactions are reported to have the following sizes: small independent grocery stores (\$11.52), discount stores (\$15.49), and electronics specialty stores (\$64.98). By

¹²⁶ For example, the Federal Reserve Board reports the distribution of transaction sizes for credit cards, showing that credit cards are sometimes used in very small transactions.

<u>Transaction Size</u>	<u>Number (billion)</u>	<u>% of Total</u>	<u>Value (trillion)</u>	<u>% of Total</u>
<\$5	2.1	10.7%	\$0.004	0.3%
\$5.00-\$14.99	3.7	18.5%	\$0.036	2.1%
\$15-\$24.99	2.9	14.5%	\$0.057	3.3%
\$25+	11.2	56.3%	\$1.624	94.4%

(2010 Federal Reserve Payments Study, p. 56)

http://frbervices.org/files/communications/pdf/research/2010_payments_study.pdf

¹²⁷ <http://usa.visa.com/merchants/new-acceptance/benefits-of-accepting-Visa.html>

¹²⁸ Hancock (1998) is available at http://info.worldbank.org/etools/docs/library/83584/Hancock_Jan1998.pdf. One can find more recent estimates of the average value of credit card transactions from other sources, such as the 2010 Federal Reserve Payments Study (available at http://frbervices.org/files/communications/pdf/research/2010_payments_study.pdf) and the “World Payments Report” (available at http://gbm.rbs.com/docs/gbm/insight/gts/perspectives/WPR_2011.pdf) In 2009, the average value of credit card transactions is estimated to have increased to \$89. (See Exhibit 92 of Federal Reserve Study) Similarly, the 2010 Federal Reserve Payments Study found that in 2009 the average size of a signature debit transaction was \$37 while the average size of a PIN debit transaction was \$39. Gerdes et al., “The 2010 Federal Reserve Payments Study: Noncash Payment Trends in the United States: 2006-2009, December 2010, p. 16.

contrast, credit card transactions were larger for small independent grocery stores (\$44.50) and for electronics specialty stores (\$148.15 to \$150.39).¹²⁹

- Using 2009 Phoenix Marketing data, Layne-Farrar (2011) reports that the average supermarket transaction sizes were \$73 (cash), \$112 (debit), and \$115 (credit).
- Restaurant tips have been observed to be larger when payment cards are used to pay the check. (Feinberg (1986)) The author observed 135 customers at random intervals over a week and recorded party size, check amount, mode of payment, and tip amount.¹³⁰
- It has been reported that “Visa and MasterCard studies show that the average ticket size of QSR purchases made with credit cards exceeds that of cash transactions—about 30% more according to Visa. Furthermore, studies show that foot traffic increases when a particular outlet begins to accept card payments. Cards boost traffic between 4% and 7% at each location that adds card payments to its offerings, according to statistics from MasterCard.”¹³¹
- In Europe, Visa reports: “In terms of average transaction values, the differential between a card-paying customer and a cash-paying customer can be quite significant. As an example, Burger King in the UK has calculated that the average transaction value for cards is up to 40 per cent higher than for cash. McDonald’s in Poland has reached exactly the same conclusion. And, looking specifically at contactless transactions, the UK restaurant chain EAT, has found that average card transaction values are six per cent higher than with cash.”¹³²

As is reported in Section IV.D.3, our research confirms that, for our sample, credit card tickets are larger than cash tickets.

c) Studies Showing Increased Sales When Credit Cards Are Introduced

There is also evidence that store sales increase when a store shifts from a “cash only” policy to a policy that allows payment by both cash and payment card. However, data that document the increase in sales that are associated with the acceptance of payment cards are not

¹²⁹ See Tables 2-1, 3-1, and 4-1, Garcia Swartz, Hahn, & Layne-Farrar (2006).

¹³⁰ Richard Feinberg, “Credit Cards as Spending Facilitating Stimuli: A Conditioning Interpretation,” *Journal of Consumer Research*, Vol. 13, No. 3, December 1986, pp. 348-356.

¹³¹ Lauri Giesen, *Fast Food Cooks up a Winning Card Recipe*, DIGITAL TRANSACTIONS, 16 (2005), available at <http://www.docstoc.com/docs/43869014/Fast-Food-Cooks-up-a-Winning-Card-Recipe>.

