Who Pays for Payments?

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Abstract

We use novel merchant-level data covering card and cash payments in the U.S. to examine how the fees that merchants pay to process card payments shape retail prices and redistribute consumption. Cards charge interchange fees to merchants to fund consumer rewards. When merchants respond by raising prices for all consumers, users of low-cost payment methods (e.g., cash and debit) cross-subsidize high-reward credit card users who shop at the same merchant. Two facts point to the potential for significant cross-subsidization. Interchange fees differ dramatically by card type: premium credit cards charge three times the fees of regulated debit cards. Evidence from a natural experiment also suggests that merchants largely pass through these fees to retail prices. However, two facts limit cross-subsidization in practice. Consumer sorting – where consumers who use different payment methods tend to shop at different merchants – is substantial and limits the exposure of cash and debit users to the effects of high interchange fees. Where users of different payment methods do overlap, such as at large grocery stores, interchange fees are 50% lower due to a combination of sector discounts and private negotiations. We embed these findings in a sufficient-statistics framework to quantify the welfare effects of interchange fees across consumer groups. We estimate that interchange fees generate an implicit annual transfer of approximately $30 billion from cash and debit users (who pay higher retail prices) to credit card users (who receive rewards). These transfers are comparable in scale but opposite in direction to major government transfer programs. Consumer sorting and merchant fee heterogeneity reduce regressivity by 25%, but do not eliminate it. Our findings also highlight how the rise of premium credit cards has reshaped the redistribution of consumption, with significant implications for competition, regulation, and the distributional impact of financial innovation.

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Section I Introduction

Payment systems redistribute consumption between consumers who choose different payment methods but shop at the same stores. This occurs because merchants' fees vary significantly by payment method — zero for cash, low for debit, and high for credit cards — yet retail prices do not (Stavins, 2018). Since the major component of merchant fees — the interchange fee — is funneled back to consumers though rewards, a cross-subsidy emerges: consumers who use cash or debit pay higher retail prices to subsidize the rewards enjoyed by credit card users (Carlton and Frankel, 1994). These redistributive effects, often described as a "reverse Robin Hood" transfer, have drawn increasing scrutiny from policymakers, most recently with the introduction of the Credit Card Competition Act (Andriotis, 2022).[1] The U.S. regulatory environment strongly contrasts with the European Union's interchange fee regulation, which capped interchange fees at less than 10% of the highest fees charged in the U.S.

Several recent industry trends have amplified concerns over high interchange fees in the U.S. One is the growth of premium credit cards, such as the Chase Sapphire Reserve, which are funded by higher interchange fees and provide higher rewards. A second is the ability of large merchants to negotiate lower interchange fees, whereas small merchants often pay the full posted rates.

Despite their policy relevance, the redistributive effects of interchange fees have been challenging to study due to a lack of merchant-level data on payment composition and acceptance costs. Redistribution arises only when different consumers use payment methods with different interchange fees at the same merchant (Gans, 2018). Many past studies of redistribution have relied on consumer survey data, making it impossible to determine if consumers using different payment methods shop at the same merchants (Felt et al., 2023). While card networks publish headline interchange fee schedules, the actual fees incurred are highly merchant-specific, shaped by factors such as sector, merchant size, and ticket size. Without merchant-level data capturing both where different payment users overlap and the actual fees paid by those merchants, prior work has been unable to quantify how much redistribution occurs in practice.

In this paper, we use novel merchant-level payments data from Fiserv to quantify how the payment system redistributes consumption across consumers with different payment preferences. These data uniquely capture both payment composition and actual interchange fees at the merchant level. The paper proceeds in three parts. First, we document striking heterogeneity in both payment mix and interchange fees across merchants. While some merchants predominantly receive low-cost payments, such as cash and debit, others are heavily skewed toward high-cost premium credit cards. We then explore the determinants of this variation and its implications for merchant-level acceptance costs. Second, we leverage this heterogeneity, along with a regulatory

[1] Some other relevant regulations include the Durbin Act of 2011, the North Dakota federal court vacating the ruling in 2025 which is pending appeal, or the Colorado's "Swipe Fee Fairness and Consumer Safeguards Act" at the state level

shock, to estimate the causal effect of interchange fees on retail prices. We find that, on average, merchants pass these fees to consumers in the form of higher prices close to one-for-one. These first two parts establish how payment mix influences merchant costs and how those costs translate into consumer prices, providing the empirical foundation for our quantification of redistribution. In the third part, we embed these findings in a sufficient-statistics framework to measure how the payment system redistributes consumption through retail prices and card rewards.

Our results highlight the magnitude and limits of redistribution through the payment system. We estimate that interchange fees generate approximately $30 billion in annual transfers from cash and debit card users to credit card users. Put differently, cash users pay the equivalent of 25% higher sales taxes than premium credit card users. These transfers are economically significant, comparable in size (but opposite in direction) to major government programs such as SNAP ($120bn), the Earned Income Tax Credit ($57bn), and unemployment insurance ($40bn). The transfers here are also large relative to other transfers in consumer financial markets, such as the inter-regional transfer due to the GSE's lack of risk-based pricing ($15 billion), consumer losses from shrouded credit card fees ($10 billion), and consumer losses from high-fee index funds ($20 billion) (Hurst et al., 2016; Agarwal et al., 2015; Brown et al., 2024).

Critically, however, two mechanisms substantially attenuate this transfer. First, consumers who use different payment methods tend to shop at different types of merchants, reducing the scale of cross-subsidization by approximately $9.9 billion. Second, at the merchants where both cash and card users tend to shop — and thus where the potential for redistribution is greatest, such as large firms and grocery stores — interchange fees are typically lower and often negotiated, further reducing the transfer by approximately $1.6 billion. While the direction of redistribution aligns with theory, the magnitude of the transfer is substantially mitigated by consumer sorting and fee heterogeneity across merchants.

To study the effect of interchange fees, we draw on two comprehensive datasets from Fiserv, a large U.S. merchant acquirer. The first is derived from merchant-level settlement data from all Fiserv merchants from 2007 to 2022, covering merchant-level transaction volumes, counts and fees by card type. We focus primarily on a 2022 cross-section of approximately 1 million merchants[2], which covers around one-fifth of all U.S. card payments. The second dataset contains transaction data from Fiserv's Clover platform, covering approximately 800,000 million merchants between 2019 and 2022. Clover is the largest U.S. cloud-based point-of-sale (POS) system and processed over $133 billion in transactions as of 2020.[3] A unique feature of the Clover data is that it includes both cash and card payments, allowing us to observe the full composition of payments. Cash transactions are notoriously difficult to capture in large datasets.

