A Reexamination of Who Gains and Who Loses from Credit Card Payments

By: Michael Turner, Ph.D.,Patrick Walker, M.A., Sukanya Chaudhuri, Ph.D.
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PERC
RESULTS AND SOLUTIONS

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Acknowledgments

Table of Contents

Abstract

This study uses a simple framework to quantify point-of-sale (POS) cross-subsidies between credit card transactions and all other transactions that occur across household income categories. Earlier studies by staff of the Federal Reserve Bank of Boston (Boston Fed) examined these cross-subsidies using a similar framework. In the basic framework used, the Boston Fed staff studies concluded that a cross-subsidy occurs from lower income households to higher income households. These results were driven by the findings that: (1) credit cards tend to be used to a greater extent by higher income households; and (2) the merchant cost for processing credit cards tends to be higher than the associated costs for alternative payment methods.

Using the general methodology of the Boston Fed staff study, this analysis modifies several of the underlying assumptions of the study and then reexamines the results. This analysis finds that the Boston Fed staff cross-subsidy estimates are not very robust, depending a great deal on particular assumptions, the design of the accounting framework, and specific factors that are included and excluded. This is problematic given the lack of precise and consistent data on many aspects of the payment system and household use of payments. The estimated cross-subsidy is also small to non-existent, with the estimated cross-subsidy totaling less than 4% of payment processing costs for the lowest income group. And, assuming that credit card use results in an increase in merchant sales of just 1%—a conservative assumption given available evidence—then the point-of-sale cross-subsidy is likely to be reversed, with higher income households subsidizing lower income households.

To summarize, by using reasonable variations of the framework assumed by the Boston Fed staff, the POS cross-subsidies are found to be small, non-existent, or reversed. Consequently, any policy remedy seeking to redress particular cross-subsidy estimates found in the Boston Fed staff studies could have either no effect or, worse yet, could have negative unintended consequences, such as economic harms to lower income consumers. Improved data collection and a better understanding of the interactions of households, merchants and payment systems, enabling more robust and sophisticated analysis appear needed to inform sound policy inquiry.

Executive Summary

Recent reports from the staff of the Federal Reserve Bank of Boston (Boston Fed) argue that credit card users and participants in credit card reward programs are subsidized at the point of sale (POS) by non-card users and non-participants. The Boston Fed staff studies find that the cross-subsidies involve a net transfer from members of lower-income households to members of higher-income households.

However, as shown in this study, the results of the Boston Fed staff studies are critically dependent upon specific assumptions, the design of the cross-subsidy accounting, and the factors considered. In this study, PERC used the same general methodology of the 2010 Boston Fed staff study, modified several of the underlying assumptions and reexamined results. In general PERC finds that the potential POS cross-subsidy identified by the Boston Fed staff studies could be highly overstated. This report further cautions that policymakers cannot have much confidence in the cross subsidy estimates owing to data limitations and poor understanding of key aspects of the interplay between households, retailers, financial institutions and payment systems. Key findings include:

» **POS cross-subsidy estimates are small, nonexistent or reversed:** Using the same assumptions and general methodology as the Boston Fed staff report, PERC finds the POS cross-subsidy to be minus $29 for households with under $100,000 in income. However this falls to minus $14 when using more realistic assumptions regarding the cost of non-credit card payments. The cross-subsidy falls further to minus $11 when shopping patterns are assumed to vary by household income. This is small by most measures, it is less than 3% of the total cost of payment processing for this group and less than a tenth of one percent of consumption (total spending) for this group. This cross-subsidy is dwarfed by credit card interest payments paid by this group (which is nearly 30 times as large) and is less than the value of credit card rewards received by this income group. And if higher income / credit card using shoppers disproportionately purchase items with higher mark ups it is possible that cross-subsidies are nonexistent, or that lower income households receive a subsidy from higher income households.

» **Increased sales from card use could eliminate any POS cross-subsidy:** The framework used by the Boston Fed research team does not consider the generation of new sales resulting from accepting credit cards and consumer use of credit cards. A small increase in the volume of sales could cover the cost of merchant fees, eliminating any potential POS cross-subsidies. For instance, PERC estimates that an increase of less than 1% in total merchant sales could cover all additional costs to merchants of accepting credit cards. In such a case, there is no POS cross-subsidy. If the sales increase is higher, then the POS cross-subsidy is reversed, with higher-income households subsidizing lower-income households. Without knowing how credit card use impacts merchant sales for individual merchants or for the retail sector as a whole, little can be said about the size or direction of POS cross-subsidies.

» **Key factors that impact consumers are excluded:** The Boston Fed researchers fail to consider important costs and benefits relating to payments transactions, including those directly impacting consumers. Without considering all such major costs and benefits one is unable to determine the overall impacts on consumers from specific payment choices or the overall impact of payment choice policy on consumers. Excluded factors include ATM fees, overdraft fees, over limit fees, checking account fees, and prepaid card fees. These are non-trivial: for instance, the total value of overdraft fees collected is roughly the same as the total value of merchant fees examined in this (and the Boston Fed authors') analysis. The total cost to consumers from checking, debit, and ATM fees could be hundreds of dollars a year, many times the estimated POS cross-subsidies. In addition, the analysis does not include non-monetary aspects of the various payment choices, such as time spent going to an ATM/teller, the value of the security, and the importance of consumer-friendly purchase protection and dispute policies when paying for large ticket items with credit cards. While finding reliable data points for some of these issues may be challenging, they at least must be recognized and considered. There are good reasons to believe that in so doing, the findings could be impacted—potentially even dramatically so.

» **Including extraneous factors undermines results:** The Boston Fed researchers extended their analysis in 2011 to include bank and merchant profits. Net transfers to higher-income households exist if only due to the profits being made. Consequently, even if there were no POS cross-subsidies (the same processing cost was used for all payment instruments), there would still be a transfer to higher-income households (stock holders), if banks made profits on revolving credit card balances. These results speak more to income and wealth inequality, in general, than to POS cross-subsidies. Such net transfers to higher income households would result from any company that charged the same price to all customers and made a profit.

Given the serious limitations of current research on POS cross-subsidies, it would be unwise to make policy recommendations, particularly policy based on specific cross-subsidy results.

1. Introduction

A hypothesis known as the "Reverse-Robin-Hood-Cross-Subsidy" claims that economically less well off consumers who pay with cash subsidize largely higher income credit card users.[1] In its simplest form, the argument goes as follows. Merchants face higher costs for accepting credit cards than they do for other payment methods, and they must find ways to subsidize those costs. These merchants cover the costs of accepting credit cards with higher prices for all consumers, that is, for credit card users and non-users alike. As a result, low-income consumers who are less likely to use credit cards are burdened with the extra costs stemming from the credit card user. In short, higher income credit card users pay less than they would if they had to cover the full cost of the credit card merchant fees and poorer cash users pay more than they would have to if credit cards were not accepted. The latter pays for the costs of the former's choice of payment method. As cash (or non-credit card) users are poorer, the poor pay for the rich.

In a study published by the Federal Reserve Bank of Boston in 2010, Schuh, Shy and Stavins provide support for this argument by using a simple accounting framework that quantifies the transfers, or cross-subsidies, by household income.[2] They find that, on average:

» Households with the lowest income (less than $20,000) pay $32 annually at the point of sale; and,

» Households with the highest income (more than $150,000) receive $313 annually.

Once credit card rewards are included, the cross-subsidy received by high-income households becomes larger in this framework. Furthermore, if profits are included as in Schuh et al. (2011), the size of the transfer is further magnified in the framework.[3] Schuh et al. (2010, 2011) base their estimates on the assumption that the cost of credit cards to the merchant is 2% of the value of sales, and the cost of "cash" is 0.5% of the value. "Cash" is defined as all non-credit card payment methods, including debit cards and checks.

The remainder of Section 1 provides an overview of the topic of POS cross-subsidies and highlights the complexity of the payment system. Section 2 of this study reexamines the value of the cost of non-credit card payments. This study begins with these steps in order to look at the relationship between the costs of credit cards and the cost of non-credit card payments in a way that more reflects the actual costs of each. Section 3 presents the results of a sensitivity analysis applied to the 2010 Boston Fed staff study POS cross-subsidy estimates. Many of the modifications and extensions explored in the later, 2011 Boston Fed staff

[1] Term used by Steven Semeraro in "The Reverse-Robin-Hood-Cross-Subsidy Hypothesis: Do Credit Card Systems Effectively Tax the Poor and Reward the Rich?" Rutgers Law Review 40 (2009): 419.

[2] Scott Schuh, Oz Shy, and Joanna Stavins, "Who Gains and Who Loses from Credit Card Payments? Theory and Calibrations" (Boston: Federal Reserve Board, 2010). Available at http://www.bos.frb.org/economic/ppdp/2010/ppdp1003.pdf

[3] Scott Schuh, Oz Shy, and Joanna Stavins, "Who Gains and Who Loses from Credit Card Payments? Theory and Calibrations" 2011

study are also considered here, including shopping patterns that differ by household income level. This study excludes some other extensions, such as bank profits, for reasons outlined in section 3.4.6. Section 4 considers a modified framework that assumes credit card usage brings about additional sales. Finally, Section 5 offers considerations for future research and policymaking.

Simple Changes in the Accounting Framework Change the Observed Impact

There does not appear to be direct evidence of systematic changes in merchant prices as a result of changes in merchant fees, nor is there direct evidence of POS cross-subsidies. As a result, in order to provide evidence of the existence, magnitude, and directions of price changes and cross-subsidies, scholars are forced to develop models or accounting frameworks. These models in turn are based on assumptions and specifications. Data for the elements of the model are then plugged in to estimate the effect. Obviously, the specifications used to construct the model or accounting framework can have a significant impact on the final estimates. If measures of the impact change significantly with reasonable changes in the specification of the framework, it is a signal that one cannot

have a high degree of confidence in the findings, and further one should be modest with inferences drawn from the findings, especially in the context of public policy considerations.

To see the far-reaching consequences the specification of the model for the outcome, consider the inclusion of bank profits in their 2011 Boston Fed staff study as an extension in their framework. This study excludes profits on the grounds that any industry making profits transfers earnings to its owners and stockholders.[4] That is, if ownership is uneven, there is always a transfer from non-owners to owners, *even in a framework in which all consumers only use credit cards.* For all profit-making industries, the disproportionate share of stock ownership among high-income groups ensures that they receive a greater share of profits than do non-owners/non-shareholders. But this transfer is not the result of payment methods, and therefore the inclusion of profits in the model muddies the waters. The uneven distribution of assets and investment income, while an important topic, is

[4] It is worth noting, however, that large shareholders tend to be institutional investors including pension funds for state, county, and municipal workers such as firefighters. Many members of these funds would be in middle- and lower-income tiers. Also, revenue generated could be used to pay or hire employees or 'subsidize' other bank operations. And, of course, the distributed profits of a firm are not the same as economic profits to stockholders. If investors bought a stock and expected it to earn $100 in profits, then earning $90 in profits could result in an economic loss for the stockholder. As has become clear over the last few years, those who hold stock (particularly financial stocks) can also lose money, even if profits are made at the firm.

beyond the core issue of POS cross-subsidies associated with payment methods, especially since these transfers exist regardless of the distribution of these payment methods.

In their 2010 report, the Boston Fed staff claim that merchant fees on credit cards are used in part to pay for credit card rewards and that, as a result, cash users subsidize part of the rewards given to credit card users.[5] The cost of these rewards is one of many costs paid by credit card issuers. Moreover, there appears to be no separate fund created by merchant fees to cover the cost of credit card rewards. Given that money is fungible, the income used to pay for the rewards comes from many sources, including merchant fees, and fees and interest income from cardholders. Even if this study takes into account that there are higher merchant fees for reward cards, these fees do not appear to be high enough to fully fund rewards. At most, only part of the rewards may be funded through higher merchant fees.

An interesting study by Agarwal et al. tests the impact of rewards on credit card spending and debt.[6] They find that with an average cash-back reward of $25, spending and debt increases by $68 and $115 a month, respectively, during the first quarter after the program starts. Given that revolving debt appears to be impacted (as is spending) by rewards, it is quite plausible, even likely, that interest payments from debt earnings and other fees are used, at least partially, to fund rewards.

Since no potential POS cross-subsidy is observed directly but is rather inferred from the accounting framework, the impact of the assumptions can be substantial. For example, the 2010 Boston Fed staff study characterizes sales as independent of payment choice. If payment choice affects sales (say, because consumers are more liquid as a result), then the acceptance of credit cards is no longer independent of sales. Credit cards reasonably could be found to increase merchant sales and profits, which in turn could result in the recovery of merchant fees, either in part or in their entirety. In such a scenario, merchants would not need to include interchange fees in the price of goods and services because the increased volume of sales would cover the cost of merchant fees. Instead, merchant fees would simply be a cost of doing business—a position taken by many business owner/operator respondents to a 2012 PERC survey.[7]

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[5] Fumiko Hayashi studies payment card rewards and what drives them. Fumiko hayashi, "The Economics of Payment Card Fee Structures: What drives payment card rewards?" (The Federal Reserve Bank of Kansas City, Economic Research Department 2009). Available at http://www.kc.frb.org/PUBLICAT/RESWKPAP/PDF/rwp08-07.pdf

[6] Sumit Agarwal, Sujit Chakravorti, and Anna Lunn, "Why Do Banks Reward Their Customers to Use Their Credit Cards?" (Chicago: Federal Reserve Board of Chicago, 2010). Available at http://www.chicagofed.org/webpages/publications/working_papers/2010/wp_19.cfm

[7] PERC Business Survey was a telephonic survey during the last week of January and the beginning of February 2012 , it included 558 small business owners. The retail sector was oversampled and the public administration sector was undersampled. For all other sectors, the sample differs by no more than 4% from the aggregate data. The survey included small business operators in the gulf coast states of Louisiana, Florida, Alabama, and Mississippi.