¹³² Visa Europe Retailer Report 2011.pdf available on Internet through http://www.visaeurope.com/en/about_us/idoc.ashx?docid=e89f9259-778e-4663-89fa-5d6a518a488e&version=-1.

widely available, since it is hard to identify stores that have shifted from a “cash only” policy to a policy of also accepting payment cards. Nonetheless, there is anecdotal support for this view.

- Cornell’s Robert Frank has noted that “when McDonald’s started allowing credit card purchases, the average purchase went from \$4.50 to \$7.00.”¹³³
- In 1998, Sonic Inc. (a QSR chain) began accepting credit cards. Sonic is reported to have found that customer orders (tickets) paid by a payment card were 80% higher than tickets for cash sales consistent with “dramatically higher sales.”¹³⁴
- In November 2002, Visa reported that studies of sales at “quick serve restaurants” found that payment cards “offer a lift to ticket sales.” In particular, it reported that average credit card transactions were 20-30% higher than average cash transactions.¹³⁵
- Trade press reports that “[S]tudies show that foot traffic increases when a particular outlet begins to accept card payments.” The same source states: “Burger King and other QSR chains are aggressively going ahead with plans to get more locations accepting cards. And part of that enthusiasm for cards relates to benefits like higher average tickets and heavier traffic. [Burger King’s] Gomez admits that the increase in sales on cards generally compensates for the increased cost.”¹³⁶
- In a 1995 survey, Ernst and Young found that 83% of the surveyed merchants stated that acceptance of credit cards led to increased sales.¹³⁷
- Subway reported that its transaction size has increased for transactions that involve credit cards.¹³⁸

¹³³ Ari Shapiro, *Why We Spend More Using Credit Versus Cash*, npr interview transcript (July 3, 2008), available at <http://www.npr.org/templates/transcript/transcript.php?storyId=92178034>.

¹³⁴ See discussion in Layne-Farrar (2011), p. 5, which is based on Frederic Lowe, *Cards Make the Fast-Food Menu* 14 CARDS AND PAYMENTS 18 (March 2001).

¹³⁵ *Visa Payment Card Acceptance Helps Bottom Line of Quick Service Restaurant Partners*, BUSINESS WIRE (November, 2002), available at <http://www.thefreelibrary.com/Visa+Payment+Card+Acceptance+Helps+the+Bottom+Line+of+Quick+Service...-a094155508>.

¹³⁶ Lauri Giesen, *Fast Food Cooks up a Winning Card Recipe*, DIGITAL TRANSACTIONS, 16 (2005), available at <http://www.docstoc.com/docs/43869014/Fast-Food-Cooks-up-a-Winning-Card-Recipe>.

¹³⁷ R. Untracht, *Do you Really Know Your Customers?* 72 CHAIN STORE AGE 6A (1996).

¹³⁸ Shirley Lueng and Ron Lieber, *The New Menu Option at McDonalds: Plastic-Fast Food Giant Will Allow Customers to Use Credit Cards: Earning Miles With Your Fries*, THE WALL STREET JOURNAL, D1 (November 26, 2002).

Because these studies are limited, as part of our research we looked for retailers that switched from a “cash only” payment policy to a policy under which they also accepted payment cards. As is reported in Section IV.D.2, we identified one retailer that switched from “cash only” to also accepting credit cards. As is explained above, this shift was associated with a significant increase in sales.

E. Existing Literature Points to Sizeable Net Benefits to Merchants from Willingness to Allow Credit Card Transactions

Our review of the existing literature finds that there are costs associated with both credit card and cash transactions. Moreover, the difference in these costs is not particularly significant. Earlier research also indicates that significant benefits are associated with the acceptance of credit cards that will more than offset the costs. In particular, there is evidence that retailers that accept credit cards will attract customers to their stores that would otherwise go elsewhere and that customers who are patronizing the store are likely to buy more if they can use credit cards than they would buy if they could only pay cash. As a result, the principal findings of the earlier studies align with the core empirical findings of our study.