[2]The data allows us to study both payment volumes at the outlet level, as well as at the corporate level. We refer to the latter as a merchant.

[3]Source: https://web.archive.org/web/20230717211716/https://investors.fiserv.com/static-files/820517ed-48a8-4925-aca7-181065168e25

We augment these sources with merchant-level characteristics such as sector and county, and validate the data against public sources including the IRS, the U.S. Census, industry trade journals, and the Diary of Consumer Payment Choice.

In the first part of the paper, we document two basic facts about heterogeneity in the cost and composition of payments across merchants. Our first fact is that the composition of payments—defined by the share of payments made with a payment method—varies substantially across merchants. For example, although debit card transactions account for a little more than half of all card transactions, the share of debit transactions across merchants has a standard deviation of approximately 20%. The distribution is also bimodal: some stores have almost all debit card shoppers, while others have few. This reflects consumer sorting, as consumers with different payment preferences tend to shop at different types of merchants. Because redistribution arises only when consumers using different payment methods shop at the same merchants, this variation constrains the extent to which credit card interchange fees redistribute consumption from cash and debit card consumers.

The composition of payments across sectors and geographies is consistent with the fact that higher-income individuals are more likely to use credit cards, especially premium credit cards, and less likely to use debit cards. Travel and retail tend to feature more credit card expenditures, whereas grocery and gas stations tend to feature more debit cards. Within retail, luxury categories, such as jewelry stores, are more likely to receive credit card payments, whereas shoe stores are more likely to receive debit card payments. Consumers in higher-income counties are also more likely to use credit cards. We confirm this relationship between income and payment choice using consumer-level survey data from the DCPC and MRI-Simmons.

Our second fact is that card type, merchant sector, and merchant size play fundamental roles in determining merchant-level interchange fees. While much of the prior literature has focused on the distinction between debit and credit, we show that different types of debit and credit cards charge significantly different fees. For example, debit cards issued by large banks regulated under the Durbin Amendment charge 0.7% whereas debit cards issued by smaller, exempt banks charge around 1.1%. These high-fee exempt debit cards account for 40% of debit transactions. Within credit cards, basic credit cards charge merchants around 1.7%, while high-fee/high-rewards premium credit cards, often used by higher-income consumers, charge around 2.1%. Credit card premiumization has accelerated in recent years; premium credit cards represented 20% of credit card volume in 2010 and now account for 60% as of 2022. The fee variation across cards plays an increasingly important role in determining merchant-level fees, as cash use—around 12% of transaction value in the Clover data—has declined.[4]

Even holding card types fixed, interchange fees also vary across merchants. Merchants in

[4]Payment methods in the U.S. have shifted gradually over time, with cash use declining and debit card use steadily increasing. The use of cash and checks fell from approximately 13% of consumer payments in 2019 to around 11% in 2022. Since 2005, debit cards have gained share relative to credit cards: while credit accounted for roughly 60% of card payment volume in 2005, it accounted for only 50% in 2022.

sectors with high credit card use, such as travel and retail, pay high interchange fees, whereas grocery stores and gas stations pay around 50 bps or one-third lower interchange fees. Large merchants also tend pay lower interchange rates. For example, large merchants in the grocery and retail sectors, with annual card sales exceeding $1 billion tend to pay lower interchange rates, which are approximately 50 bps (33%) lower compared to smaller merchants in the same sector. These lower rates are the consequence both of publicly posted volume discounts as well as private negotiation and reflect the bargaining power of larger merchants.

In the second part of the paper, we present novel evidence that interchange fees have real effects on merchant sales. To do this, we exploit variation in the effects of the 2011 Durbin Amendment across merchants. The Durbin Amendment capped interchange fees only on debit cards issued by large banks, but not on debit cards issued by small banks, nor on credit cards. We focus on its effect in the restaurant sector because the policy reform had highly heterogeneous effects across restaurants. The interchange fee caps inadvertently increased debit card interchange fees for restaurants with small average transaction sizes, while creating significant savings for restaurants with large transaction sizes. We implement a difference-in-differences design that compares sales growth across restaurants with different predicted savings from the Durbin Amendment. We find evidence suggesting that Durbin Amendment led to a decline in prices and, ultimately, find that every one percentage point in interchange expense saved causes around a 7% increase in card sales. While we do not observe retail prices directly, when we use average transaction size as a proxy for price we find that merchants pass-through fees to prices roughly one-for-one.[5]

In the final part of the paper, we incorporate these facts about merchant heterogeneity in the composition of payments and interchange fees into a sufficient statistic framework to quantify redistribution in the payment system. Our sufficient statistic framework captures how consumer welfare changes as merchants readjust prices in response to changes in interchange fees and consumers reallocate their consumption in response to these price changes. The sufficient statistics apply to any model in which issuers fully pass through interchange fees to rewards and merchants fully pass through interchange fees into retail prices. These statistics remain valid even when consumers' payment and shopping preferences are arbitrarily correlated. The key insight of our approach is that the welfare effects of interchange fees can be fully summarized by simple moments of the distribution of payment shares across merchants by sector and firm size, as well as the fees for these diffferent groups of merchants. This transparency is a significant advantage: our welfare calculations are directly interpretable and do not require fully estimating consumer demand over merchants.[6]

[5]Using zip-code level data on retail gasoline prices, Mukharlyamov and Sarin (2025) find that they lack sufficient power to identify the effects of interchange fees on retail prices. In our setting, we are able to use the Fiserv data to show that merchant-level shocks to interchange fees do affect merchant-level sales.