There is evidence to indicate that the acceptance of credit cards increases sales. A 2012 PERC survey of small business operators found approximately 68% of respondents reporting that accepting credit cards generated more business.[8] Given that merchants choose to accept credit cards, and do so, presumably, to increase sales and profits, this is a reasonable result. The data also show that a large percentage of small businesses do not accept credit cards. According to a 2008 survey by the National Federation of Independent Businesses (NFIB), only 49% of the independent businesses surveyed accepted cards.[9] The corresponding number from the 2012 PERC survey of businesses is 58%.[10] In that merchants have a choice about whether or not to accept credit cards, evidence strongly suggests that those who do accept credit cards do so because they see a net benefit.

Whether or not a merchant chooses to accept credit cards is a business decision, depending on the costs and benefits of their use.[11] To the extent that merchants choose to accept credit cards for the additional business they bring, then the profit that the merchant makes on additional sales must generally be higher than the amount he/she pays in the form of merchant fees. That is the economic rationale behind accepting credit cards. With the popularity of debit cards increasing across all income groups, merchants have the option of not accepting credit cards while still offering convenient non-cash payment methods. Costco Wholesale is an example of a large retail establishment that accepts debit cards but not Visa or MasterCard credit cards.

In the 2012 PERC small business survey, nearly 42% of business owners said that consumers spend more when they use credit cards. Academic studies also support these claims. Drazen Prelec and Duncan Simester of the Sloan School of Management at MIT found that subjects were willing to pay more when they were told they could only use credit cards than when they were limited to using only cash. In fact, results showed that subjects were willing to spend up to 100% more with credit cards.[12]

Reward cards may boost sales even more. Almost 50% of the merchant owners in the 2012 PERC small business survey reported that accepting reward cards brought in more business. This makes sense in that rewards programs often incentivize consumers to make purchases that they may not otherwise make.

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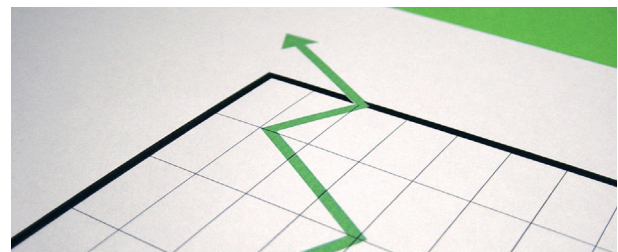
[8] Op. Cit.

[9] National Federation of Independent Businesses, "National Small Business Poll: Credit Cards," vol. 8, issue 3 (2008), available at: http://www.411sbfacts.com/sbpoll.php?POLLID=0067&KT_back=1). Accessed on April. 2012.

[10] PERC. PERC Business Survey. 2012.

[11] Michael Turner, "The Value of Credit Cards" (PERC, 2012).

[12] Drazen Prelec and Duncan Simester, Always Leave Home Without It: A Further Investigation of the Credit-Card Effect on Willingness to Pay (Netherlands: Kluwer Academic Publishers, 2001), available at: http://web.mit.edu/simester/Public/Papers/Alwaysleavehome.pdf.

In a similar vein, Semeraro questions the Reverse Robin-Hood hypothesis for many of the reasons discussed above.[13] He argues that the hypothesis is overly simplistic and that credit cards may provide significant benefits to merchants, benefits that outweigh the incrementally higher out-of-pocket costs. Although the evidence is from a narrow retail segment, Semeraro concludes that credit card acceptance generally appears to benefit all consumers: higher sales volumes lead to scale economies and thereby lead to lower retail prices. He argues that these benefits exceed anything that could be offered if the merchants chose not to accept cards.

The Complexity of Payment System, and Consumer and Merchant Attitudes

The payment system, in its various dimensions, presents a very complex picture. While this observation seem trivial, it is of significant consequence when in this study PERC tries to make sense of measures of any ostensible cross-subsidy between different payment methods.

The Reverse Robin-Hood hypothesis is based on assumptions about how merchants spread out payment-processing costs, the benefits they receive from accepting different payment methods, and how they choose to provide discounts for the various payment methods. In and of itself, this is very complex. But to understand how and whether groups of consumers may be economically affected by different payment choices, a multitude of other costs and benefits borne by consumers and others must be taken into account.

Examples of consumer costs and benefits from payment choices include but are not limited to:

» ATM fees for withdrawing cash
» Checking account fees
» Overdraft fees
» Over credit limit fees
» Purchase protections
» Insurance coverage
» Loss minimization (if purse/wallet is lost or stolen)
» Fraud protection
» Physical safety

Modeling or properly accounting for this complex payment landscape by household income is beyond the scope of this study. A review of the literature suggests that no such ambitious undertaking has been completed as of sending this study to press.

Each payment instrument imposes a different cost on the merchant. Some of these costs are explicit, such as merchant fees, and some are implicit, such as longer check-out times for those paying with checks.

The consumer, on the other hand, faces a separate array of costs, such as checking/debit account fees, credit card fees, ATM fees, overdraft fees, over credit limit fees, and costs of checks. Each instru-

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[13] Steven Semeraro, "The Reverse-Robin-Hood-Cross-Subsidy Hypothesis" (Rutgers Law Journal, Volume 40, No.2, Winter 2009.

ment may also have unique benefits to the consumer. For instance, debit cards offer easy access to personal funds without having to carry cash. Credit cards offer the ability to pay over time and carry supplemental insurance and protections. The fact that individual consumers typically choose to use several different types of payment instruments demonstrates that each payment instrument has distinct advantages, and that consumers may have equally distinct payment method preferences, depending on the transaction.

Since the settlement of the federal antitrust case with Visa and MasterCard in 2011, merchants have enjoyed greater freedom in steering customers to particular payment methods and in differentiating prices based on payment method.[14] U.S. merchants have greater liberty to provide discounts for non-credit card payments and inform consumers on associated costs of credit card processing.[15]

In practice, merchants steer customers to different payment methods for reasons other than the cost of processing. For instance, at gas stations, credit card users may pay up to $1 more per gallon than those who pay with cash. The price incentive to use cash brings customers into the store where sales of marked-up goods provide more profit.[16] Some merchants may offer a one-time 10% discount on purchases if their customers open a store line of credit in hopes that this may generate greater future sales. Others still, such as Target, may want to capture a portion of the credit card/debit card market by offering incentives for their customers to use their brand of credit or debit card by offering a 5% discount whenever their card is used.[17]

This being said, most consumers and small business operators are opposed to the notion of charging different prices depending on payment method.[18] And most also doubt that reductions

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[14] Sutherland Asbil and Brennan LLP,"Court Approves DOJ Antitrust Settlement with Visa and MasterCard,"(July 25, 2011). available at: http://www.sutherland.com/files/News/6e8c1562-4474-47f2-85e9-82548465a8ef/Presentation/NewsAttachment/7c1450a9-a785-4b84-9d27-84f4e1535322/CORP%20Alert%207.25.11.pdf.

[15] This is different than the removal of the no surcharge rule (NSR), which prohibits surcharging consumers when they choose to pay with credit cards. That is, discounts can be made and surcharges cannot be made (in many cases). Although, mathematically, there is equivalence between discounts and surcharges, Schuh, Shy, Stavins, and Triest argue that there is a practical difference from the perspective of the consumer. [Scott Schuh, Oz Shy, Joanna Stavins and Robert Triest " An Economic Analysis of the 2010 Proposed Settlement between the Department of Justice and Credit Card Networks", Journal of Competition Law & Economics 8(1): 107-144 (March 2012).

[16] "Cash or Credit: Are You Being Gouged at the Pump?" Sayville-Bayport Patch, March 15, 2012. Available at: http://sayville.patch.com/articles/sound-off-are-you-being-gouged-at-the-pump. See also Christina Couch, "Bonus or Bogus: Who Pays for Rewards Credit Cards?" Cardratings.com, (February 16, 2012). Available at http://www.cardratings.com/bonus-or-bogus-who-pays-for-rewards-credit-cards.html.

[17] See Target, "REDcard." Last modified 2012. Available at https://redcard.target.com/redcard/rc_main.jsp.

[18] PERC. PERC/ORC Consumer Survey. 2012. & PERC Business Survey 2012. PERC/ORC Survey of 2,000 credit cardholders was an online survey. 1,589 were reward cardholders. Additionally, 501 non-credit card holders were surveyed. The online survey was carried out by ORC in January of 2012.

in merchant fees for accepting credit cards would be passed on in full to consumers.[19] Nearly 40% of small business operators in PERC's business survey said they would not pass on any savings to consumers. And two-thirds of small business operators said merchant fees were just a cost of doing business.[20]

Given these facts—the different costs and benefits of different payment systems for merchants, the complex relationships between them, the perhaps more complex relationship between payment methods and sales, and finally, different costs and benefits for consumers—neither this study nor others, such as the Boston Fed staff studies (2010, 2011), provides a basis for determining the effects of using the various payment methods, and specifically, whether households from different income groups, on net, benefit or suffer. This study does, however, evaluate the Boston Fed staff findings on the narrower slice of that larger issue.

Any study that explicitly or implicitly calls for a shift in policy—as opposed to simply pointing to avenues for further research—should be held to a high standard. The findings of models or accounting frameworks, in cases such as these, should be robust under different specifications. In short, there shouldn't be drastic changes to the outcomes that are being measured simply as a result of reasonable and relatively common sense based changes in the assumptions.

This is the guiding principle tested in PERC's work. By modifying certain assumptions, and assuming a simple cross-subsidy (transmitted via merchant prices) as a consequence of the differing costs of all forms of payment, this study reexamines the Boston Fed staff studies (2010, 2011) and evaluates the robustness of their findings.

The next section provides a background on payment methods currently used (and their evolution and market share) and explores merchant costs of various payment methods. The merchant costs of payment methods are key components of the accounting framework used to estimate the POS cross-subsidies. For this reason, they will be subjected to the appropriate level of scrutiny.

[19] Ibid.
[20] Ibid.

2. Payment Methods

This section unbundles a key assumption underpinning the Boston Fed staff reports on credit cards and rewards programs, i.e., the cost of processing non-credit card payments. It finds the assumption in the Boston Fed staff studies on the cost of non-credit card payment processing to be too low. This, as will be seen in section 3, can dramatically change POS cross-subsidy findings. It also reexamines the trend in overall use of credit cards by consumers in the US and international experiences with interchange regulation.

2.1 Market shares, changes over time, and innovations

This section reviews changes in the payment system over the past few decades. This historical perspective is very important because the rise or fall or lack of change in overall credit card use may impact not only the views expressed in this paper, but also the measure of cross-subsidies. For instance, if credit card payments represent only a tiny share of payments but are growing very rapidly, then today's small cross-subsidies could become much larger in the future.

Payment methods have evolved over time with changes in need and the advance of technology. The traditional use of cash and paper checks was followed by the rise of charge cards and credit cards in the 1950s and 1960s. Debit cards, introduced in the 1970s, are a relatively newer payment option. These were followed by bank account payments and pre-paid cards in the 1980s. With the increased adoption of personal computers and the internet in the 1990s, online bill payment methods have been instituted. And today, with the explosive growth of cell phones and smart phones, mobile wallets and payments are now becoming common. [21]

With the introduction of alternative payment methods, the use of physical currency has witnessed a secular decline. While diffusion of the ATM may have slowed this decline, the decreased use

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[21] Scott Schuh, "Evolving Consumer Financial Services Marketplace: Payments and Banking" (Boston: Federal Reserve Bank of Boston, Consumer Payment Research Center, December 1, 2011). Available at: http://www.bos.frb.org/economic/cprc/presentations/index.htm.

of currency over the long-term is not in question. Unlike other payment methods, currency does not need to be processed, making it difficult to count the number of currency transactions and their value. From a research perspective, this is unfortunate.

As a proxy for currency use, Bauer and Littman use the value of currency in circulation per Gross Domestic Product (GDP).[22] In the US, they found that, in the smallest denominations ($1s, $5s, $10s, and $20s), bills in circulation declined by 50% relative to GDP between 1980 and 2006. They also found that this rate of decline increased after 2000.[23] A Visa Payment Panel Study found that currency's share of spending among participants fell from 21% of total spending in 1995 to 14% in 2005.[24] And Humphrey estimated that total

currency transactions as a share of all consumer expenditures fell from 39% in 1974 to 16% in 2000.[25] The 2009 Survey of Consumer Payment Choice (SCPC) found that 28% of consumer transactions were in currency.[26]

The use of non-cash payments is easier to track over time given that these transactions must be processed. Figure 1 shows that although the use of checks has declined since 2000, credit card use has remained fairly flat and debit card use has risen rapidly.

[22] Bauer, P. ,and Littman, D. (2007) "Are Consumers Cashing Out? " Federal reserve Bank of Cleveland Economic Commentary 1 (October)

[23] Paul W. Bauer and Daniel Littman, "Are Consumers Cashing Out?" Economic Commentary. (Cleveland: Federal Reserve Bank of Cleveland, October 1, 2007). Available at: http://www.clevelandfed.org/research/commentary/2007/100107.cfm.

[24] VISA USA Research Services, "Payment Trends Summary: VISA Payment Panel Study." (2006). Available at: http://www.bostonfed.org/economic/cprc/conferences/2006/payment-choice/papers/hampton.pdf.

[25] David B. Humphrey, "U.S. Cash and Card Payments Over 25 Years" (Philadelphia: Federal Reserve Board, 2002). Available at: http://www.philadelphiafed.org/research-and-data/events/2002/financial-services-and-payments/papers/Humphrey.pdf.

[26] Kevin Foster, Erik Meijer, Scott Schuh, and Michael A. Zabek, "The 2009 Survey of Consumer Payment Choice" (Boston: Federal Reserve Bank of Boston, 2011). Available at: http://www.bos.frb.org/economic/ppdp/2011/ppdp1101.pdf.