VI. CONCLUSION

Many small retailers do not accept credit or debit cards,¹³⁹ perceiving that it is more profitable for them to only accept cash payments. Such a perception is likely rooted in the belief that cash transactions are not associated with costs that are comparable to the fees that would be paid if the transactions involved the use of a payment card. However, based on a review of the available evidence, it is clear that cash is not costless to use. Moreover, the acceptance of payment cards increases store profitability by increasing sales.¹⁴⁰

Using data collected from five case study participants, we calculate the costs of using cash and the costs of using payment cards. Specifically, the calculation reflects: (1) cost of transaction times associated with the different payment systems (with time typically valued by the cashier's wage rate);¹⁴¹ (2) cost of the time spent depositing cash at a bank (valued at owner's time); (3) cost of handling cash at store (*e.g.*, setting up tills, closing tills, and reconciling cash, valued at a blend of the owner's and employee's time); (4) credit card and debit card fees; and (5) cost of time spent reconciling credit card statements.

¹³⁹ According to a report by Intuit, “55 percent of the nation’s 27 million small businesses do not accept credit cards.” <http://www.forbes.com/sites/tjmccue/2013/08/16/why-dont-more-small-businesses-accept-credit-cards/>

¹⁴⁰ A recent report issued by The Aite Group reaches a similar conclusion. See “Tender Truths: the Real Cost of POS Transactions in the United States,” July 2014 (concluding that “[f]or the most part, merchants benefit from card acceptance over cash at the POS Card acceptance drives up average ticket purchase amounts, speeds throughput at the checkout, and is less vulnerable to theft than cash.”).

¹⁴¹ There is no valuation for the lost business due to customers not shopping at the store because the queue is too long, since none of the stores perceived this to be a significant issue and we did not observe lost business when we were in the store. However, for some stores this could be significant. For example, a fast-food restaurant may lose significant business if there are nearby options and customers are deterred by long lines.

The results of these calculations on a per-transaction basis are summarized in **Table VI.1**.¹⁴² Our calculations indicate that the cost of cash is nearly the same as, and sometimes higher than, the cost of payment cards.

For all of the case study participants, the cost differential appears to be quite small relative to the incremental profits that would result from increased sales. For example, using the values in **Table VI.1** for a \$100 transaction, the retailer is paying no more than \$2.12/transaction more in transaction costs if a payment card is accepted, rather than cash. However, the incremental profits on a \$100 transaction are likely to exceed \$20.00 (and may even exceed \$30.00).¹⁴³

As this comparison suggests, looking at the costs of using different payment methods is only half of the analysis that is needed to assess whether retailers profit from allowing their customers to pay by payment card. One also needs to consider whether there are incremental benefits that offset any cost differential that might be present. When one factors in the benefits retailers obtain by allowing customers to pay by payment card, it becomes clear that for most retailers it is profitable to allow the use of payment cards. In particular, as is also explained above, a major benefit that results from allowing customers to pay with payment cards is that a merchant has more customers. In addition, the customers that decide to patronize the store are likely to buy more if they can use a payment card. Together, these effects lead to significant increases in the merchant's sales, increasing profitability.

¹⁴² The cash processing costs (cost handling and cash deposit costs) are calculated on a per transaction basis for the average transaction size. For a \$30 transaction, it is assumed that these costs are the same as they are for the average transaction, since the number of trips to the bank and other processing costs will not vary with the increased transaction size. For the generation of \$100 in revenues, we simply multiply the average transaction size by \$100/average transaction size to determine costs. In a parallel analysis that allocates costs on a per dollar basis, rather than a per transaction basis, the results are not significantly different.

¹⁴³ This assumes a profit margin of 20%-30%, which aligns with the gross margins reported by Census. See note 97 above.