[6]While our sufficient statistic holds exactly for small changes in interchange fees, in Appendix B we validate it by calibrating a structural model of retail competition that matches the distribution of payment shares and interchange fees across merchants. Our structural model captures how large merchants pass through interchange fees imperfectly

Even after accounting for the complexities of the interchange schedule and the variation in payment composition across merchants, we find that the payment system generates large transfers from cash and debit card users to credit card users of around $30 billion per year. Our calculations suggest that cash users lose around 92 basis points of purchasing power and that regulated debit card users lose around 42 basis points. Although much of the emphasis has been on cash users subsidizing credit card rewards, our results suggest that debit card users also subsidize a substantial share of those rewards. Relative to an average state and local sales tax rate of around 6%, our calculation suggests that interchange fees are analogous to raising the sales tax rate for cash users by around 15% and that for regulated debit card users by 7%. In contrast, basic and premium credit card users consume around 55 basis points more as a result of high interchange fees, effectively reducing their effective sales taxes by 9%.

At the same time, we find that consumer sorting matters for the magnitude of this transfer. Since cross-subsidization occurs at the merchant level, there is no redistribution if cash, debit card, and credit card users shop at different merchants. Consumer sorting reduces the effective size of the transfer by approximately $9.9 billion per year. This effect is largely driven by the tendency of many high-income, premium credit card users to shop at merchants that primarily serve similar customers. If a merchant primarily receives payments from premium credit cards, there is little to no cross-subsidization. As a result, consumer sorting insulates cash and debit card users from the full effects of the rise in premium credit card usage.

Variation in interchange fees across merchants, driven by a combination of sector discounts and the bargaining power of large merchants, also has important implications for redistribution. Redistribution requires that consumers with different payment methods shop at the same merchants, and that the payment methods incur different interchange fees. Grocery stores, gas stations, and large retailers have the largest overlap between consumers with different payment methods, but also the lowest differences in interchange fees across payment methods due to sector discounts and private negotiations. Even though fee heterogeneity suggests that Visa and Mastercard exert market power over merchants, the networks do so in a way that moderates the amount of redistribution in the payment system. These sector and negotiated discounts lead to a progressive redistribution of approximately $1.6 billion per year to cash and debit card users, attenuating the overall transfer.

We also use our framework to examine how two recent shifts in the industry, the Durbin Amendment and the rise in card premiumization, have impacted redistribution. Although cash users benefited from the Durbin Amendment, our analysis shows that credit card users were the primary beneficiaries. Our results also indicate that the Durbin Amendment was a regressive policy, benefiting wealthier households on net at the expense of lower-income households. Similarly, we find that the increase in credit card premiumization has been regressive as higher

to retail prices due to market power. We find that our sufficient-statistics framework closely approximates the full structural model, suggesting that our main results are robust to these additional considerations.

income consumers are the most likely to use premium cards.

I.A Related Literature

Our paper contributes to the literature on two-sided markets by quantifying how payment platform fees redistribute consumption among consumers. Prior theoretical work has focused on whether high interchange fees encourage efficient payment choice (Rochet and Tirole, 2011; Wright, 2012; Edelman and Wright, 2015). These papers typically assume that consumers using different payment methods shop at the same merchants and that all merchants pay the same interchange fees. In contrast, we document substantial heterogeneity in both payment composition and interchange fees across merchants and show that this has important implications for redistribution across consumers.

From a methodological perspective, our framework builds on the literature using sufficient statistics to evaluate the welfare effects of market interventions (Chetty, 2009; Kleven, 2021). Whereas sufficient statistics are usually applied in settings without market power to quantify the social efficiency of government policies, we show that a sufficient statistics approach can also be applied to quantify redistribution in an industry model with imperfect competition.

Our analysis highlights the redistributive potential of payment system innovations. Existing work has documented the benefits of expanding payment options, such as the gains from debit card adoption in Mexico (Higgins, 2024) or the consumer value of payment choice (Alvarez and Argente, 2020). Our premium credit card counterfactual provides a complementary perspective by showing that innovation can redistribute consumption when new payment methods charge high fees to merchants to fund consumer benefits. This is relevant for understanding the effects of new Buy Now, Pay Later products around the world, which charge merchants even higher fees to fund interest-free payments for consumers (Berg et al., 2024). Our findings help explain why high-income consumers may resist adopting new low-cost payment innovations such as FedNow or central bank digital currencies (Whited et al., 2022): because they benefit from current reward structures, they have weak incentives to switch to low-cost alternatives.

Our findings on redistribution through the payment system contrast significantly with prior work that emphasizes how unsophisticated consumers cross-subsidize sophisticated consumers when both types of consumers pool on the same financial products (Gabaix and Laibson, 2006; Fisher et al., 2024; Agarwal et al., 2025). In our setting, however, redistribution arises when naifs and sophs choose different financial products but pool at the same merchants. This leads to qualitatively different recommendations on how to reduce redistribution. Whereas in most traditional settings separating contracts (between consumer types) can reduce redistribution, in our setting, it is precisely this separation across payment methods (i.e., payment instruments) that drives redistribution.

Our analysis of the Durbin Amendment builds on Manuszak and Wozniak (2017); Mukharlyamov and Sarin (2025), who document pass-through to deposit account fees. We complement

this work by using merchant-level data on interchange fees and sales to estimate how the Durbin Amendment affected the merchant side of the market.

Section II Institutional Setting and Data

In this section, we outline the institutional details and describe our data. We begin by explaining how credit and debit card payment systems operate, focusing on the key participants as well as the associated costs, benefits, and transfers. We then introduce our two primary merchant-level payments datasets from Fiserv, which allow us to observe how the types and costs of payment methods vary across merchants. Together, these data provide a detailed view of the U.S. payment system, linking card types, merchant characteristics, and fees.

II.A Payments Processing and Interchange Fees

A typical card payment involves the customer making a purchase, the merchant accepting the payment, and three key financial intermediaries: the merchant acquirer, the issuer, and the card network. The issuer, effectively the consumer's bank (e.g., Chase), facilitates the transaction from the consumer's perspective by providing the card and processing the payment. Merchants, in turn, accept card payments by contracting with a merchant acquirer, usually a bank (e.g., Wells Fargo) or fintech firm (e.g., Fiserv, Square), which supplies payment terminals and facilitates settlement and fund transfers. The card network (e.g., Visa, Mastercard, American Express, Discover) is an intermediary between the issuer and the acquirer, routing transaction data, collecting and distributing fees, and coordinating settlement.