Figure 1: Non-currency shares of transactions
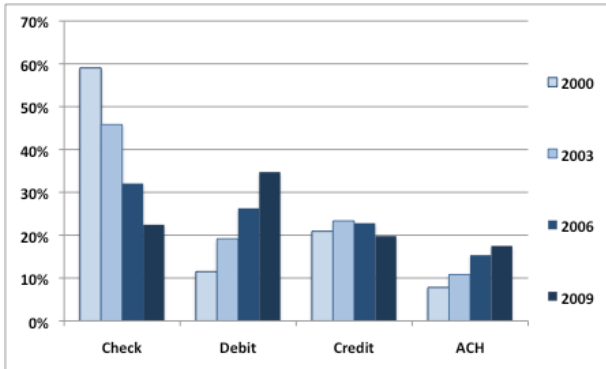
Source: 2004 Electronic Payments Study for Retail Payments Office at the Federal Reserve Bank of Atlanta, The 2007 Federal Reserve Payments Study Noncash Payment Trends in the United States: 2003 – 2006, Federal Reserve System, and The 2010 Federal Reserve Payments Study Noncash Payment Trends in the United States: 2006 – 2009, the Federal Reserve System. ACH refers to Automated Clearing House, an electronic method for financial transactions.

Figure 2 shows more recent data for credit and debit card transactions. Specifically, it compares the number of Visa and MasterCard debit and credit card transactions. It shows that while in 2005 the number of credit and debit transactions were almost equal, by 2011 there were about two and a half times as many debit as credit transactions.

Figure 2: Debit transactions and credit transactions (millions)
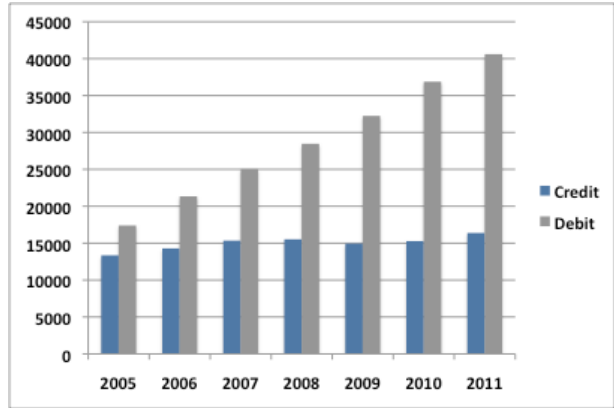
Source: PaymentSource, see http://www.paymentssource.com/statistics/. Figures compare Visa and MasterCard credit and debit card transactions.

Figure 3 shows this comparison for spending as a share of GDP. While debit spending shows a consistent rise, credit card spending is flat as a share of GDP, with 2011 spending slightly below the figure for 2007 (the peak before the financial crisis and ensuing recession).

Figure 3: Debit spending and credit spending (% of GDP)
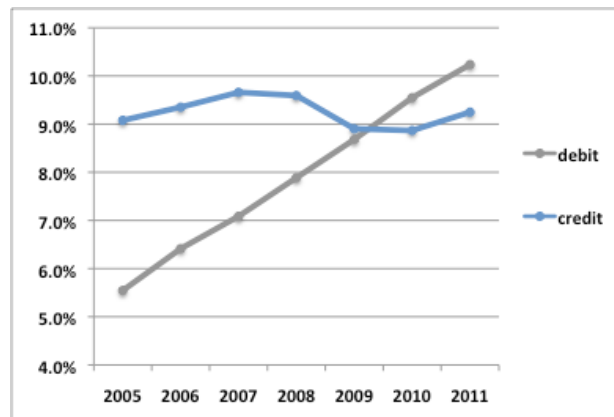
Source: For card spending see PaymentSource, see http://www.paymentssource.com/statistics/, nominal GDP from the BEA. Figures compare Visa and MasterCard credit and debit card spending.

Together these charts show little change in the rate of credit card use and the unambiguous rise of debit cards; this comparison strongly suggests that the use of debit cards has been rising at the expense of cash, checks and other non-card payments. Trends in payment choices are consequential for estimating any POS cross-subsidy. Meaningful analysis must account for the marked decline in cash and checks, the meteoric rise in debit card and pre-paid payments, or other changes. Changes have occurred so rapidly in the payment space, that it likely that any analysis would have a relatively short shelf life.

The lack of a noticeable increase in credit card use relative to other payment methods is contrary to what the Boston Fed staff study (2010) found. The authors of that study list the increase in credit card use as the first basic fact motivating "analysis and modeling of transfers among consumers." However, because the research was initiated several years ago, data collection ended in 2007. As a result, credit card usage peaks in 2004. What appeared to be an upward trend in credit card usage up to 2007, in retrospect appears to show a rise in usage up to about 2003-04, followed by a period of leveling.

It is also worth noting that while the use of some payment instruments has risen or fallen over time, today, consumers typically use several payment methods. Some are typically used for small purchases (such as cash) and some are used more for larger purchases (such as credit and charge cards).[27] The modal American consumer, then, is a hybrid transactor—using multiple payment methods when purchasing. Far less common is someone who makes purchases with a single medium, such as cash or card. Efforts to assess a POS cross-subsidy among groups of consumers must account for this fact.

2.2 Cost and Benefits of Payment Instruments

Any measure of a potential cross-subsidy across payment means of course has to identify the costs and benefits the measure assumes. As suggested above, a comprehensive inclusion of all the costs and benefits of all payment methods is exceedingly difficult owing to the complex interactions between payment methods and among payment methods and sales. An examination of costs and benefits is necessary in order to help the reader evaluate the rationale for consumer payment choices and the decision by some merchants to accept credit cards.

2.2.1 Merchant Costs and Benefits

The costs and benefits associated with each payment instrument are borne by consumers, merchants, payment processors, and issuers. Some costs are closely linked to the ticket size (purchase amount) and some are flat costs. There have been a number of studies aimed at calculating these different costs. Of particular interest is the comparison between currency and electronic forms

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[27] The Federal Reserve, "Non Cash Payment Trends in the United States: 2006-2009," 2010 Federal Reserve Payment Study (Washington, DC, April 5, 2011). Available at: http://www.frbservices.org/files/communications/pdf/press/2010_payments_study.pdf.

of payment. Though much of the merchants' cost associated with credit card payments should be very obvious (costs of the merchant fees), the cost of cash is not always so clear.

For obvious reasons, no cost benefit assessment of credit cards vs. cash can be made without a reasonable accounting of the costs of cash. To assume that it is costless is misleading and wrong. Nor is the cost of cash unexplored.

Studies have used different approaches to calculate the cost of currency and other payment instruments. This study focuses on costs to merchants for the various payment instruments, and not to consumers or society as a whole. And, consistent with the initial Boston Fed staff study (2010), this study compares the cost of credit card payments with the average cost of non-credit card payments.

To facilitate the comparison of costs of credit cards to non-credit card payment instruments, a weighted average of estimated costs of non-credit card instruments was used.

A study by Garcia-Swartz et al. in 2006 was one of the first to empirically examine the move toward a cashless society using a cost-benefit analysis.[28] Table 1 shows average costs and estimated costs of different payment instruments to merchants.

Table 1: Estimated payment instrument costs to merchants

	Cash	Non-Verified Check	Verified Check[29]	Signature Debit	PIN Debit	Credit/ Charge
Average purchase for payment type	$11.52	$54.24	$54.24	$33.00	$41.05	$44.15
Payment processing cost per $100 of sales	$2.61	$1.17	$0.86	$2.27	$1.40	$2.58

Source: Garcia-Swartz et al., "The Move toward a Cashless Society: A Closer Look at Payment Instrument Economics" (Review of Network Economics, Berkeley Electronic Press, vol. 5(2), 2006).

The average ticket size is relatively low due to the study's focus on grocery store payments. Table 1 shows average ticket sizes by type of payment instrument and the cost to process these payments per $100 of sales. The analysis involved the use of a straightforward multiplication (a linear scaling, so to speak): for example, if the cost to process a $20 purchase was $1, then the processing cost for processing a $100 purchase was assumed to be $5. However, if there are fixed costs, this method might overstate actual processing costs.

If cash purchases are in fact smaller than check purchases, then $100 in sales would require approximately 9 cash purchases, whereas only 2 check purchases would be required to arrive at

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[28] Daniel D. Garcia-Swartz, Robert W. Hahn, and Anne Layne-Farrar, "The Move toward a Cashless Society: A Closer Look at Payment Instrument Economics" (Review of Network Economics, Berkeley Electronic Press, vol. 5(2), 2006).
[29] Non-verified checks are manually authorized at the checkout counter. Verified checks are electronically authorized to have sufficient funds in the account to cover the purchase.

the same dollar amount of sales. As a result, the cash purchases would actually be associated with a greater amount of fixed costs. Given the advantages and disadvantages to such linear scaling of costs to calculate the cost for $100 in sales, the authors have calculated the marginal costs for two sizes of transactions - $11.52 and $54.24. These costs are shown below in Table 2.

Table 2: Estimated payment instrument costs to merchants by ticket size

	Cash	Non-Verified Check	Verified Check	Signature Debit	PIN Debit	Credit/ Charge
Marginal cost for $11.52	0.30 (2.6%)	0.42 (3.6%)	0.44 (3.8%)	0.68 (5.9%)	0.57 (4.9%)	.61 (5.3%)
Marginal cost for $54.24	0.43 (0.8%)	0.64 (1.2%)	0.47 (0.8%)	0.82 (1.5%)	0.57 (1.1%)	1.22 (2.2%)

Source: Garcia-Swartz , et al. "The Move toward a Cashless Society: A Closer Look at Payment Instrument Economics" (Review of Network Economics, Berkeley Electronic Press, vol. 5(2), 2006).

Using this approach, the higher ticket size of $54.24 puts the cost of currency at 0.8% and the cost of checks 50% higher at 1.2%.

Debit card regulations, which were introduced in October 2011, have put a cap on debit card fees. The rate is held to no more than 0.05% of the total transaction plus a maximum of $0.21 fixed fee for all transactions. This puts the cost of using debit cards at 0.62% (assuming an average debit card transaction of $38 used in the 2010 Federal Reserve Payment study).[30] It should be noted that debit cards from smaller lenders are exempted from these regulations. However, this report uses the fee structure from 2007 in order to be consistent with the Boston Fed staff studies (2010,2011), whose data and fees date from that year.

The Garcia-Swartz et al. (2006) study, along with studies by Bergman et al. (2007) and Gresvik et al. (2009) were referenced by the Boston Fed staff study (2010) in their discussion of the cost of cash. [31][32][33] The study by Bergman et al. (examining the cost of cash in Sweden) distinguishes between costs to the retail sector, the general public, and the banks. [34] The total cost of handling cash to the retail sector is 3.68 billion Swedish Krona (SEK) for handling 235 billion SEK. This puts the cost of cash at 1.5%. Bergman et al.

[30] The 2010 Federal Reserve Payments Study Noncash Payment Trends in the United States: 2006 – 2009,

[31] Daniel D. Garcia-Swartz, Robert W. Hahn, and Anne Layne-Farrar, "The Move toward a Cashless Society: A Closer Look at Payment Instrument Economics" (Review of Network Economics, Berkeley Electronic Press, vol. 5(2), 2006).

[32] Olaf Gresvik and Harald Haare, "Costs in the Norwegian Payment System," Norges Bank Payment Systems Department, Staff Memo No. 4/2009.

[33] Mats Bergman, Gabriella Guibourg, and Björn Segendorf, "The Costs of Paying – Private and Social Costs of Cash and Card Payments." Working Paper Series No. 212, (Publisher, December 2007).

[34] Ibid.

conclude that the unit social cost of handling cash is 4.6 SEK, which is 40% more than the social cost of handling card at 3.2 SEK. Also, they note that the actual cost depends on the size of the transaction.

A comprehensive study by Gresvik et al. (2009) estimates the 2007 costs of the use and production of the most common Norwegian payment services: payment cards, giros and cash.[35] The merchant incurs a cost of 0.322 million Norwegian Krone (NOK) for handling cash payments worth 62.1 billion NOK. Thus, the estimated cost of cash is 0.5%.

Consultants from McKinsey and Co. have estimated that "society spends about €200 (£180) a year per person to cover the cost of cash," and the "real" cost of cash to a retailer is 1.3% of the purchase price.[36]

This study makes use of a simple average to compute the cost of currency to merchants, though for Garcia Swartz et al. a single value is used, corresponding to the average of the two-ticket size estimates used in that study. [37]

Table 3: Estimated currency costs

	Garcia-Swartz et al. (average for $11.52 and $54.24 ticket size)	Bergman et al.	Gresvik et al.	McKinsey	Average Cost
Cost of Currency	1.7%	1.5%	0.5%	1.3%	1.25%

Source: Garcia-Swartz , et al. "The Move toward a Cashless Society: A Closer Look at Payment Instrument Economics" (Review of Network Economics, Berkeley Electronic Press, vol. 5(2), 2006).
Mats Bergman, Gabriella Guibourg, and Björn Segendorf, "The Costs of Paying – Private and Social Costs of Cash and Card Payments." Working Paper Series No. 212, (Publisher, December 2007).
Olaf Gresvik and Harald Haare, "Costs in the Norwegian Payment System," Norges Bank Payment Systems Department, Staff Memo No. 4/2009
Olivier Denecker, Florent Istace, and Mieke Van Oostende, "ATMs: Complex Weapons in the War on Cash," (McKinsey on Payments, November2008).

The average cost estimate for cash shown above in Table 3 may be considered low if one considers that Bergman et al. and Gresvik et al. do not include fraud/theft costs.[37][38] Garcia Swartz et al. estimates these to be $0.03 for the average cash purchase of $11.52. This translates to 0.26% of the purchase.[39]

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[35] Olaf Gresvik and Harald Haare, "Costs in the Norwegian Payment System," Norges Bank Payment Systems Department, Staff Memo No. 4/2009.

[36] Daniel D. Garcia-Swartz, Robert W. Hahn, and Anne Layne-Farrar, "The Move toward a Cashless Society: A Closer Look at Payment Instrument Economics" (Review of Network Economics, Berkeley Electronic Press, vol. 5(2), 2006).

[37] Mats Bergman, Gabriella Guibourg, and Björn Segendorf, "The Costs of Paying – Private and Social Costs of Cash and Card Payments." Working Paper Series No. 212, (Publisher, December 2007).