**Table VI.1
Cash & Payment Card Cost Analysis: Detail**

Costs	Fast-Food Restaurant	Full-Service Restaurant - with Tip	Gas Station - Gas Only Purchase	Gas Station - Cashier Purchase	Convenience Store	Grocery Store
Time Period	7/1-7/7	6/26-7/12	6/17-6/24	6/17-6/24	6/30-7/6	6/1-6/23
Establishment's Total Transactions/Week*	1,544	512	2,795	1,473	8,259	874
Total Cash and Credit Transactions/Week	1,538	506	2,770	1,442	7,164	814
Cashier Hourly Wage	\$8.15	\$8.92	\$9.50	\$9.50	\$9.00	\$10.50
Cash						
Cash: Number of Transactions/Week	933	133	1,180	1,265	5,998	376
Cash: Sales Volume/Week	\$7,284.34	\$4,678.99	\$24,975.45	\$26,768.08	\$30,888.39	\$3,480.72
Cash: Average Transaction Size	\$7.81	\$35.18	\$21.17	\$21.16	\$5.15	\$9.27
Cash: Average Tender Time (seconds)	23.43	21.01	68.49	12.23	17.10	23.23
Credit						
Credit: Number of Transactions/Week	605	373	1,590	177	1,166	438
Credit: Sales Volume/Week	\$5,482.36	\$26,489.42	\$59,763.99	\$5,336.93	\$9,854.59	\$7,966.48
Credit: Average Transaction Size	\$9.06	\$70.93	\$37.59	\$30.15	\$8.45	\$18.19
Credit: Average Tender Time (seconds)	19.26	31.91	37.97	24.47	18.36	19.86
Time Associated with Handling Cash						
Deposit Time (Hours/Week)	0.73	0.75	1.33	1.33	2.78	1.30
Owner's Cash Handling Time (Hours/Week)	0.29	2.49	2.92	2.92	10.73	2.92
Employee Daily Cash Handling Time (Hours/Week)	1.75	4.08	5.25	5.25	14.00	0.00
Wages Associated with Handling Cash						
Deposit Time Wage (Owner's Time)	\$26.43	\$26.43	\$26.43	\$26.43	\$17.50	\$26.43
Owner's Cash Handling Wage	\$26.43	\$26.43	\$26.43	\$26.43	\$26.43	\$26.43
Employee Cash Handling Wage	\$8.15	\$8.92	\$9.50	\$9.50	\$9.00	\$0.00
Time Associated with Handling Credit						
Owner's Credit Reconciliation Time (Hours/Week)	0.08	0.25	0.08	0.08	0.08	0.08
Wages Associated with Handling Credit						
Owner's Cash Reconciliation Wage	\$26.43	\$26.43	\$26.43	\$26.43	\$26.43	\$26.43
Cash Costs						
Cash: Deposit Cost per Transaction	\$0.0207	\$0.1490	\$0.0299	\$0.0279	\$0.0081	\$0.0915
Cash: Owner's Cash Handling Cost per Transaction	\$0.0083	\$0.4938	\$0.0653	\$0.0609	\$0.0473	\$0.2053
Cash: Employee's Cash Handling Cost per Transaction	\$0.0153	\$0.2739	\$0.0423	\$0.0394	\$0.0210	\$0.0000
Cash: Tender Cost per Transaction (in Employee Hourly Wage)	\$0.0530	\$0.0521	\$0.1807	\$0.0323	\$0.0428	\$0.0678
Total Cash Cost per \$100 Revenue	\$1.245	\$2.754	\$1.503	\$0.758	\$2.313	\$3.933
Credit Costs						
Credit: Fees per Average Transaction	\$0.2581	\$2.0727	\$0.8517	\$0.7030	\$0.2475	\$0.4990
Credit: Tender Cost per Transaction (in Employee Hourly Wage)	\$0.0436	\$0.0791	\$0.0000	\$0.0646	\$0.0459	\$0.0579
Credit: Owner's Credit Reconciliation Cost per Transaction	\$0.0036	\$0.0177	\$0.0014	\$0.0124	\$0.0019	\$0.0050
Total Credit Cost per \$100 Revenue	\$3.370	\$3.059	\$2.270	\$2.587	\$3.494	\$3.089
Credit Costs Relative To Cash Costs	\$2.12	\$0.30	\$0.77	\$1.83	\$1.18	-\$0.84

* Total transactions per week taken from transactions data. Includes gift card and debit card transactions.

Note: A separate debit cost analysis was not included because there was only substantial, distinguishable Debit Card payment data at the Convenience Store. At most retailers, the processing of debit cards was indistinguishable from the processing of credit cards at the transaction level. "Gas Station - Gas Only Purchase" captures gasoline-only credit sales at the outdoor pump and gasoline-only cash sales in store. "Gas Station - Cashier Purchase" captures all indoor purchases.

The credit card rates and fees used are as follows: Fast-Food Restaurant: 1.75% plus \$0.10; Full-Service Restaurant: 2.78% plus \$0.10; Gas Station: 2.00% plus \$0.10; Convenience Store: 1.75% plus \$0.10; Grocery Store: 2.01% plus \$0.13. Since information was not provided by the Fast-Food Restaurant owner regarding credit card rates and fees, the Convenience Store rates and fees were used, since both are franchises. Additionally, the rate and fee for the Gas Station were estimated using the total credit card cost share of sales, which was 2.37%.