To accept card payments, merchants must pay transaction fees, which vary by payment method due to the involvement of different financial intermediaries and the services bundled with each method (e.g., credit card rewards). The merchant discount fee is split among the intermediaries, with the primary component being the interchange fee, which is remitted to the issuer and primarily determines both the merchant's cost and the consumer's rewards. Therefore, interchange fee data is essential to understanding cross-subsidization within the payment system.

Figure 1 illustrates how fees flow among these parties. When a consumer makes a card payment, the merchant pays a merchant discount fee to its acquirer. While the acquirer retains a portion of this fee, it passes most of the fee to the issuer as an interchange fee. Additionally, both the issuer and the acquirer pay network fees to the card network. The interchange fee is typically the largest component of the merchant discount fee and funds consumer rewards, and consequently, is the focus of much of our analysis.

The typical merchant discount fee for a credit card transaction in the US is 2.25%, of which the average interchange fee accounts for about 1.90% and the average consumer reward is around 1.40% (Nilson, 2023; Drechsler et al., 2025). In contrast, network fees average only 0.14% of the transaction value and do not vary with card type or merchant sector.

Our analysis focuses on both the level and heterogeneity of interchange fees across payment methods and merchants, and the implications for redistribution. Interchange fees vary based on

the type of card used, the sector and size of the merchant, and other transaction characteristics. Table 4 presents an excerpt from Visa's 2022 public interchange schedule, illustrating variation along these dimensions. For example, a premium credit card transaction at a small grocery store incurs an interchange fee of 7 cents plus 2% of the transaction value. For a $100 transaction, this would amount to $2.07. The same transaction on a regulated debit card would cost just 27 cents. If the $100 transaction occurred at a gas station, the cost would be $1.10, while at a large grocery store, it would be $1.45. Although it has been understood, at least anecdotally, that transaction fees potentially vary across merchants, we are the first to study data on the realized fees paid across merchants.

II.B Data

We use two proprietary datasets from Fiserv, one of the largest U.S. merchant acquirers, to examine how interchange fees vary across merchants and their impact on consumer welfare. A key feature of these data is that we observe both the composition and price of transactions at the merchant level, which, as detailed in Section V, is critical for understanding the implications for redistribution and capturing heterogeneity in payment costs.

II.B.1 Sources

Our primary dataset comes from Fiserv's payment settlement records, which cover approximately one million merchants and account for one-fifth of all U.S. card volume. As discussed above, Fiserv is a merchant acquirer responsible for processing transactions and calculating the interchange fees owed to issuers, making it an ideal source for studying how the composition and cost of payments vary across merchants. The data include both in-person and online transactions.

For each card transaction, we observe the establishment (defined at the merchant-sector-location level), the transaction value, the type of debit or credit card, and the associated interchange fee. All sales and interchange values are measured net of returns and chargebacks. We focus on a single cross-section of data covering all payments made in 2022, which reflects current pricing structures and consumer behavior.[7] Sectors are defined using the merchant's MCC code. Since merchants often set uniform prices across establishments (DellaVigna and Gentzkow, 2019), but the cost of accepting different payment methods can vary substantially, we aggregate the data to the merchant-by-sector-by-payment-method level. This also allows us to split large multi-sector merchants (e.g., those selling gas and retail goods under different MCC codes).

In our analysis of the Durbin Amendment, we use the settlement data to study a three-year panel of card sales and interchange fees at restaurants. In that dataset, we aggregate the data to

[7]We use 2022 as our primary cross-section because it represents the most recent year with complete overlap between our Fiserv settlement data and Clover point-of-sale data. This overlap is essential for observing the full payment composition including cash transactions, which are only available in the Clover data.

the establishment-by-payment method-by-year level to study the dynamic effects of the Durbin Amendment from 2010 to 2013.

Our second dataset comes from Clover, a Fiserv-owned point-of-sale (POS) system, covering approximately 800,000 merchants from 2019 to 2022. A distinguishing feature of the Clover data is that it includes cash and check transactions, which are typically unavailable in settlement data. These additional observations allow us to capture the complete set of transactions at the merchant level.

Similar to the settlement data, the Clover dataset contains information on the merchant (at the firm-location level), transaction value, payment method, and interchange fee (if applicable). We also observe each merchant's location, sector, and firm size. While the Clover sample skews toward smaller merchants, it provides valuable insight into cash usage and variation in payment composition that informs redistribution. As discussed below, the dataset is broadly representative of the overall merchant population.

We supplement our data from Fiserv with survey data on consumers' preferred payment method from the Atlanta Federal Reserve's Diary of Consumer Payment Choice (DCPC) and the MRI-Simmons Ultimate Survey of Americans (USA). The Diary of Consumer Payment Choice records the transactions of around 5,000 respondents each year and tracks their payments over a three day window in October. Crucially for our applications, it provides us with data on consumers' incomes and their preferred payment methods. The MRI-Simmons USA surveys around $50,000$ respondents each year on their brand preferences, including for financial products. The data on bank choice and credit card type allow us to group consumers by more granular payment preferences that are relevant for the rewards they receive and the interchange fees they impose on merchants.

II.B.2 Data Coverage and Representativeness

The Fiserv data is highly representative of the broader U.S. economy in terms of sectoral coverage, firm size (based on card sales), and geographic distribution. Figure 2a compares the sector composition of card transactions in the Fiserv data to that reported in the Diary of Consumer Payment Choice. We observe close alignment across major retail categories such as restaurants, grocery stores, merchandise retailers, gas stations, and travel. Figure 2b compares the state-level distribution of card transactions in the Fiserv data with state shares of GDP. Most points lie along the 45-degree line, indicating strong geographic representativeness. Figure 2c compares firm size distributions in the Fiserv dataset with those reported by the IRS Statistics of Income, again showing close correspondence across revenue categories.

The Fiserv payment data is also representative of external measures of average transaction size by payment method. Figure **??** (in the appendix) compares the average transaction size of credit and debit card transactions in the Fiserv data with external measures from an industry trade publication, the Nilson Report. While the average ticket size for credit card transactions in

the Fiserv dataset are around 20% lower than the external data, the average size of debit card transactions is only around 5% lower.

The breadth and granularity of the Fiserv data allow us to analyze how payment fees vary across merchants and how changes in fee policies may affect economic outcomes. A key advantage is that we observe payment methods at the merchant level, allowing for a detailed analysis of the distributional impacts. We also capture fine-grained information on specific payment types, including distinctions across debit card regulation status, credit card tiers, and the inclusion of cash.