[38] Olaf Gresvik and Harald Haare, "Costs in the Norwegian Payment System," Norges Bank Payment Systems Department, Staff Memo No. 4/2009.

[39] Daniel D. Garcia-Swartz, Robert W. Hahn, and Anne Layne-Farrar, "The Move toward a Cashless Society: A Closer Look at Payment Instrument Economics" (Review of Network Economics, Berkeley Electronic Press, vol. 5(2), 2006).

It also is likely that the time it takes to process card payments at point of sale has been decreasing relative to the time it takes to process cash. This is probably due to the increasing use of card swipes where no signature is necessary, faster network connections, and increased practice of consumer swiping and signing or entering PINs on their own. In fact, cashiers in typical large retail stores now do very little direct card processing.

A 2006 MasterCard presentation included figures from a 2005 conference in which the checkout time at a large pharmacy chain was shown to be seven seconds faster—using a card transaction requiring no signature—than a transaction that involved cash.[40] If the total hourly cost of a cashier to a merchant is $20, then seven seconds translates to $0.04, or 0.34% of $11.52.[41]

For estimates of other non-credit card instruments, the values cited in the Boston Fed staff study (2011) were used. Thus, the cost of checks was determined to be 1.2%. For debit cards, the weighted average of 1.75% (no PIN) and the midpoint of 0.58–1.14% (PIN) was used, using weights from the 2010 Federal Reserve Payments Study.[42] The cost of pre-paid cards was taken to be 1.3%.

For the weights of the non-credit card payment instruments relevant to this study, the Survey of Consumer Payment Choice (SCPC) was used. Table 4 shows the relative weights and costs of the non-credit card payment instruments. By weights, it is meant that the payment choice's share of non-credit card transactions and by cost it is meant the cost of that payment choice in terms of the transaction amount.

Table 4: Non-credit card costs and relative weights

	Debit cards	Currency	Checks	Prepaid Cards	Non-credit Card
Weights	41%	40%	18%	2%	100%
Costs	1.4%	1.25%	1.2%	1.3%	1.3%

The proportion of prepaid cards may not seem very high given the size of the economy; but prepaid card usage is increasing over time, and these cards are overwhelmingly popular in the lowest income group with earnings of less than $20,000 annually. For this group, prepaid cards account for 11% of transactions.[43] The cost of these cards can be very high to the consumer, and because they can be processed as either a debit or credit card, the cost of processing them can vary between 0.6% and 2%.

[40] MasterCard PayPass, "The Simpler Way to Pay" (MasterCard International, April 25, 2006). This report claims that contactless cards were processed 21 seconds faster than cash checkouts. This suggests that as card transactions began to require no signature and relied more heavily on consumer swiping, checkout processing time got considerably faster.

[41] A true cost-benefit analysis would take into consideration the cost of the POS terminal. As technology evolves over time, all costs change.

[42] Federal Reserve System. The 2010 Federal Reserve Payments Study: Noncash Payment Trends in the United States: 2006 – 2009. 2010, updated 2011.

[43] Kevin Foster, Erik Meijer, Scott Schuh, and Michael A. Zabek "The 2009 Survey of Consumer Payment Choice" (2009) Federal Reserve Bank of Boston. Available at http://www.bos.frb.org/economic/ppdp/2011/ppdp1101.pdf

It is taken to be 1.3 % for the calculations in this study. Thus, for the cost of non-credit card payments to merchants in 2007, the weight average cost of debit cards, currency, checks, and prepaid cards is used. This is 1.3% of the transaction value.

One methodological issue that should be raised is that the group "non-credit card payments" is an artificial construct meant only to allow a clear comparison between credit card payments and all other payments. In reality, given that merchants have different costs for each instrument (and these costs vary by merchant and ticket size), simple cross-subsidies as explored in this analysis may exist among all the payment instruments. For instance, in some stores, cash users may be subsidizing debit users, while the reverse occurs in other stores. The extent of these various cross-subsidies should be examined more fully, as they could have policy implications as significant as that of potential cross-subsidies between credit cards and non-credit cards.

The results of the Boston Fed staff analysis are very sensitive to assumptions about the use and cost of non credit card payments. As shown herein, those assumptions should be adjusted to best reflect the payment landscape.

2.3 Rules, regulations and agreements

There has been a growing interest in the debate surrounding interchange fees and whether and how they should be reformed. The recently enacted Durbin Amendment, which is part of the Dodd-Frank Act (2010), has capped the interchange fees on debit card transactions.[44]

As mentioned previously, under the final rule, the maximum permissible interchange fee that an issuer may receive for an electronic debit transaction will be the sum of $0.21 per transaction and five basis points (0.05) multiplied by the value of the transaction. This provision regarding debit card interchange fees went into effect on October 1, 2011.

When combined with the maximum permissible interchange fee under the fee standards, a covered issuer eligible for the fraud prevention adjustment could receive an interchange fee of up to approximately $0.24 for the average debit card transaction, which is valued at $38. Thus, the interchange fee falls to about 0.6% from approximately 1.6% prior to the Durbin Amendment.

The ultimate impact of this regulation is not yet known. Evans et al. argue that the regulation could significantly harm consumers and have no countervailing benefits.[45] They find that the banks will recover the lost interchange fee by imposing different

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[44] Dodd-Frank Wall Street Reform and Consumer Protection Act, Pub. L. 111-203. Available at http://www.gpo.gov/fdsys/pkg/PLAW-111publ203/content-detail.html

[45] David S. Evans, Robert E. Litan, AND Richard Schmalensee, "The Economic Principles for Establishing Reasonable Regulation of Debit-Card Interchange Fees that Could Improve Consumer Welfare" (February 22, 2011). Available at SSRN: http://ssrn.com/abstract=1769890 or http://dx.doi.org/10.2139/ssrn.1769890

types of fees on consumers. This in turn will cause greater harm to the consumers. Given how recent this policy change is, and the lack of available data, it is far too early to tell whether this is occurring.

Credit card merchant fees and a perceived lack of full information about merchant fees have also been a focus of government attention. The 2011 settlement of the U.S. Department of Justice complaint against Visa and MasterCard empowers merchants to inform their customers of payments costs and provide discounts. Specifically, merchants are allowed to communicate to consumers the cost incurred when a consumer uses a particular credit card network, type of card within that network, or other form of payment. In addition, merchants can offer consumers a discount or rebate or a free or discounted product or service for using a particular credit card network, low-cost card within that network or other form of payment. That is, merchants can steer customers to the merchant's preferred method of payment.

These government and court actions are likely impacting the availability and pricing of payments mechanisms. How these actions will ultimately impact POS cross-subsidies is not known. However, to the extent that merchants have greater control over steering customers and offering rebates, POS cross-subsidies are becoming more a story about merchant choices and pricing. The following subsection illustrates this point by briefly describing the case of Australia, wherein interchange fee policy was implemented.

2.4 International Experiences: Australia

In 2002, the Reserve Bank of Australia (RBA) announced its regulations pertaining to interchange fees. The regulations focused primarily on the new approach to interchange calculation and the elimination of the no surcharge rule. An aim of the regulations was to drive merchants to surcharge appropriately, making credit card usage less attractive. However, some evidence suggests that the new regulations have given rise to a number of unintended consequences.

Chang et al. find that 30% to 40% of lost revenue from reduced interchange fees were recovered by banks via different fees.[46] They also find that while merchants probably benefited from reduced interchange fees, there is little empirical evidence that savings were passed on to consumers. They cite a Cannex Australia survey of merchants that found "less than 5 percent declared that they had reduced prices to consumers. On the other hand, more than 20 percent reported that their profits had increased and almost 60 percent reported that they had not experienced any changes in their regular operations."

Since 2002, the merchants have not been systematic in levying surcharges. Some make use of surcharges, some do not; some merchants have introduced differential surcharging by brand and many do not clearly disclose their surcharging scheme. As a result, the RBA is looking into

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[46] Howard Chang, David Evans, and Daniel Garcia-Swartz, "The Effect of Regulatory Intervention in Two-Sided Markets: An Assessment of Interchange-Fee Capping in Australia," Review of Network Economics, 4 (4) (December 2005).

setting surcharging standards.[47] Others have also been skeptical of whether consumers have benefited from the regulations.[48] On the other hand, a General Accountability Office (GAO) report discussing the mixed evidence for Australia notes that merchant representatives and Australian regulators (including the RBA) believe that consumers have benefited, but they acknowledge that this is difficult to demonstrate conclusively.[49]

The RBA is investigating lower-than-expected investments in payment system innovations. This may be another consequence of the regulations that reduced revenues (and potential revenues) from the payment system.[50] It is encouraging that the RBA is attempting to address some of the unintended consequences of its 2002 intervention into the payment system market.

It is fair to say that until now, the intervention must be judged as yielding mixed results at best. Growth in credit card usage has slowed relative to the preceding decade, while growth in the use of debit cards has increased dramatically.[51] The net social benefit—and clear aim of the RBA—was to encourage more responsible borrowing and consumption. This has arguably been one

outcome, although whether this was a result of the regulation, or of an unrelated growth in use of debit cards (which showed a parallel growth in the United States) is not entirely clear.

However, to the extent that merchants have both increased average surcharges levied on credit card users, and have not reduced prices on goods and services in response to the reduced fees, they are effectively engaging in price gouging. On this front at least, the RBA's intervention has failed to meet its intended target and has led to an extensive range of undesirable and negative consequences. This should serve as a cautionary tale for those seeking to implement similar reforms in the US.

The next section presents results for POS cross-subsidies. It uses the cost of non-credit card payments derived earlier in this section as a more realistic alternative to the estimated cost used in the Boston Fed Staff report (2010).

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[47] "After a decade of regulatory intervention, the Australian cards market continues to adopt to intended—and unintended—consequences of central bank involvement." Steve Worthington, "Payment Cards In Australia: Plus Ca Change," Lafferty Cards and Payments Insights, 1 (4) (April 12, 2012): 15. Available at: http://edition.pagesuite-professional.co.uk/launch.aspx?referral=other&pnum=&refresh=2Lg1j40J8K p1&EID=152cd81c-ebc7-4aae-9ced-54373c0f5d73&skip=.

[48] See Robert Stillman, William Bishop, Kyla Malcolm, and Nicole Hildebrandt. "Regulatory Intervention in the Payment Card Industry by the Reserve Bank of Australia, Analysis of the Evidence." CRA International (April 2008); Todd J. Zywicki, "The Economics of Payment Card Interchange Fees and the Limits of Regulation." ICLE Financial Regulatory Program White Paper Series (ICLE: June 2, 2010).

[49] GAO. "Credit Cards: Rising Interchange Fees Have Increased Costs for Merchants, but Options for Reducing Fees Pose Challenges." (Washington, DC: GAO, November 2009).

[50] Ibid., pp. 15, 29.

[51] Ibid.

3. Reexamining the Accounting of Who Wins and Who Loses

This section reexamines the accounting method used in the Boston Fed staff report (2010), using a revised value for the cost of processing non-credit card payments and adding the effects of different shopping patterns among households. Also examined is the value of estimated cross-subsidies in context with other costs and benefits of the payment systems. This section finds that the approach used in this report and the Boston Fed staff report is over-simplistic and should not serve as the basis for policy decisions. Further, reasonable modifications to assumptions produce relatively large changes to cross subsidy estimates. This is problematic given the lack of precise and consistent data on many aspects of the payment system and household use of payments.

3.1 Limits of models and accounting

Due to complexity and gaps in data, a robust and comprehensive model of the payment system market does not exist. This alone should caution against specific conclusions based on the current state of research in this area. The complexity is a function of several factors. First, there is a diverse and evolving set of payment instruments. Most consumers use several payment instruments and make choices among them depending on the type and size of purchases. Second, the costs to use and process these instruments are borne by several parties, including consumers, merchants, and entities that process the payments. Each of these parties is also heterogeneous and each has its own set of costs and benefits. Third, the cost/price structure is not completely comparable across instruments. For instance, the pecuniary cost for a merchant to process a debit card transaction is usually a flat fee, while for credit cards it is usually a percentage of the value of a sale. As such, a merchant pays for the ability to accept credit cards only as a share of sales purchased with credit cards.

Creating a complex model (or a model of a complex system) is, in principle, a surmountable problem. But the model can't be completed without the needed data, and in fact, much of the work on the payment markets has emphasized the need to collect more data.[52] Despite the lack of comprehensive data and models, more narrowly focused analyses have been performed, such as the Boston Fed staff study (2010), which considers how merchant costs for credit and non-credit payments impact various consumer income groups.

A concern with such an approach is that other important costs and benefits, such as those borne directly by the consumers, are not included in the analysis. For instance, overdraft fees, which

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[52] For instance, in the policy implication section, Schuh et al. 2011, "Who Gains and Who lLoses from Credit Card Payments? Theory and Calibrations" include data collection as needed. Also, see the conclusions of Hayashi and Weiner (2008) "Developments in Interchange Fees in United States and Abroad" and Hayashi (2006), " "A Guide to the ATM and Debit Card Industry: 2006 Update" which call for gathering comprehensive data.

are associated with checking and debit payments, totaled between $30 and $40 billion in the years between 2008 and 2011. These figures are of approximately the same magnitude as the consumer-related merchant fees examined in this paper and in original Boston Fed staff study (2010). The fees are many times larger than any estimated transfers or cross-subsidies.[53] Consumers Union estimates that the cost to consumers from checking/debit/ATM fees could range between $327 and $439 annually within the first year, for those consumers who don't try to minimize costs (for example, by never using out-of-network ATMs).[54]

The cost of prepaid cards can be equally large for consumers who do not attempt to minimize costs. And for credit cards, there are fees for cash advances and for spending above the credit limit or paying late. Beyond direct pecuniary costs there are indirect costs and benefits related to time, convenience, and safety, as well as differences between paying for everything in cash and paying for purchases with credit cards. And some consumers may prefer to purchase big-ticket items with premium credit cards or charge cards because of additional insurance offered, or the ability to dispute merchant charges via the card (since credit cards allow for the dispute of charges).