All of the retailers who were interviewed understood that their sales were larger than they would be if they stopped accepting payment cards. This belief was confirmed by the florist we studied (and the experiences of other retailers described above) who found that their sales increased when they shifted from a "cash only" operation to one that also allowed customers to make payments by payment card. It is also consistent with our finding (which is supported by

others who have undertaken similar studies) that customers who purchased items using a payment card tend to make larger purchases than customers who paid cash.

In sum, the cost to retailers of accepting cash nears, and in some businesses (e.g., fuel merchants) exceeds, the cost of accepting payment cards. However, even when retailers face higher costs when they accept payment cards than when they accept cash, they are typically better off allowing customers to pay by payment card, since their sales will increase by more than enough to cover any incremental costs associated with payment cards.

APPENDIX

INFORMATION ON RESEARCHERS

A. Economists Incorporated

Economists Incorporated, which was retained by MasterCard to undertake this study, is a premier economic consulting firm in the fields of law and economics, public policy, and business strategy. With offices in Washington, D.C. and San Francisco, Economists Incorporated offers expert consulting and testifying services in the context of litigation, arbitration, proposed mergers and acquisitions, regulatory hearings, and business planning. Our clients include legal counsel, businesses, trade associations, government agencies, and multi-nation organizations.

EI economists hold advanced degrees from leading universities; many held senior positions in government agencies, including the Department of Justice, Federal Trade Commission, U.S. International Trade Commission, Interstate Commerce Commission, Securities and Exchange Commission, and Federal Communications Commission. EI economists also have substantial experience providing expert witness services and other forms of litigation support. For example, EI has been involved in major antitrust matters, including leading monopolization cases, major collusion cases, and large merger investigations. Similarly, EI economists have been involved in securities litigation, large environmental claims, false advertising, international trade disputes, contract disputes and lender liability claims.

EI economists have developed substantial institutional expertise in hundreds of industries. More specifically, EI economists have expertise in most traditional manufacturing industries (*e.g.*, chemicals, oil refining, natural gas, metal industries, coal, plastics, toys, and food products). We also have extensive experience in network industries (*e.g.*, telephone, cable, Internet, software, integrated circuits, and credit card networks). In addition, EI economists have developed expertise in health care, pharmaceuticals, sports leagues, retail and wholesale trade, mass media, financial services, transportation and many other industries.

B. Primary Researchers

1. Philip Nelson



Dr. Nelson, who holds a Ph.D. from Yale University, is a Principal. He was Assistant Director for Competition Analysis at the FTC and an adjunct professor at Fordham Law School. While at the FTC, he served on the FTC's Merger Screening and Evaluation Committees.

Dr. Nelson has written numerous articles and two books, *Corporations In Crisis: Behavioral Observations for Bankruptcy Policy* and *U.S. International Competitiveness*. He also edited the ABA Antitrust Section's *Market Power Handbook: Competition Law and Economic Foundations*. After joining Economists Incorporated, Dr. Nelson played a major role in matters involving mergers, price fixing, vertical restraints, Robinson-Patman Act, unfair competition, intellectual property, class certification, and damage issues. He has provided testimony and affidavits on antitrust, intellectual property, class certification, and damages issues. He has analyzed competitive issues for FERC proceedings, contributed to dumping and Sect. 232 trade cases, reviewed transfer prices in tax and government royalty cases, and examined liability and damage issues in environmental damages cases, including Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) compensation cases. Among the industries he has analyzed are: oil, gas, minerals, refineries, pipelines, oil field equipment, defense, retailing, wholesaling, grocery products, vehicles, pharmaceuticals, pesticides, toys, electrical equipment, machine tools, plastics, chemicals, metals, household products, security exchanges, telecommunications, electrical utilities, insurance, cameras, computer hardware and software, integrated circuits, cable television, newspapers, and health-care technologies and services. He has served as vice chair of the ABA Antitrust Section's, Intellectual Property Committee and as

chair and vice chair of the section's Economics Committee. He is currently vice chair of its Health Care and Pharmaceuticals Committee.