Section III Variation in Payment Mix and Payment Costs

How consumers pay for goods and services has important implications for merchants' costs and, ultimately, prices. It also generates distributional effects. We begin by documenting trends in payment methods and the variation in payment behavior across merchants. We show that consumers' choice of payment method varies substantially across and within industries. At some merchants, consumers primarily pay by credit card, while cash and debit dominate at others. Fees also vary by the type of card, the sector of the merchant, and the size of the merchant.

The heterogeneity in the composition and pricing of payments has two essential implications for quantifying the amount of redistribution in the payment system, as we illustrate in Section V. First, cross-subsidization only arises when consumers with different payment preferences shop at the same set of merchants. Second, redistribution is further reduced (amplified) if the firms that serve the most heterogeneous consumer bases pay lower (higher) interchange fees.

III.A Variation in Payment Mix

One notable feature of the data is that the composition of payments varies significantly across merchants. We examine how the use of cash, debit cards, and credit cards differs across the merchants in our sample and then investigate how the payment mix varies across sectors, regions, and other firm-specific factors.

We begin by documenting heterogeneity in payment types across merchants in Figure 3, panels (a)-(d). Figure 3a displays the distribution of the share of cash payments across merchants, focusing on those merchants where cash accounts for at least 2% of sales. Observations are at the merchant-by-year level using our Clover data, which includes information on cash payments. We measure the cash share based on the dollar-weighted share of cash and check payments relative to the total transaction value. We group cash and check payments into a single category, labeled as 'cash,' because they are distinct from card payments in that they do not incur interchange fees for the merchant and do not generate explicit rewards for the user. On average, cash accounts for 11% of transactions at a given merchant (Figure 3b). However, this masks substantial heterogeneity. For approximately two-thirds of merchants, cash accounts for less than 2% of transactions. In contrast, for the one-third of merchants where cash represents at least 2%

of sales, it accounts for more than 30% of their transactions—and for merchants in the 90th percentile, over 80%.

This heterogeneity is critical when considering redistribution. For the two-thirds of firms where cash use is almost nonexistent, there is little scope for redistribution between cash and card users. Similarly, at firms where cash is the predominant payment method, redistribution is limited. Redistribution inherently requires a mixed payment environment.

The remaining 89% of sales occur via debit and credit card payments. Here, too, the payment mix varies across merchants. Figure 3c displays the share of credit-card payments relative to total card payments (i.e., debit plus credit) in card settlement data. Observations are at the merchant-by-month level. The figure illustrates that, on average, credit card sales account for 53% of card transactions at the typical merchant in our sample. Moreover, the share of credit card transactions has remained relatively constant over time (Figure 3d).

The distribution of credit card sales is bimodal, with peaks at approximately 25% and 70%. This bimodality suggests that although credit cards account for 53% of card transactions on average, merchants tend to fall into two distinct groups: those where credit accounts for around 25% of card transactions and those where it accounts for about 75%. This pattern has implications for cross-subsidization. Debit cards carry lower interchange fees and rewards relative to credit cards. Just as cash transactions can subsidize credit card rewards, debit card transactions also potentially play a subsidizing role. The bimodal nature of the distribution suggests that variation in card payment mix is significant at the merchant level—again limiting the potential for cross-subsidization.

III.A.1 Variation Across and Within Sectors

Part of this heterogeneity in the merchant payment mix stems from sector-specific characteristics. Figure 4 shows the payment shares, weighted by transaction value, across sectors. Although cash accounts for only 11% of transactions at the average merchant, it plays a more significant role in sectors such as grocery, restaurants, and gas stations. For instance, cash accounts for 23% of sales in the grocery sector, slightly less than the share for credit cards. By contrast, in the travel sector, credit cards account for 70% of sales, with debit and cash representing 27% and 3%, respectively. These summary statistics suggest that, in the travel sector, there is limited scope for redistribution between credit and cash users, and any residual redistribution is likely minimal and occurs primarily between credit and debit users.

In addition to variation across sectors, we also find substantial dispersion in the composition of payments within sectors. Figure 5 plots kernel densities of the share of card transactions on credit cards across merchants in each of the major sectors. Although grocery stores tend to have a relatively low share of credit card transactions, and travel merchants tend to have a higher share, there remains substantial dispersion within these sectors. This dispersion is important, as it implies that even within a given sector, consumers with different payment preferences shop at

different merchants.

III.A.2 Variation Across Regions and Income Levels

Beyond sector-level differences, payment methods vary systematically with consumer income, which has important implications for the redistributive effects of the payment system. We combine data from the DCPC and the MRI-Simmons USA to document how payment method preferences vary across the income distribution. The DCPC provides information on consumer preferences between cash, debit, and credit by income level, while MRI-Simmons USA offers supplementary data on whether debit card users have accounts at small or large banks (relevant for distinguishing exempt versus regulated debit) and whether credit card users hold premium cards (such as Visa Signature or Mastercard World). Figure 7 illustrates the key pattern: at low levels of income, consumers prefer using debit cards and cash, while at higher levels of income, consumers increasingly use credit cards, and in particular premium credit cards with higher interchange fees. This income gradient in payment choices means that transfers from cash and debit card consumers—driven by interchange fees and rewards—also represent transfers from relatively lower-income consumers to higher-income consumers.

Geographic variation in payment mix also reflects these underlying income differences. Figure 6a displays the county-level share of cash payments. Light green and yellow regions correspond to higher cash usage, while dark blue areas reflect lower usage. In some counties (highlighted in yellow), cash accounts for more than 23% of transactions. Cash usage is higher in the Midwest and the South, while card usage is more prevalent along the East and West Coasts, as well as in metropolitan areas.

Figure 6b displays the county-level share of credit card transactions relative to all card payments. Areas shaded in yellow and light green correspond to higher credit card usage, whereas areas shaded in dark green and blue reflect higher debit card usage. The results indicate that debit card usage is especially prevalent in the Deep South relative to other U.S. regions. Conversely, credit card usage is higher in the coastal areas.