Without accounting for these other fees, costs, and benefits, it is impossible to determine total net costs from the mix of payment instruments used by groups having different household incomes. Equally important, without an understanding of the total payment market landscape, it is difficult to understand how changes in some costs/fees might impact other costs/fees, and thus the ultimate impact of the changes on different income groups.

Such limitations are straightforwardly acknowledged in much of the research. At the beginning of the policy implication section, authors of the Boston Fed staff report (2011) pointedly state that "...further research is needed to determine the full effects on social welfare." [55] While a lack of ideal models and data should not unduly limit research (otherwise little research would be carried out), it dilutes the strength of the findings and limits the conclusions that can be drawn from the results.

Another complicating factor is that a single customer, Jane Doe, may have multiple products with a bank, such as a mortgage, credit card, bank account and debit card. The bank may cross-sell different financial products to this customer and view her as a single bank customer. The bank may want to appeal to her with an attractive credit card offer and then, later, offer her a home equity line of credit, for example, which results in more revenue to the bank. Viewing the costs associated with one particular element of the financial system, such as credit cards, may produce a skewed picture of the "total" impact on Jane Doe.

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[53] Brian O'Connell, "Banks Made Less on Overdraft Fees Last Year," DailyFinance. (March 19, 2012), available at: See http://www.daily-finance.com/2012/03/19/banks-made-less-on-overdraft-fees-last-year/.

[54] Brian O'Connell, "Banks Made Less on Overdraft Fees Last Year," DailyFinance. (March 19, 2012), available at: See http://www.daily-finance.com/2012/03/19/banks-made-less-on-overdraft-fees-last-year/.

[55] Scott Schuh, Oz Shy, and Joanna Stavins, "Who Gains and Who Loses from Credit Card Payments? Theory and Calibrations," 2011, Page 29.

3.2 Methodology of replication and re-analysis of Who Gains and Who Loses

As discussed, analyzing potential cross-subsidies in the payments system can be highly complex. This study will now turn to a more specific analysis of potential POS cross subsidies based on the framework of the Boston Fed researchers. In the subsections that follow, the point-of-sale transfers (called cross-subsidies in this paper) were replicated using the methodology generally outlined in 2010 Boston Fed staff study on this topic. Some of the figures derived in this study are a perfect match with those presented in that 2010 study (for instance, columns 2 and 3 in Table 1 of that study), while others varied by a few percentage points from the figures in the 2011 study by the same researchers (for instance, columns 2 and 3 in Table 1 of that study). Overall, using the same assumptions, this study's point-of sale results are quantitatively somewhat different, but qualitatively they are very similar to those found in the 2010 Boston Fed staff study.

The main purpose of this exercise was not to replicate results, but rather to determine how sensitive the results are to changes in certain assumptions, such as the cost of non-credit payment to merchants. That is, this exercise is carried out to determine whether the results are robust enough to allow for meaningful conclusions in support of policy changes.

The data was compiled from various sources, as no single survey could provide all the needed variables. The Survey of Consumer Finances (SCF 2007) was used extensively but it was supplemented by calculations made from the Consumer Expenditure Survey (CEX).[56] The CEX was used for calculating the average propensities to consume among the various household income groups as outlined in the 2010 Boston Fed staff study.

These average propensities were multiplied by the average income (by household income group) from the SCF to calculate total consumption for each income group. The total consumption expenditure was then scaled to equal $5.7 trillion, which according to National Income and Product Accounts (NIPA) is the sum of included spending.

Total annual credit card spending was computed as the sum of the (weighted) values of data gathered by the SCF in response to questions about consumers' total use of credit cards in the past month.[57] The credit card revolver indicator was constructed as any cardholder who had a positive balance in any of the credit card spending series.

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[56] Household income was measured as the sum of variables x5702, x5704, x5706, x5708, x5710, x5712, x5714, x5716, x5718, x5720, x5722, and x5724 in the SCF 2007.

[57] Total card expenditure equaled sum of x412, x420, x423, and x426 all multiplied by 12. To arrive at the total amount of revolving balance per month, x413, x421, x424, x427 and x430 were added together.

The total number of households for 2007 is 116 million, according to US census data.

The reward penetration figures (from Table 2 of Schuh et al. (2010)) are derived from the 2007-08 Consumer Finance Monthly survey.[58]

As is evident from the above paragraphs, the various components contributing toward the actual cross-subsidy were compiled from various sources. The total credit card expenditure is derived from the SCF (2007) by taking the average credit card expenditures for a household income group and multiplying that by the population of that group, which is taken from the US Census.

The first two columns of Table 1 in the 2010 Boston Fed staff study were perfectly replicated in this study. However, the third column was not replicated, as the share of credit card spending shown in Column Three was based on an aggregate spending amount taken from a previous draft of the report by the Boston Fed authors.

When dividing the average monthly balances between revolvers and convenience users (Table 1 in Boston Fed staff study (2011)), the numbers were broadly consistent, and the maximum difference at the higher income levels was around 4%. This variance could be due to slight differences in average

propensities to consume, the precise way balances were calculated, or other seemingly minor methodological differences.

When combining data from different sources, there are several issues of data accuracy, compatibility, and bias that can arise (and do arise here). For instance, the average income reported in the 2007 CEX for those who earn over $150,000 is $235,000, while the average income reported for the same group in the 2007 SCF is $417,000. Further, summing the income or expenditure data from these surveys (and multiplying by the appropriate number of households) does not equal the commensurate data from national accounting figures.

This inconsistency is handled in a direct way, by choosing income and credit spending levels from SCF, consumption ratios from CEX, and then scaling expenditures to national accounting levels. But, given such large level differences between the data sets, it is likely that applying ratios calculated on one to another produces somewhat biased results. That is, it would seem unlikely that the data differ in scaling alone.

Furthermore, problems within the data sets may also be large. For instance, Zinman (2009) found that while credit card charges in the 2004 SCF aggregate credit card charges match well with

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[58] 2007-2008 Consumer Finance Monthly survey conducted by the Ohio State University.

industry figures, the SCF misses half of revolving credit card debt.[59] Zinman also found that this discrepancy was likely to grow over time.[60]

Given the challenges in combining inconsistent data sets and the identified inaccuracy of some of the datasets used, the created dataset used to estimate POS cross-subsidies is undoubtedly flawed and misrepresents reality, to some degree at least. As such, the figures calculated here and in the 2010 Boston Fed staff study should not be taken as precise estimates, but as approximations or estimates of magnitudes at best. A worthwhile extension may be to explore to what extent these data imperfections could impact the results.

The cross-subsidies are calculated as detailed in the 2010 Boston Fed staff study. The cross-subsidy of each income group consists of the difference between cost imposed on the payment system by that group and the share of the cost of the payment system paid by that income group. The total cost imposed on the payment system is the sum of the total merchant fees paid on credit card payments and the total cost of the non-credit card system for that group. The cost paid by the income group is the share of the total expenditure by that group times the total cost of all payment systems by all income groups. Details on the exact calculation are in the appendix.

3.3 POS Cross-subsidy Estimates

Figure 4 shows point-of-sale cross-subsidies (or transfers) as estimated by PERC and by staff at the Boston Fed (2010). The PERC estimate was calculated using the general methodology outlined in the 2010 Boston Fed staff study. This produced slightly different ratios of credit card spending to total spending for the income groups shown. These estimates vary somewhat from the figures presented in the report by the Boston Fed authors but show the same basic patterns and magnitudes. The differences may be due to slight methodological differences in the details of how this and the Boston Fed staff study (2010) datasets were compiled (that is details that were not reported in the Boston Fed study (2010) or slight methodological changes between the different versions of the Schuh et al. papers that were not reported).[61]

Figure 4: POS cross-subsidies
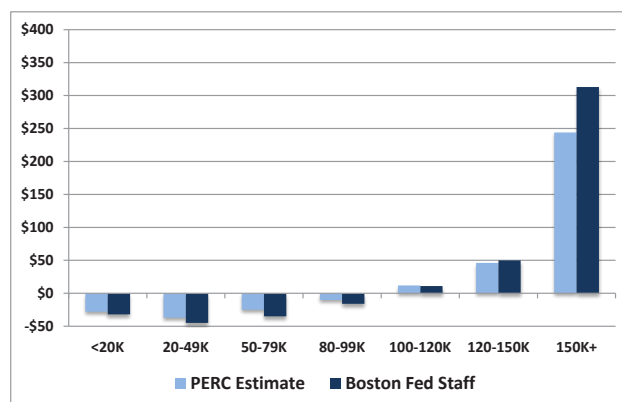
[59] Jonathan Zinman. " Where is the missing credit card debt? Clues and Implications." Review of Income and Wealth, Series 55, Number 2, June 2009.
[60] Zinman also found that this discrepancy was likely to grow over time.
[61] The signs on the cross-subsidies in Table 5 are the reverse of those in the study by the Boston Fed staff because of how cross-subsidies are defined. In this research subsidies are positive when they are received and negative when they are paid.

In both cases, as seen in figure 4, the lowest income households pay transfers of approximately $30 and the highest income households receive transfers of over $200. These point-of-sale transfers, however, do not account for several complicating factors and are based on a low average cost of non-credit card payments or "cash." In the next subsection the cost of "cash" is revised. In the subsections that follow, the methodology designed to create the PERC estimate is used as the basis of the calculations.

3.4 Revisiting the Assumptions

A major concern with the estimates of a cross-subsidy between payment methods is that many of the assumptions are neither self-evidently justified nor do they have a solid empirical basis. It could easily be the case that some alternate assumptions may be more warranted. In this section the assumptions are more closely examined and cross subsidy estimates based on alternative and more empirically based assumptions that are more reflective of the US retail environment are produced.

3.4.1 Revising Cost of "Cash"

The original Boston Fed staff study (2010) used a cost of "cash" equal to 0.5% of the value of the cash transactions. Because "cash" is the combination of non-credit cards payment instruments, the cost of "cash" is taken to be a weighted average of the costs of currency, checks, debit cards and pre-paid cards. Choosing weights and costs for 2007, the estimated cost for cash is 1.3%. The derivation of this percentage is shown in Section 2 of this report.

Table 5: POS Cross-subsidies with Different Costs of "Cash"

Cost of "Cash"	0.5%	1.3%
Less than $20,000	-28	-13
$20,000 to $49,999	-37	-17
$50,000 to $79,999	-25	-11
$80,000 to $ 99,999	-10	-5
$100,000 to $119,999	12	6
$120,000 to $149,999	46	22
$150,000 plus	244	114
Low income (≤$100,000)	-29	-14
High income (>$100,000)	127	59

As shown above in table 5, choosing a more realistic value of 1.3% for the cost of non-credit card payment methods, the estimated cross-subsidy is cut roughly in half. This is not surprising as the cross-subsidy between credit card spending and non-credit card spending is a function of the difference in payment instrument costs for the merchant. Using this approach, in order for the estimated cross-subsidy to be eliminated, the cost of processing non-credit card payments would need to be 2%. The assumption in this case (as in the analysis by the Boston Fed researchers) is that cost to process non-credit card payments is lower than the cost to process credit card payments.

3.4.2 Different Merchants

In addition to the cost of non-credit card transactions, a potentially important factor in the calculation of cross-subsidies is where the spending occurs. If all high-income households spend at hi-mart and all low-income households spend at lo-mart, then no cross-subsidy would result, since the relevant merchant would have no customers of the other income group to subsidize. On the other hand, if the two types of household were equally likely to spend at each merchant, then the full cross-subsidy would occur, as discussed previously.

The first column in Table 6, which is identical to the last column in Table 5, describes this scenario of equal spending at each merchant. However, it would be surprising to find that very high and very low-income households have the same spending patterns across merchants. The 2011 Boston Fed staff report chose to split the spending patterns so that 70% of high-income spending occurred at Merchant 1 and 30% at Merchant 2. The reverse was assumed for low-income spending.

Instead of using just two groups (high and low income), this analysis breaks down spending patterns across seven income groups, as shown in Table 6. The third column in Table 6, labeled 80/20, shows results for the following pattern: 80% of spending from households with incomes under $20,000 is with Merchant 1, 70% of spending from households with incomes between $20,000 and $49,999 is with Merchant 1, and so on, with the remaining spending occurring with Merchant 2. For this column then, in households with over $150,000 in income, 20% of the spending occurs at Merchant 1.

Table 6: Account for spending differences across merchants

Income Groups	50/50	70/30	80/20	90/10
Less than $20,000	-13	-12	-10	-8
$20,000 to $49,999	-17	-16	-14	-12
$50,000 to $79,999	-11	-10	-9	-7
$80,000 to $ 99,999	-5	-5	-4	-3
$100,000 to $119,999	6	5	4	2
$120,000 to $149,999	22	19	16	12
$150,000 plus	114	104	93	76
Low income (≤$100,000)	-14	-12	-11	-9
High income (>$100,000)	59	54	48	38

To be generally consistent with the Boston Fed staff study methodology (2011), focus is placed on the results shown in the 80/20 column. This produces a dichotomous split in shopping patterns close to that of 70/30, which is used in the Boston Fed staff report (2011), where 70% of those with incomes above 100K shop at merchant 1 and 30% shop at merchant 2, with the opposite for those in lower income households.

Modifying the analysis to include differences in shopping patterns across income groups seems to be a more realistic approach than was used in earlier studies. Just this slight modification in the framework results in a significant further reduction in the estimated cross-subsidies. The addition of different shopping patterns across merchants, assuming the 80/20 pattern, results in a decrease in cross-subsidies of approximately 20% to 30%.