2. John Gale



Dr. Gale, who holds a Ph.D. from the University of Wisconsin, is a Vice President. He has extensive experience providing economic analysis of antitrust, regulatory, class certification, intellectual property, and damages issues relating to telecommunications, consumer products, and professional services markets. Dr. Gale has testified on class certification issues in cellular markets and conducted extensive analysis of the appropriateness of class certification in horizontal and vertical restraint of trade cases. In addition, Dr. Gale has provided expert opinions on valuation of cable television providers and likely regulatory review of prospective mergers. Dr. Gale has extensive experience with network industries and has authored filings in Federal Communications Commission proceedings on a-la-carte cable programming pricing, program exclusivity, spectrum ownership caps, interactive television rules, retail availability of cable boxes, reciprocity rules, and digital radio standards.

Dr. Gale has assisted clients during agency merger reviews in the financial information services, electricity, television programming, gasoline, mobile communications, newspaper publishing, paper products, beer, feminine hygiene, candy, batteries, water purification, hybrid corn, medical devices, hospital services, and accounting services markets. In addition to publishing on this subject in Antitrust, he has extensive experience developing merger simulation models, analyzing auction models, and conducting consumer demand studies.

Prior to joining Economists Incorporated, Dr. Gale was an economic consultant with The Brattle Group and Charles River Associates. Dr. Gale has also taught economics and business courses at the Mississippi University for Women and Mississippi State University.

3. Gale Mosteller



Dr. Mosteller, who holds a Ph.D. from the University of Chicago, is a Vice President. Her antitrust experience includes analyzing allegations of cross-subsidization by regulated firms, sham litigation, collusion, and Robinson-Patman Act violations, as well as assessing the competitive effects and efficiencies of proposed acquisitions and joint ventures in a variety of industries. She focuses particularly on quantifying effects, such as computing the expected gain/loss in profits from price rises. She assisted Bruce Owen with his testimony for *In re Foreign Currency Conversion Antitrust Litigation*. His testimony explained why plaintiffs' allegations of price fixing and other conspiracies did not make economic sense, lacked direct evidence, and were contradicted by many facts. Moreover, rational unilateral decisions by networks and issuers in a competitive market could readily explain the behavior at issue.

She has also assessed the impact of legislation, evaluated the pricing of unbundled network elements and of common cost markups in state telecommunication proceedings, evaluated overcharges for telephone subscriber listings, modeled and computed data compensation payments under FIFRA, and testified before the Postal Rate Commission about access costs and cross-subsidization. Dr. Mosteller has analyzed economic damages in cases involving false advertising, the *Exxon Valdez* oil spill, securities fraud, contract breach, and the theft of confidential information, and has written about when damages should be discounted. She has published an article about "Comparability in the U.S. Steel Transfer Pricing Case" in *Tax Notes* and worked on transfer pricing matters. Industries that she has analyzed include: chemicals, oil, natural gas, fisheries, converted paper products, major home appliances, electrical

distribution equipment, hardware, defense, automobiles, pharmaceuticals, vitamins, telecommunications, rental car companies, title insurance, tobacco, and postal delivery.

4. Steve Siwek



Mr. Siwek, who holds an M.B.A. from George Washington University, is a Principal. He was formerly senior consultant at Snavelly, King and Associates, Inc., a Washington, D.C. based consulting firm. He is a specialist in financial and cost analyses and in the estimation of lost profit damages. Mr. Siwek has particular expertise in detailed costing analyses of telecommunications facilities and services. He has testified as an expert witness in more than sixty proceedings before federal and state regulatory authorities. Mr. Siwek's consulting specialties also include the analysis of economic damages in commercial litigation and antitrust. He has evaluated damage claims in litigation involving telecommunications companies, media firms, airlines, motorcycle race promoters and event operators, satellite service providers, parts locator providers and others.

Mr. Siwek has specific experience in estimating damages for a fashion forward catalogue provider who was to have been acquired by a nationally known retailer of women's clothing. He has also conducted a variety of analyses for a major online retailer in connection with proposals to revise provisions for the collection of state and local sales taxes by online sellers. Mr. Siwek also participated with EI's Australian partner in a study of the economic contributions of eBay to the U.S. economy as a whole.

Mr. Siwek also has substantial consulting and research experience in international trade. In the international area, Mr. Siwek has focused particularly on the media and software industries. He is co-author (with Steven S. Wildman) of *International Trade in Films and Television Programs*, American Enterprise Institute/Ballinger Publishing Company and

International Trade in Computer Software, Quorum Books (with Harold Furchtgott-Roth). Mr. Siwek has also published annual studies of the “Copyright Industries” in the US economy on behalf of the International Intellectual Property Alliances.

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