III.A.3 Decomposing the Variation in Payment Methods

To better understand what drives the variation in payment methods, we estimate regressions of the form:

$$Cash\ Share_{jt} = X'_{jt}\beta + \mu_{l(j)} + \mu_t + \mu_{c(j)} + \epsilon_{jt}. \tag{1}$$

Observations are at the merchant (j)-by-month (t) level. The dependent variable $Cash\ Share_{jt}$ measures the dollar-weighted share of cash transactions relative to other payment methods. We control for merchant characteristics in the vector X_{jt}, including average transaction size and total transaction volume. We also include fixed effects for industry (l), time (t), and county (c) fixed effects. In addition to studying cash share, we also analyze how the share of credit versus debit card transactions varies across merchants.

We report the corresponding estimates in Table 2. Columns (1)–(3) examine cash and check as a share of all payment volumes in the Clover data, while columns (4)–(6) analyze the share of credit card usage within card transactions. In all columns, the dependent variable is scaled by 100, so coefficients are interpreted in percentage points.

The results in Table 2 show that consumers are more likely to use cash at merchants with higher sales volumes but lower average transaction values. In column (1), a 100 log-point increase in total sales is associated with a 1.37 percentage point (12%) increase in the share of cash transactions. In contrast, a 100 log-point increase in average transaction value is associated with a 5.55 percentage point (50%) decline in cash usage. Unsurprisingly, cash usage is negatively correlated with e-commerce: a 10 percentage point increase in a firm's e-commerce share is associated with a 0.38 percentage point decline in cash usage.

Consistent with the income gradient documented in Figure 7, local demographics systematically influence cash usage across merchants. Consumers are more likely to pay in cash in less wealthy, less educated, and less densely populated regions. Column (2) shows that a one standard deviation increase in median income is associated with a 0.14 percentage point decline in cash usage. Similarly, a one standard deviation increase in the share of college-educated households corresponds to a 1.07 percentage point decline in cash usage.

In contrast, consumers are more likely to use credit cards (relative to debit cards) at merchants with lower sales volumes and higher average transaction values. Column (4) indicates that a 100 log-point increase in transaction value is associated with a 9.11 percentage point (17%) increase in credit card usage. Reinforcing the individual-level income patterns we showed earlier, credit card usage is more prevalent in wealthier, older, more educated, and more urban areas.

Overall, these results suggest that the payment mix varies substantially across merchants, depending on characteristics such as sector and region. As shown below, this heterogeneity has important implications for both the cost and redistributive aspects of payments.

III.B Variation in Payment Costs

The heterogeneity in the payment mix that we document implies that merchants may face substantial variation in average transaction costs. Figure 8 displays the distribution of average card interchange fees across merchants in our sample. On average, merchants pay around 1.5% of sales to accept cards, but this average masks considerable variation. At the 10th percentile, interchange fees are 0.8% of sales, while at the 90th percentile, they rise to 2.2% of sales.

Part of the variation in average transaction costs is driven by the mix of cash versus card payments across firms, as cash transactions incur zero interchange fees, while card interchange fees can be upwards of two percent. However, there is still substantial variation in card-related costs across merchants. Figure 8 displays the average card transaction costs across merchants in our sample with more than $100,000 in annual sales. The average transaction cost is 1.5%, with

a standard deviation of 0.5%.

We next examine the factors driving this variation in payment costs. The overall payment mix—including the types of debit cards (regulated vs. exempt) and credit cards (basic vs. premium) used—has a first-order impact on merchant costs. Additionally, even within a given payment type, cost variation arises due to merchant-specific characteristics, such as industry, firm size, and the average transaction size at a merchant. We begin by documenting the variation in transaction costs and conclude by decomposing this variation into its key components.

III.B.1 Card Types

We classify card payments into four categories: regulated debit, exempt debit, basic credit, and premium credit. Distinguishing between these card types is crucial because they impose different costs on merchants. Figure 9, panels (a)–(d), and Table 3 display average interchange rates for each of these categories. Regulated debit cards earn around 0.7% of transaction value in interchange, while exempt debit cards earn higher rates around 1.1%. Basic credit cards carry higher interchange rates, around 1.7%, and premium credit cards have even higher rates, averaging approximately 2.1%.

We classify debit card transactions based on whether the issuing bank is regulated or exempt under the Durbin Amendment, which capped interchange fees for debit cards issued by large banks (regulated debit) but not for those issued by smaller institutions (exempt debit). Specifically, the 2011 Durbin Amendment capped interchange fees for debit cards issued by banks with over $10 billion in assets, setting a maximum fee of 22 cents plus 0.05% per transaction. Banks below this threshold remained exempt and continued to earn higher fees. Table 4a compares reported exempt and regulated debit interchange rates across sectors using Visa's public interchange schedule. At an average debit card transaction size of around $40, exempt rates are substantially higher than regulated rates in many sectors. Figure 9b displays average interchange fees for both debit and credit cards over time, while Figure 9c shows debit card fees separately for regulated and exempt debit cards. Figure 9c shows that average debit card interchange fees fell by more than 50% following the implementation of the Durbin Amendment.

Figure 10a shows the share of debit card transactions that are subject to the Durbin Amendment cap over time. By definition, the share of regulated debit transactions was zero before the amendment, and it jumped to 60% following its introduction in 2011. This share has remained roughly constant since then.

We classify credit card payments into basic and premium categories. Premium cards include those in higher interchange tiers, such as Visa Signature, Visa Infinite, Visa Signature Preferred, Mastercard World, and Mastercard World Elite. These cards offer enhanced rewards and carry higher interchange fees.[8] Basic credit cards include all other credit cards. Table 4a shows that

[8]Rewards can still vary within card type because the exact structure of rewards are determined by issuers. Visa and Mastercard influence the set of rewards primarily by changing the interchange fees issuing banks can earn for different card types.

premium credit cards have publicly reported interchange rates that are higher than those for basic cards. Figure 9b displays average interchange fees for both debit and credit cards over time, while Figure 9d shows credit card fees separately for basic and premium credit cards. Figure 9b shows that average credit card fees have increased over time. However, this increase is primarily driven by the growing prevalence of premium credit cards, as the average interchange fees for basic and premium cards have remained relatively stable over this period (Figure 9d). Figure 10b illustrates the rising dominance of premium cards, which grew from about 20% of credit card volume in 2006 to 60% in 2022.[9]

We examine the extent to which differences in payment mix can explain variations in transaction costs. Specifically, we predict each merchant's average transaction costs based on their payment mix, including variations within card types (e.g., regulated vs. exempt debit and basic vs. premium credit). Variation in payment mix accounts for approximately 24% of the overall variation in transaction costs. The dashed red line in Figure 12 shows the density of predicted transaction costs based on each merchant's observed payment mix. The remaining variation in transaction costs is attributable to within-card type differences in interchange fees, which reflect variation across merchants due to factors such as industry, firm size, and transaction size.