The most recent Boston Fed staff study (2011) also shows a reduction in the cross-subsidy (over their earlier findings) when differences in shopping patterns are introduced. However, their results also include redistributed profits, and as such, are not comparable. For instance, for the calculations

for those in the $100,000 and under group, the cross-subsidy would fall from -$14 to $0 when shopping patterns go from a 50/50 split to a 100/0 split of complete shopping segregation. However, for the Boston Fed staff (2011), the comparable measure falls from $85 to $55. This shows that the majority of the transfers described in the most recent Boston Fed staff study (2011) are not from POS cross-subsidies (which are eliminated in cases of complete shopping segregation) but are due to other factors, such as redistributed profits. Redistributed profits are not factored in for reasons discussed in Section 3.4.6

Another factor not explored here or by the Boston Fed staff (2011) is the impact on cross-subsidy estimates from different shopping patterns by consumers (by income segment) within a merchant. Take a big box retailer as an example. It is likely the case that goods and services are not all marked up the same. It may be the case that staple items aimed at price sensitive shoppers (who may use credit cards less) are not marked up as much as items aimed at less price/budget sensitive shoppers. And it may also be the case that using a credit card makes shoppers less price sensitive and more likely purchase items with a higher mark up. Hence, it could easily be that retailers disproportionately cover costs and make profits from higher income / credit card using shoppers. As a result, it could be that higher income shoppers subsidize lower income shoppers, generally and on POS costs. Assume (1) a cost of non-credit card payments of 1.3%, (2) a cost of credit cards of 2%, (3) two groups of consumers (high income and low income), (4) one merchant that serves both groups, and (5) members of high-income households purchase goods and services with mark-ups 7% higher than members of low-income house holds. An example of this would

be if members of low-income households paid an average mark up of 20% and members of high-income households paid an average mark up of 21.4%. That is, a slight, practically irrelevant difference. In this case, however, the direction of the POS cross-subsidy reverses, with high-income households subsidizing lower income households.

Without a better understanding of this (the way costs are actually passed on to customers), it is not even clear of the direction of a potential POS cross-subsidy.

If we combine this factor of heterogeneous markups within a store with different shopping patterns across merchants, with different merchant fees by type of card and merchant, it becomes clear that estimating potential POS cross-subsidies in the real world is very challenging.

3.4.3 Pass Through

Thus far it has been assumed that all merchant costs to accepting credit cards are passed through to consumers (via higher prices). This is referred to as 100% pass through. The opposite would be if prices were completely unaffected by merchant costs (with merchant profits rising and falling with merchant costs).

While the 2010 Boston Fed staff study does not take into account the pass through rate, implicitly assuming a 100% rate, their more recent study (2011) produces a sensitivity analysis of transfer resulting from different pass through rates. For that analysis, at 100% pass-through, low-income households are subsidizing high-income households. At a 50% rate, there is essentially no transfer. And below 50%, high-income households subsidize low-income households.

[62] This assumes that the additional cost of accepting credit cards or changes in that cost is borne by the merchant.

The fact that no cross-subsidies occur at a 50% rate results from the inclusion of bank and merchant profits in the accounting framework of Schuh et al. (2011).

For this analysis, which does not include bank and merchant profits in the accounting of POS cross-subsidies, cross-subsidies disappear when the pass through rate is 0%. This is the point at which merchant fees (or changes in fees) are no longer passed through to consumers.[62]

As noted in Section 2.4, evidence from Australia does not suggest a high pass through rate. The RBA (Reserve Bank of Australia) reduced merchant fees in the hope that the savings made by the merchants would be passed on to the consumers. Evidence does not support this result.[63]

A PERC survey of consumers in the US found skepticism that merchants would pass along any savings from reduced merchant fess one-for-one.[64] Nearly 9 in 10 cardholder respondents believed that merchants would either keep all the savings (44%), or would only pass on some of the savings (42%).[65] More surprising was a survey of small business owners and operators that found nearly 4 in 10 (37%) reporting that they would not pass on any savings to customers from a reduction in merchants fees, while another 20% reported they would share some of the savings with customers, but not all.[66] Given the Australian evidence, and the PERC small business survey results, it is

unlikely that the pass-through rate in America would be more than modest. Please see PERC's white paper, "First Do No Harm: A White Paper on Cardholder and Small Business Operator Views About Credit Card Fees and Surcharges" for further discussion on this matter.[67]

Another consideration is that the extent of pass-through depends on the type of store. A store that receives most of its payments through credit cards might find it more logical to pass through costs from merchant fees. Thus, the pass-through rate might be a function of the share of purchases made with credit cards.

It might seem that pass-through will eventually occur in a competitive setting.[68] However, the complexity of the entire system must be kept in mind. Currently, there is a whole array of interchange fees. Any cap on interchange fees might not be binding for all merchants. And if prices were already set in accordance to price competition with merchants who currently have some of the lowest merchant fees, there might be little impact.

In this analysis, with 100% pass-through, if the costs of processing credit cards was reduced, consumers would see 100% of this savings via lower prices. However, if only 70% of processing cost reductions are passed on to consumers via lower prices then they would only see 70% of these savings.

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[63] MasterCard Worldwide, "Interchange Regulation: Lessons Learned from RBA Intervention in Australia," Insights (MasterCard WorldWide, First Quarter 2007), available at: http://www.masterintelligence.com/upload/169/113/MC53-Interchange-FNL-S.pdf.
[64] PERC. PERC/ORC Consumer Survey 2012
[65] Ibid.
[66] PERC. PERC Business Survey. 2012
[67] PERC. Michael Turner, "First Do No Harm: A White Paper on Cardholder and Small Business Operator Views About [68] Credit Card Fees and Surcharges." 2012.
[68] Adam Levitin, "Interpreting Australian Interchange Regulation's Consumer Impact," (Credit Slips, May 14, 2010), available at: http://www.creditslips.org/creditslips/2010/05/interpreting-australian-interchange-regulation.html.

3.4.4 Revolvers and Transactors

While not directly impacting the results of this paper, the cross-subsidies can be further broken into three categories: non-card users, revolvers and transactors. The actual cross-subsidies for transactors and revolvers are not of immense importance. However, the split between transactors and revolvers in the data is needed in later calculations where interest payments and float are discussed. While the most recent Boston Fed staff study (2011) considers transactors and revolvers in their framework, they also consider bank profits. (It has been argued earlier as to why bank profits are not included in this framework.) The Boston Fed authors (2011) do not explicitly calculate the POS cross-subsidies for transactors and revolvers, and, as such, the results here cannot be compared to their results.

Revolvers are defined as credit card users that do not pay off their credit card balance in full every month. As such, they typically pay interest charges on credit card debt. Transactors, on the other hand, pay off their balance every month, and thus, do not pay interest charges. In this way the results then show cross-subsidies from non-card users to card users. The cross-subsidies broken into non-card users, revolvers and transactors categories is in Table A1 in the appendix.

This study finds, across all income categories, non-credit cardholders are paying a cross-subsidy and all transactors are receiving a cross-subsidy. The results are mixed for the revolvers. This is not surprising as transactors tend to use credit cards the most and non-credit cardholders do no use them at all. Again, these straightforward results do not have an influence on the findings in this study.

3.4.5 Costs, Cross-subsidies and rewards

Presenting estimated cross-subsidies may be more useful when some context is included. For instance, a $20 cross-subsidy between two groups of consumers on a $40 item may be viewed differently than a $20 cross-subsidy on a $200,000 item (such as a home). Since the estimated POS cross-subsidy is the difference between payment processing costs imposed on merchants and the costs paid to merchants (by income group), cross-subsidies will be compared to the costs paid (in Table 7). Table 8 will compare the cross-subsidy to the value of credit card rewards.

Table 7: Household Payment Processing Costs and Cross-subsidies

Income Groups	Payment Processing Cost *Paid* to Merchant via Prices	Payment Processing Cost *Imposed* on Merchant	Cross-subsidy	Cross-Subsidy as Percent of Cost Paid
Less than $20,000	279	269	-10	-3.6%
$20,000 to $49,999	426	412	-14	-3.3%
$50,000 to $79,999	619	610	-9	-1.5%
$80,000 to $ 99,999	814	810	-4	-0.5%
$100,000 to $119,999	930	934	4	0.4%
$120,000 to $149,999	1106	1122	16	1.4%
$150,000 plus	2659	2752	93	3.5%
Low Income (≤$100,000)	472	461	-11	-2.3%
High Income (>$100,000)	1767	1815	48	2.7%

Table 7 above shows the payment processing cost imposed on merchants (by household income group) as well as payment processing costs paid to merchants (by household income group). The difference between these two, what is imposed and what is paid, is the POS cross-subsidy. The cost imposed for any income group is the cost of

the payment methods they use times the volume of sales made with each payment method. Consequently, groups that use payment methods that are costlier to process, impose a greater cost.

The cost paid is simply the total payment processing costs spread out equally according to sales. So if one income group accounts for 10% of sales, they pay 10% of processing costs. All figures in Table 7 are at per household level.

The cross-subsidies represent a very small share of the total payment processing costs paid by consumers. In the most extreme cases the largest cross-subsidy is under 4% of total costs paid by the groups. This highlights the fact that cross-subsidies are a very insignificant part of the total processing cost.

The small scale of the cross-subsidies can be seen in figure 5, which graphs the high income and low-income groups of Table 7. The cross-subsidy, either received or paid, is the difference in the height of the bars for each group. So, the high-income group receives a subsidy since the processing costs it imposes on the merchants is more than the costs it pays. The opposite is true for the low-income group.

Figure 5: Processing Costs and Cross-subsidies for High- and Low-income Households
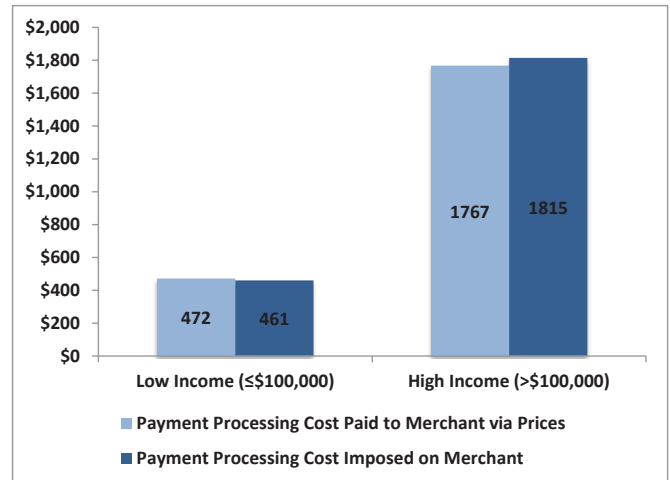
The difference in the height of the bars for each group is barely perceptible.

A concrete example of this is the case of a typical consumer in the lowest household income group. For a purchase of $100, the typical cost imposed on merchants for processing payment would be $1.38. This is the case because they make some transactions with non-credit cards that cost $1.30 to process and they make some transactions with credit cards that cost $2.00 to process. However, via prices the consumer would have paid $1.43. This is higher than $1.38 because, on average, the credit card share of transactions is greater for the average consumer than the consumer from the lowest income household. Taken together then, for a $100 purchase, the consumer in the lowest income group is paying a cross-subsidy of about $0.05 (this is derived from $1.43-$1.38).

Table 7 shows that the cross-subsidy is a very small percentage of the actual cost to the merchant. All payment methods entail a certain cost for

the merchant. Given the differences in the costs of various payment methods, cross-subsidies are bound to exist, at least to some extent, particularly using this simple framework. But with such relatively small cross-subsidies, one has to question the need for policymakers and policy solutions to focus on this issue.

Table 8: Cross-subsidies and rewards

Income Groups	Cross-subsidy	Credit Card Rewards (2007)	Credit Card Rewards (2012)	Cross-subsidy + 2007 Credit Card Rewards
Less than $20,000	-10	11	16	1
$20,000 to $49,999	-14	19	26	5
$50,000 to $79,999	-9	46	63	37
$80,000 to $ 99,999	-4	76	93	72
$100,000 to $119,999	4	102	134	106
$120,000 to $149,999	16	157	176	173
$150,000 plus	93	411	532	504
Low Income (≤$100,000)	-11	29	39	18
High Income (>$100,000)	48	258	327	306

Table 8 adds the estimated cross-subsidy from the 80/20 column of Table 6 (and the Cross-subsidy Column of table 7) to estimated rewards earned per household income group. This is similar to Table 7 in the 2010 Boston Fed staff study, with the exception that this research finds that rewards are greater than the estimated cross-subsidy across all income groups. This reverses a key finding of the 2010 Boston Fed staff study in which, after accounting for the impact of rewards, the lowest income households paid $21. Instead, this research finds the lowest income households receive $1. This change resulted primarily from the increase in the cost of non-credit card payments (from $.50 to $1.30 and the inclusion of different shopping patterns. As shown in Table 8, when factoring in the dollar value of benefits awarded to rewards cards participants, all income tiers experience net gains. This is partly driven by the fact that even among households with the lowest income, reward cards are used. In fact, there appears to be a trend towards greater rewards penetration among all household income groups and a more egalitarian distribution of reward cards across households by income.[69]

3.4.6 Accounting for Bank and Merchant Profits

While the 2010 Boston Fed staff study examined POS cross-subsidies (transfers) and then added the impact of rewards, the 2011 version of the study includes merchant profits, bank profits, rewards, interest payments, and float directly in the transfer accounting. This was an attempt to include other important elements into the accounting framework and to create a closed system, in the sense that no funds leaked out. Funds either flowed to households or covered costs.

[69] Comparing the PERC/ORC consumer survey in 2012 with the OSU Consumer Finances monthly survey in 2007-2008 data, shows that the reward card penetration rate on those card holders with household incomes under $20,000 was 64% of the rate of those with household incomes over $150,000 in the 2007-08 data, and 74% in the 2012 data.

There are critical drawbacks to this approach. First, because major costs and benefits to households by income group from payment instruments (such as ATM and overdraft fees) are excluded, as well as bank level costs and benefits (also by household income group), it is difficult to extend the findings to the real world. That is, the analysis artificially creates a closed system out of few elements. In this sense, PERC prefers the initial approach taken by the Boston Fed authors (2010), which examines the price (POS) cross-subsidy and separately adds on rewards.

From a practical perspective, the complexity of modeling merchants, consumers, banks and processors, including the various ways banks receive revenues from households over time, makes modeling the entire system and calculating transfers between households a daunting task, particularly given the data limitations.