III.B.2 Merchant Sectors

Interchange rates also vary across sectors, with high-margin sectors typically paying higher fees. Figure 11b plots average interchange rates in the Fiserv data across five major spending categories: travel, restaurants, merchandise, grocery stores, and gas stations. These five categories account for approximately 85% of card sales. We focus on rates for credit cards and exempt debit cards, as the Durbin Amendment cap limits variation in regulated debit card fees.

Fees are highest in the travel and retail sectors, which generally have higher margins and more affluent customers compared to other sectors. In contrast, grocery stores and gas stations, which operate on thinner margins and serve a broader swath of the income distribution, pay interchange fees that are one-third or 50 basis points lower. One natural explanation for why high margin merchants are more willing to accept cards is that interchange fees are charged as a percentage of sales. Even if accepting credit cards has the same impact on sales across sectors, card acceptance would increase profits at high-margin businesses by a greater amount. Historically, Visa and Mastercard had lower acceptance at supermarkets until they started to give supermarkets discounts on interchange rates in the 1990's (Stearns, 2011).

Accounting for the merchant sector, in addition to the payment mix, explains roughly 43% of the overall variation in transaction costs. The dashed green line in Figure 12 shows the

[9]Historically, card networks such as Visa and Mastercard have required that merchants accepting their cards must accept all cards issued under their respective brands. In other words, merchants cannot selectively accept certain Visa cards—they must accept all Visa cards or none at all. This policy has been the subject of ongoing "honor-all-cards" litigation.

distribution of predicted transaction costs based on each merchant's observed payment mix and sector.

III.B.3 Merchant Size and Other Characteristics

Interchange fees are generally lower for larger firms. Figure 11c plots average interchange rates in the merchandise and grocery store sectors for large firms (with more than $1 billion in sales) and smaller firms (with less than $1 billion in sales). Larger firms pay approximately 50 basis points less in fees on their credit card and exempt debit card transactions. For credit cards, this pattern aligns with public data from Visa's interchange schedule, shown in Table 4b.

One explanation for this size-based discount is that large merchants can influence consumer payment behavior by choosing not to accept specific payment methods. In response, networks offer lower interchange rates to large merchants to keep them on the platform. Historically, large department stores were slow to accept Visa and MC credit cards because they had their own alternatives in the form of store credit. Only after Visa made concessions did JC Penney become the first large department store to accept credit cards, and Sears held out until the mid-1990s (Nocera, 1995).

Another important factor influencing the average interchange fee is the transaction size. Visa's public interchange schedules, as shown in Table 4, indicate that interchange fee schedules include a fixed component that does not vary with the transaction size, as well as a variable component that scales linearly with the transaction size.

Accounting for firm characteristics such as total sales and the average transaction size, in addition to payment mix and sector, explains approximately 64% of the overall variation in transaction costs. The dashed orange line in Figure 12 shows the distribution of predicted transaction costs based on each merchant's observed payment mix, sector, and firm characteristics.

Section IV Real Effects of Payments

In this section, we show that payment costs have real effects on retail sales and prices. The pass-through of fees into prices is essential to cross-subsidization among cash, credit, and debit users. Documenting the real effects of interchange fees motivates our subsequent analysis of cross-subsidization in Section V.

IV.A The Heterogeneous Effects of the Durbin Amendment

The 2011 Durbin Amendment, passed as part of the Dodd–Frank Act, imposed a binding cap on debit card interchange fees for banks with over $10 billion in assets that had highly heterogeneous effects across merchants. As illustrated in Figure 9b, the Durbin Amendment had a substantial impact on debit interchange fees while having no effect on credit interchange.

We study the effects of the Durbin Amendment on restaurants.[10] Figure 13 examines how the policy had heterogeneous effects across restaurants. Figure 13a binscatters average firm-level

[10]We focus on restaurants because they are one of the only sectors with large, heterogeneous effects of the Durbin

debit interchange rates, τ_j against the average pre-regulation transaction size of debit cards t_j. We measure firm-level interchange fees as the dollar value of interchange fees divided by the total dollar volume of transactions, and we measure transaction size as the total dollar volume of debit transactions divided by the total number of debit transactions. By comparing the two curves, we see that the regulation increased interchange fees for restaurants with low ticket sizes, and decreased it for restaurants with large ticket sizes.

This change occurred because the Durbin Amendment changed the structure of debit interchange for restaurants from a large linear fee with a low fixed fee (1.19% of transaction value + 10 cents) to a low linear fee with a high fixed fee (0.05% of transaction value + 22 cents) (**?**).

Figure 13b binscatters average debit interchange fees against the post-Durbin share of debit transactions on regulated cards at the ZIP code level, $r_{z(j)}$, both before and after the regulation. Using post-Durbin data, we calculate the share of debit card transactions at restaurants in each ZIP code conducted on regulated cards.[11] After the Durbin Amendment, average interchange rates declined sharply in areas with a higher share of regulated banks.

IV.B Estimation

We implement an instrumented difference-in-differences design that compares restaurants who vary in their expected gains from the Durbin Amendment based on their pre-regulation characteristics across areas with differential exposure to regulated banks. We estimate:

$$\Delta y_j = \beta \Delta \tau_j + \gamma X_j + \delta_{z(j)} + \epsilon_j \tag{2}$$

where Δy_j is the change in log sales at merchant j in the year following the Durbin Amendment (October 2011 to October 2012), $\Delta \tau_j$ measures the average change in credit and debit interchange fees (expressed as percentage points) at merchant j following the Durbin Amendment, X_j are firm-level controls, and $\delta_{z(j)}$ are zip-code fixed effects. The coefficient β measures the percentage change in sales for each percentage-point change in fees, with $\beta = 1$ corresponding to full pass-through of fees to prices.[12]

The raw change in fees $\Delta \tau_j$ is mechanically related to changes in consumer composition at the firm level (e.g. if growing firms attract more debit users). Therefore, we construct an instrument for $\Delta \tau_j$ based on pre-Durbin merchant characteristics and post-merchant geographic

Amendment. Heterogeneous effects require large changes in both the fixed and linear fee. As per Visa's public interchange fee schedules before and after the policy (**?**), the change in fixed fees was much smaller for retailers and gas stations (from 15 cents to 22 cents), whereas there was no change in the linear fee for grocers.