In addition, another major drawback from creating such a closed system is precisely that profits (both from merchants and banks) flow back to households. While it is certainly the case that such profits do flow to some degree to households, this adds an element that makes a reasonable interpretation of findings very challenging.

For instance, as is pointed out in the most recent Boston Fed staff study (2011), even if high-income and low-income households shopped at different merchants (so no price/POS transfer was possible)

the accounting would still show a transfer. This could be because banks were making a profit on revolving balances and this profit was distributed disproportionately to higher-income households. In fact, most of their calculated transfers appear to be from factors other than the direct price/POS transfer.[70] The problem with this is that the results then become a function of many issues much larger than price/POS transfers.

Therefore, if there was no price/POS transfer and no differences in rewards received across income groups, there would still be a transfer from low-income households to high-income households if banks were making profits from revolvers. If transfers from low-income households to high-income households are something to be opposed by policy, what are the policy implications of this? Eliminating profits or a redistribution of stock ownership? If some degree of inequality in income and assets is acceptable and expected, how much is it and what level of transfers is acceptable? If profits are to be included in the accounting and redistributed to higher-income households disproportionately, then it is likely that most industries would be guilty of a so-called "reverse Robin Hood" redistribution.

There are some additional challenges associated with including lender and merchant profits in cross-subsidy estimates. The first is to estimate the extent to which households actually benefit.

[70] On page 27 of Schuh et al (2011) Who Gains and Who Loses from Credit Card Payments? the authors show that the transfers paid by the low-income group falls from $85 to $55 when high-income and low-income households shop with different merchants.

The Boston Fed staff study (2011) uses stock- holding by household income group as reported in the SCF. This probably captures direct stock holdings, perhaps even most mutual fund holdings, but is likely to miss much of the equity owned by large institutions invested in retirement funds. Most of these funds are likely to benefit middle-income households.

More fundamentally, even though a profit is made and distributed to shareholders, this does not necessarily result in a benefit to them. If an investor buys a stock with the expectation of earning a $10 dividend, but the dividend is only $5, then the investor may have incurred a loss. The return must compensate the investor for risk and the opportunity cost of making other investments. Assuming a CAPM (Capital Asset Pricing Model) beta of about 1 (which is roughly the case), then the required return for credit card issuers should approximate the overall market. Between 1980 and 2011, the average total return on the S&P 500 index was about 12.7% (including capital gains and dividends). This is the profit required to achieve zero economic gains. A greater return would result in an economic profit; a lesser return, an economic loss. That is, an investor would need to earn a 12.7% return to make investing worthwhile.

The issue of credit cards profits presents another challenge. These may not be entirely distributed to shareholders, but they may nonetheless have a distributional impact, whether they are used to cover underperforming divisions of the company, or maintain wages and employment. Given these complications, properly accounting for profits proves to be a difficult task.

While income and wealth inequality, in general, are extremely important topics that should be studied and understood, including stock and business ownership when examining the costs and benefits of payment instruments and financial services across households inappropriately extends this research. For these reasons, a transfer model for price/POS cross-subsidies is used, followed by an analysis of the individual impact of other factors—such as interest payments.

3.5 Including Revolving Balances and Float

In this section, PERC extended the analysis to include the cost of revolving balances and the benefit of float. Estimated interest payments are calculated in a manner similar to the most recent Boston Fed staff study (2011), using revolving balance and interest rate information from the Survey of Consumer Finances for the various household income groups.

Here the similarity ends. The issue of payments is treated very differently. In the Boston Fed staff study (2011), estimates of profits from revolving balances are included in a "closed system" in which they are redistributed according to stock ownership by income group. The approach used here, simply includes those profits as payments made by credit card users, as discussed earlier in this section. In Table 9, the cost of processing payments and the cost of interest payments is subtracted from rewards and the benefit of float. This shows the total amount paid out and received by each income segment.

Float is a benefit, an interest free loan that transactors who pay off their balances in full receive. With debit cards, an account must have funds to make purchases. Credit cards, on the other hand, provide the option of paying a month later without any additional cost. In some sense, float is in the same category as rewards. However, float is an implicit benefit, unlike rewards in the form of cash back, airline tickets and others, which are explicit. Of course, float could also be viewed as a benefit to merchants in terms of implicit financing, given that credit cards are giving their customers a loan to purchase the merchants' goods and services. This would be similar to a merchant invoicing a customer for later payment, putting purchases on a tab, or giving customers a line of store credit at no cost.

The authors of the Boston Fed staff study (2011) also include the benefits of float in their calculations. But, they consider float in conjunction with bank profits and other factors as mentioned previously. They use the same method to calculate float that is used here, namely using a rate of 0.87% on

transactors' balances. However, the numbers used here and by the Boston Fed staff (2011) cannot be compared directly, as their report does not provide the tables with float value alone. The magnitude of the benefit of the float is comparable to the rewards and also to the cross-subsidies as seen in Table 9.

Table 9: Household Rewards and interest payments

Income Groups	Payment Processing Cost Paid to Merchant via Prices	CC Rewards	CC Interest Payments	Float	Total
Less than $20,000	-279	11	-119	7	-380
$20,000 to $49,999	-426	19	-249	17	-639
$50,000 to $79,999	-619	46	-540	33	-1,080
$80,000 to $ 99,999	-814	76	-702	49	-1,391
$100,000 to $119,999	-930	102	-675	64	-1,439
$120,000 to $149,999	-1106	157	-734	94	-1,589
$150,000 plus	-2659	411	-585	354	-2,479
Low income (≤$100,000)	-472	29	-329	21	-751
High income (>$100,000)	-1767	258	-648	204	-1,953

Comparing the total column in Table 9 to the value of cross-subsidies shown in Table 8, reveals that the cross-subsidies are less than 3% of the total net cost shown in the last column of Table 9. As mentioned before, the price/POS cross-subsidy is a small share of total costs and benefit of payment methods.

3.6 Measure of Cross-subsidies from Another Data Set

Above PERC implied that part of the challenge of estimating cross-subsidies between payment methods is the fact that, in addition to significant sensitivities to the specifications of the model, the measures also depend on the sources of data used.

In this paper, a Phoenix Marketing International (PMI) data set was used to calculate price/POS cross-subsidies to see what happened to the estimates. The PMI study is based on consumers surveyed between June 2009 and June 2010, and includes data on credit card and non-credit card spending for consumers from different income groups. In all, 21,866 consumers who had a credit card were surveyed. Unfortunately, the data set did not have spending for households with incomes under $20,000, so the SCF was used for this. The data set also did not have spending for those without credit cards. As such, comparisons between the two should be treated with caution.

Table 10: Price/POS Cross-subsidies from different data sets

Income Groups	Cross-subsidy (SCF/CEX)	Cross-subsidy (PMI)
Low income (≤$100,000)	-11	-6
High income (>$100,000)	48	27

Table 10 above shows cross-subsidies calculated on the basis of the SCF/CEX data set and data from PMI. These figures use the 80/20 merchant split and a cost for non-credit payments of 1.3%, as previously discussed in section 3.4.2. The results indicate that there could be substantial variation in the estimated cross-subsidy depending on the underlying data used. This variation could arise either from the exclusion on the non-credit cardholders, or the different time period in the PMI data. The purpose of this modification is not to say that PMI estimates are more accurate than the ones derived from SCF. It is just to illustrate how sensitive cross subsidies can be to different data sets.

This variation underscores the need to improve data collection. Cross-subsidy estimates based on PMI data can only be used to assess the magnitudes of possible cross-subsidies. They cannot be expected to provide precise estimates. As mentioned previously, given the current state of data, it may be fruitful for future research to estimate upper and lower boundaries for possible cross-subsidies. This could be achieved by creating reasonable upper and lower boundaries for credit card and non-credit card expenditures for each household income group.

3.7 Summary of POS Cross-Subsidies Findings

Table 11 below summarizes the different assumptions that were used in this study, and shows their effect on the magnitude of the total cross-subsidy. A plus before a modification in the first column indicates that the modification is added to the previous modification. For the sake of simplicity,

two income categories were considered: less than $100,000 and greater than $100,000. The modifications were based either on payment studies (like the cost of non credit card payments) or reasonable assumptions (different shopping patterns by household income). Adherence to the broad framework of Schuh et al. (2010) has been important while also considering modifications introduced in Schuh et al. (2011).

As can be seen in the summary chart (Figure 6 in Section 4), depending on the data set used, the assumptions regarding the cost of non-credit card payments, shopping patterns and the impact on price/POS cross-subsidies varies. The cross-subsidy can be either received by, or paid by low-income households.

Table 11 Summary of various plausible modifications and associated cross-subsidies.

Modification	Description	Less than $100k	Greater than $100k
Initial	PERC replicates the results from Schuh et al. (2010)	-29	127
+ Revised Cost of "Cash"	PERC revises the cost of non-credit card payments based on a weighted average of non-credit card payment methods	-14	59
+ Different Merchants	PERC assumes different shopping patterns across income groups. [1]	-11	48
+Rewards	PERC includes the value of credit card rewards.[2]	18	306

1. To be consistent with Schuh et al. (2011), an 80/20 split is assumed, as explained earlier
2. This is again to be consistent with Schuh et al. (2011)

4. Taking the Potential Changes in Consumer Spending into Consideration

Suppose that new regulations were to be imposed on rewards, and therefore reward cardholders were to reduce their consumption by 1%. In the accounting framework used in this paper and by both Boston Fed staff studies (2010, 2011), total credit card expenditure is $1.2 trillion. And though reward cardholders account for around 78% of that amount, the spending on reward cards is much higher. According to Master Card, reward cards contribute to around 92% of their total spending. Therefore, a reduction of 1% of credit card spending by reward cardholders translates to about 0.9% reduction in overall credit card spending. Thus, total annual credit card spending would be reduced by $10.8 billion should rewards cardholders reduce spending by just 1%. This figure is larger, in most cases many times larger, than the aggregate amount of transfers or cross-subsidies estimated here or by the authors of the Boston Fed staff study (2010).

In order to understand how an increase in sales and profits from accepting credit cards might impact a POS cross-subsidy, the following crude calculation was made. First, non-credit card transactions were assumed to be a 1.3% average cost (as

estimated in section 2). It was further assumed that merchants made a 20% markup or profit on goods and services sold.[71] In this scenario, if just 3.5% of credit card spending was new spending, then this would cover the additional cost to the merchants of accepting credit cards over non-credit card purchases.[72] As such, there would be no cross-subsidies because the additional costs of credit cards are fully recovered through additional new sales.

However, in this framework credit card spending is only about one-fifth of total spending, As a result, the 3.5% 'increase' in credit card spending results in a total spending increase for the merchant of less than 1%, with an increase of about 0.74% (about one-fifth of 3.5%). This increase would be barely perceptible for most merchants given other factors that may impact business, but it would be enough to cover the additional credit card costs. Interestingly, if 5% of credit card spending were new spending, then merchants would more than recover their credit card costs. This would represent about a 1% increase in total sales for the merchant. If a 100% pass-through is assumed and that all prices are eventually lowered as a result of this increase in sales, then the estimated cross-subsidy is reversed. In other words, those households with incomes under $100,000 receive a $6 cross-subsidy and those over $100,000 pay a $25 cross-subsidy. Robin Hood would be proud!

Table 12: Price/POS cross-subsidies for additional spending with credit cards

Income Groups	1.3% cost for "cash" and no sales increase	1.3% cost for "cash" and 3.5% of CC spending is new spending	1.3% cost for "cash" and 5% of CC spending is new
Low Income (≤$100,000)	-14	0	6
High Income (>$100,000)	59	0	-25

Without a good understanding of how credit cards impact spending, types of purchases, and merchant profits, very little can meaningfully be said about the magnitudes or directions of potential cross-subsidies.

There is good reason to believe that should policy prescriptions be implemented aimed at POS cross-subsidies and reducing rewards, reward card spending would be affected. PERC's recent survey of cardholders found that 7 out of 10 rewards cardholders would discontinue using rewards cards altogether should a fee be charged for rewards program participation, while a further 3 out of 10 reported that they would reduce use.[73]

Given that reward card spending accounts for such a large share of credit card spending, it would be reasonable to expect that issuing reward cards that are less appealing would result in reduced

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[71] This level of markup is not unrealistic and may even be conservative. For instance, see gross margins by retail segment at http://www.retailowner.com/Benchmarks.aspx, and see http://www.ericsink.com/bos/Product_Pricing.html and http://www.ehow.com/info_12006023_normal-markup-percentage.html

[72] This can be seen since the additional profit from the new spending would be 20%*3.5%*credit card sales = 0.7%*credit card sales. Since merchants are paying an extra 0.7% (2%-1.3%) for credit card sales, the additional profits cover the additional cost of accepting credit cards.

[73] PERC. PERC/ORC Consumer Survey

credit card spending, at least by a small amount. But even a small reduction could have a sizeable impact. In addition, as shown above, income generated from small credit card purchases accounts for more income than all the additional costs of accepting credit cards for merchants.

In very simple models of economic activity, given fixed labor and capital in the current period (as well as technology or other additions), there is a fixed level of output that can be used either for consumption or savings/investment. In these models, households and society face a trade-off between current consumption and savings/investment, which translates to future, greater consumption. Therefore, a rise in consumption in the current period is not possible (holding labor, capital, and other factors constant) without reducing investment and future consumption.

The reality, however, is much more complicated. For instance, in the current economic environment, labor and capital are not being fully used, and it will probably be many years before that point is reached. The precise mechanisms for affecting consumer demand, particularly regarding rewards and payment choice, are not well under-

stood. However, given that consumer spending accounts for a very large share of the economy, factors that significantly affect consumer spending will necessarily affect the economy as a whole.

Consumer spending typically accounts for a larger share of the economy as an economy develops. Not surprisingly, card usage and credit card usage, is also typically higher in more advanced economies. Zandi and Singh (2010) estimate (in an arguably simple fashion) that over the 2003-2008 period, a 1% increase in card use/penetration in developed countries was associated with a 0.041% increase in consumption.[74] This relates to both debit and credit cards.[75] Ludvigson (1999) finds that "consumption growth is correlated with predictable consumer credit growth in U.S. aggregate data."[76]

On the individual consumer level, there is some evidence that consumers spend more when they are using credit cards than when they are using cash. For instance, Feinberg (1986) found that consumers were willing to spend more if an establishment displayed credit card logos.[77] Prelec and Simester found that when bidding for basketball tickets, a group that was instructed to pay with a Visa or MasterCard was willing to pay much more

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[74] Mark Zandi and Virendra Singh. " The Impact of Electronic Payments on Economic Growth" (Economic Analysis from Moody's Economy. com. March 2010. Available at http://corporate.visa.com/_media/moodys-economy-white-paper.pdf

[75] Ibid.

[76] Sydney Ludvingson. "Consumption and Credit: A Model of Time Varying Liquidity Constraints" The Review of Economics and Statistics. August 1999. Vol 81, No.3, Pages 434-447.

[77] Richard A. Feinberg. "Credit Cards as Spending Facilitating Stimuli: A Conditioning Interpretation," Journal of Consumer Research,1986, 12, 348-356.

for the tickets than a group instructed to pay in cash.[78] Also, Agarwal et al. find that consumers generally spend more when offered 1% cash-back rewards.[79] They find that average spending increases by $68 per month in the first quarter after the cash-back rewards program starts.

On the other hand, a study has found a negative relationship between credit card debt and growth in future consumption.[80] However, this finding may not be relevant to this study because only those consumers with credit card debt (excluding the transactors) are considered, and the impact on total consumption is unknown.

Given evidence that consumers spend more, on average, when using credit cards and rewards cards, the assumption that spending levels are not affected by credit card use, at least in the short and medium run, seems unfounded. It would be far more realistic to assume that reduced rewards and reduced use of credit cards would result in reduced consumption (to some extent) with economic consequences.


Figure 6 below compares the actual cross subsidies under different assumptions and frameworks. In the case in which estimates are most similar to those of the study by researchers of the Boston Federal Reserve Board, the low-income households pay, on average, $29 to higher-income households. In the case where it's assumed that cost for cash is 1.3% and 1% of spending is new, then low-income households receive, on average, $6 from high-income households. That is, the Reverse Robin Hood cross-subsidy is reversed to become a Robin Hood cross-subsidy.

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[78] Drezen Prelec and Duncan Simester, Always Leave Home Without It.

[79] Sumit Agarwal, Sujit Chakravorti, and Anna Lunn, "Why Do Banks Reward Their Customers to Use Their Credit Cards?" (Chicago: Federal Reserve Board of Chicago, 2010). Available at http://www.chicagofed.org/webpages/publications/working_papers/2010/wp_19.cfm

[80] Tufan Ekici and Lucia Dunn, "Credit Card Debt and Consumption: Evidence from Household-Level Data," Applied Economics, 42(4) (2010): 455-462

Figure 6: Summary of POS cross-subsidies findings for <$100,000 and $100,000+ household incomes
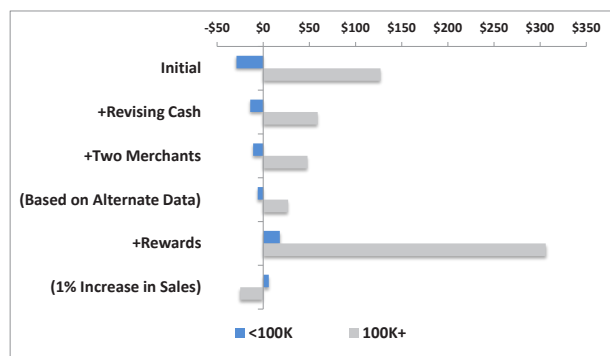
5. Conclusion

The rapidly evolving payment market landscape complicates attempts to analyze the system, and shortens the shelf life of such analyses as the two recent Boston Fed staff studies (2010, 2011) and this report. For instance, in 2000 there were more check transactions than credit or debit transactions combined. Since then, with the explosive growth of debit payments and a precipitous decline in the use of checks, there are today probably three times as many debit transactions as there are check transactions. Also, since the release of the study by Schuh et al. in 2010, new regulations regarding debit card fees have been enacted. Furthermore, the terms of the settlement of the Visa and MasterCard case by the Department of Justice have given merchants more freedom to offer customers discounts based on choice of payment method.[81]

In addition, technology continues to press on. With the introduction of "Square," which gives even the smallest merchants the ability to accept credit and debit cards via smart phones, the landscape is again changing. A survey of internet users and technology experts found that two-thirds believed that smart devices, such as smart phones, will be the dominant means by which transactions are handled, supplanting cash and cards.[82] This suggests that any analysis of the payment market may be rendered moot shortly after its release.

In addition, in such a fast-evolving industry, with new entrants—such as PayPal, Google, Apple, and merchants—and with the impending rise of mobile payments in general, not only does research have a short shelf-life, but the resulting policies and regulations will be short-lived as well. The biggest risk of making policy changes under these circumstances is that they may have a chilling effect on innovation, or may result in other unintended

[81]As this paper was being finished, yet another change to the payment landscape has occurred. A 2012 proposed settlement with Visa and MasterCard means that, among other things, retailers in many states will have the ability to surcharge credit card users. This innovation would impact the results of this paper and those of Schuh et al. (2010) to the extent that surcharges actually are implemented and where they are implemented (such as whether in high-end stores, or in stores where credit card usage is proportionally greater). This would make the issue of potential POS cross-subsidies even more about how merchants decide to pass on costs to customers then was the case when this paper was written. This settlement is different from the earlier one (2011) that allowed merchants to offer discounts to cash users, even though mathematically, offering discounts and levying surcharges are equivalent to each other.

[82] Aaron Smith, Janna Anderson, and Lee Rainie, "The Future of Money in a Mobile Age" (New York: Pew Research Center, 2012). Available at http://pewresearch.org/pubs/2242/smartphone-money-consumer-purchases-credit-cards-consumers.

consequences. While this risk is always present to some extent, it is particularly true for a market as complex and fast-changing as this one, which has so many new players that it is very difficult to anticipate its nature and operation in the next five or ten years.

Detailed analysis of the complete landscape of payment methods is also complicated by a lack of available and consistent data, particularly when household income groups are segmented. Combining various data sets primarily from 2007, the 2010 Boston Fed staff study created a new data set of credit card and non-credit card consumption broken down by various income groups. The creation of this data set was as straightforward as possible. Nonetheless, major discrepancies had to be taken into account. The authors then assumed a simple POS cross-subsidy framework (accounting) and estimated that, on average, households with the lowest incomes (less than $20,000), annually pay $32 at the point of sale and households with the highest incomes (more than $150,000), annually receive $313 in cross-subsidies.

This study used the same data as the 2010 Boston Fed staff study but assumed: (1) that consumers go to two different merchants (depending in part on household income); and, (2) a more realistic value of the cost to merchants of non-credit card payments. The results show that:

> » Households with the lowest incomes (less than $20,000) pay $10 at the point of sale,

and households with the highest incomes (more than $150,000) receive $93 in cross-subsidies; and,

> » If rewards were added to this, all household income groups would receive a positive payment.

In this formulation, POS cross-subsidies are small relative to the total costs of processing payments, representing less than 4% of total costs in even the most extreme cases (those earning less than $20,000 a year and those earning over $150,000 a year).

In addition to rewards and total costs, the estimated cross-subsidies are also dwarfed by credit card interest payments. Adding together the costs and benefits from payment processing costs paid to merchants via prices, credit card rewards, credit card interest payments, and the value of float, the households with the lowest income pay $380 and the highest pay $2,479.

The findings also show that many elements excluded from the calculations, such as ATM fees and overdraft fees, are much larger than the cross-subsidies. Overdraft fees alone are larger than all credit card merchant fees examined in this study and the 2010 Boston Fed staff study. Echoing recommendations made in past payment studies, this study too recommends continuing research and improving data collection in this area.[83]

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[83] For instance, in the policy implication section, Schuh et al. " Who Gains and Who Loses from Credit Card Payments? Theory and Calibrations" include data collection, and see the conclusions of Hayashi and Weiner (2008) "Developments in Interchange Fees in United States and Abroad "and Hayashi (2006), "Developments in Interchange Fees in United States and Abroad"which call for the gathering of comprehensive data.

A real danger with enacting policy based on an analysis of only one part of a very complex system is that policymakers will engage in a "whack-a-mole" strategy. Some fees will be "whacked" down, only to see fees pop up in other areas. If the distribution patterns of the new fees are found to be unfair, then these fees in turn will be targeted, and so on. All fees are probably scrutinized for fairness at some time. However, since banks need fees and/or interest income to generate revenue, it is impossible to greatly reduce all fees and still maintain operations. If some fees are forced to go down then others will necessarily go up.

One key aspect of payment choice deserving deeper consideration is consumer behavior. Do consumers spend more with credit cards? Are they more likely to make larger purchases with credit cards? Are consumers willing to pay more for a particular good or service because the use of credit cards gives them greater confidence or makes them less price sensitive? If so, then increased costs associated with accepting credit cards could be covered by increased income generated by increased consumer spending or more profitable spending. And it may simply be the case that higher income / credit card using consumers purchase items with higher mark ups, which disproportionately contribute to merchant profits and cover merchant costs. In these cases, the use of a simple cross-subsidy framework for a study such as this one and the one conducted by staff at the Boston Fed (2010) may be altogether inappropriate.

Without a good understanding of these questions, the true magnitude and direction of POS cross-subsidies is unclear. For instance, this analysis found that if 3.5% of credit card spending was new spending resulting from accepting credit cards, then this would more than cover the additional costs paid by merchants to accept credit cards (relative to other payments). This 3.5% of credit card spending represents a barely perceptible 0.74% of total merchant sales. And if 5% of credit card spending were new spending (about 1% of merchant sales), this could result in a reversal of cross-subsidies, a case in which lower income households would receive a cross-subsidy from higher income households. That is, the Reverse Robin Hood cross-subsidy is reversed to become a Robin Hood cross-subsidy.

Policy prescriptions based on particular cross-subsidy results would be at best unwise, given a combination of factors: (1) a lack of robustness in estimated cross-subsidies depending on the data sets used and/or assumptions made; (2) the relatively small size of the POS cross-subsidies; (3) the exclusion of other key elements of the payment system that have an impact on consumers; (4) uncertainties regarding the impacts on sales and profits from accepting credit cards; and (5) uncertainties regarding how costs are actually passed on to customers.

So long as consumers use different payment methods, there will undoubtedly be different costs (and benefits) associated with them for merchants. These will also vary among merchants. The costs include checkout time, security, fraud, counting and depositing of cash, and debit and credit card merchant fees, among other costs. As with other merchant costs—including merchant rewards and promotions—interchange fees may be distributed among all customers. This is the case for many

smaller merchants who do not know the precise costs (and benefits) incurred by processing and accepting cash or checks, or even by processing and accepting debit and credit cards.

Although merchants can choose to provide discounts based on payment method, the fact that most do not choose to do so is compelling evidence of the lack of support for such a measure in the market. In recent PERC surveys, majorities of both cardholders and small business operators expressed opposition to multiple pricing schemes. Cardholders opposed it believing it to be confusing, as did the merchants.

A contributing factor for small business operators is probably the fear that cardholders, and especially reward cardholders, will reduce purchases if prices varied across payment methods. Given that more than 9 in 10 rewards cardholders indicated that they would either discontinue using their rewards card altogether, or would reduce usage in response to a fee (charging a higher price for credit card purchases is effectively a fee), there is good reason to expect the outcome merchants may fear if pricing varied by payment method.

Cross-subsidies (or at least what could be viewed as cross-subsidies) exist in nearly every industry as a result of system inefficiencies, lack of perfect information, and unwillingness to charge every customer different prices depending on the associated costs of specific customer transactions. For instance, airlines offer free coffee to all passengers, even though only some will drink it, some restaurants offer free Wi-Fi to customers, even though only some will use it, and some hotels have pools and gyms, even though only some

guests will swim and workout. These practices, and countless others, could and do result in cross-subsidies since certain customers benefit without explicitly paying for the benefit.

Some cross-subsidies may be seen as progressive, some may be seen as regressive, and some may not fit either category. In some cases, like free coffee on airlines, it may be difficult to argue that the benefit increases demand and pays for itself. In the case of credit cards, however, compelling evidence exists suggesting that most or all of the cost is recouped through increased demand. Even excluding this possibility, the results of this study indicate that, to the extent that a cross-subsidy exists between credit cards and other payment methods, it appears to be small.

Appendix

$$X_i = \text{Cross Subsidy paid by } ith \text{ income group}$$

$$X_i = \text{cost paid toward payment system} - \text{cost imposed on the payment system}$$

$$\text{cost paid toward the payment system} = \mu \times S_i^d + \epsilon \times S_i^h$$

$$\mu = \text{ interchange fee}$$

$$\epsilon = \text{Cost of Non Credit Card Payments}$$

$$S_i^d = \text{Credit Card Expenditure of } ith \text{ income group}$$

$$S_i^h = \text{Non-Credit Card Expenditure of } ith \text{ income group}$$

$$\text{cost imposed on the payment system} = \frac{S_i}{S} \times (\mu S^d + \epsilon S^h)$$

$$S^d = \text{Total Credit Card Expenditure}$$

$$S^h = \text{Total Non-Credit Card Expenditure}$$

$$\frac{S_i}{S} = \text{Share of Total Expenditure of } ith \text{ income group}$$

$$X_i = [\mu \times S_i^d + \epsilon \times S_i^h] - \frac{S_i}{S} \times (\mu S^d + \epsilon S^h)$$

$$X_i = \text{cost paid toward payment system} - \text{cost imposed on the payment system}$$

$$= \mu \times S_i^d + \epsilon \times S_i^h - \frac{S_i}{S} \times (\mu S^d + \epsilon S^h)$$

Note: This framework (including the variables used here) is identical to the one the Boston Fed researchers used in their 2010 study

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