[11] We measure the regulated bank share at the ZIP-code level rather than merchant level to address endogeneity concerns: merchant-level bank shares measured after the regulation may reflect endogenous changes in merchant customer composition, while ZIP-code level variation provides plausibly exogenous geographic variation in treatment intensity.

[12] We model passthrough using a standard log-linear specification common in the tax literature. The standard log-log pass-through regression regresses $\log P\,(1+\tau)$ on $\log\,(1+\tau)$ (Butters et al., 2022). Since interchange fees are small relative to prices, this is nearly identical to our specification on the right-hand side, except where we replace log price with log sales in some regressions.

characteristics. Formally, we construct the instrument as:

$$\widetilde{\Delta\tau_j} = r_{z(j)} \times d_j \times \left(\tau^{\text{Reg Debit,Post}}(t_j) - \tau^{\text{Exempt Debit,Post}}(t_j)\right) \tag{3}$$

$$\tau^{\text{Reg Debit,Post}}(t_j) = 0.0005 + \frac{0.22}{t_j} \tag{4}$$

$$\tau^{\text{Exempt Debit,Post}}(t_j) = 0.0119 + \frac{0.10}{t_j} \tag{5}$$

Given this design, we include $\tau^{\text{Reg Debit,Post}}(t_j) - \tau^{\text{Exempt Debit,Post}}(t_j)$, d_j as controls X_j.

We report results for the one-year change in sales in columns (1)-(2) of Table 5. Column (1) presents OLS estimates, while column (2) presents our IV estimates. The OLS results indicate that a one-percentage-point increase in average interchange fees leads to approximately a 10.6% decrease in sales. However, as discussed previously there are many reasons why increases in interchange rates are mechanically associated with lower sales. Column (2) then presents IV estimates that a one-percentage-point increase in average interchange fees causes a 6.2% decrease in sales. Columns (3) and (4) show the two-year effects. Assuming full pass-through of interchange fees to prices ($\beta = 1$), these estimates imply a demand elasticity of around 7.2.

This decline in sales could reflect either a price increase and/or a decline in product quality (e.g., a rise in the quality-adjusted price). Although we do not observe the prices set by the restaurants, we do observe average transaction sizes as a proxy of price. Column (5) shows that increases in interchange are strong negative predictors of average transaction size. This reflects the mechanical negative correlation between transaction size and percentage interchange rates that arises when interchange fees have fixed components. Column (6) shows that our IV estimate instead finds that a one percentage point increase in interchange causes a roughly one-for-one increase in prices, but with substantial standard errors. The passthrough of costs in this setting is consistent with findings in Amiti et al. (2019) that small firms tend to pass through costs one-for-one to prices.

Section V Redistribution

In the previous section, we show that payment methods and fees vary across merchants and consumer demographics, ultimately impacting firms' costs and prices. In this section, we develop a simple quantitative framework that incorporates these facts to evaluate the welfare consequences of changes in interchange fees across a wide range of fully-specified models of consumer demand and retail pricing. We then use this framework to quantify the extent of redistribution generated by the payment system, and how sorting across merchants and merchant fee heterogeneity mitigate this redistribution.

V.A Economic Environment

We model the behavior of consumers, merchants, and payment networks. Consumers with fixed payment preferences choose how to allocate spending across merchants subject to a budget constraint. Merchants set retail prices in response to the composition of payments they receive and the fees on each payment method. Payment networks set interchange fees and pay consumers rewards.

V.A.1 Consumers

Consumers with different preferred payment methods take prices as given and solve optimal consumption problems over merchants. There is a unit mass of consumers, each with income that depends on their rewards from their payment method, f_k. Let $k = 1, \ldots, K$ denote different payment methods, and let the share of consumers who use payment method k equal π_k, with $\sum_k \pi_k = 1$. Consumers spend their income on goods from $j = 1, \ldots, J$ merchants. Let p_j denote the price set by merchant j and q_{jk} denote per-capita purchases from merchant j by card-k consumers. We use stars to denote equilibrium values.

Equilibrium consumption solves the consumer's utility maximization problem

$$q_{jk}^* = \arg\max_{q_{jk} \geq 0} U_k\left(\{q_{jk}\}_j\right) \text{ s.t. } \sum_j p_j q_{jk} \leq 1 + f_k,$$

where U_k is a strictly increasing, strictly concave, and twice-continuously differentiable utility function.[13] Because utility functions depend on payment preferences, this allows our model to capture the fact that credit, debit, and cash consumers may shop at different stores.

V.A.2 Merchants

Merchant's set prices based on on their marignial costs to maximize profits. Critically, a merchant's marginal cost depends on its expected interchange fee for a given transaction.[14]

Let τ_{jk} denote the interchange fee charged to merchant j for card k, expressed as a fraction of the transaction value. Let $s_j \in \{1, \ldots, S\}$ denote the sector of merchant j, and let b_j denote whether merchant j has negotiated rates. The interchange fee τ_{jk} charged to merchant j for payment method k equals:

$$\tau_{jk} = \overline{\tau}_k + \tau_{s_j k} + b_j \delta_k \tag{6}$$

where $\overline{\tau}_k$ is a baseline fee, $\tau_{s_j k}$ is a sector adjustment, and $\delta_k < 0$ is a negotiated discount. Without loss of generality, we normalize the baseline fee so that the average sector adjustment

[13] These regularity assumptions rule out two goods being perfect substitutes for each other and ensure that consumer demand functions over merchants are continuously differentiable in prices almost everywhere. We assume own-price elasticities dominate cross-price elasticities (Assumption I.B in Appendix A) and are not too large relative to the level of merchant fees.

[14] Individual merchants face weak incentives to surcharge by payment method despite different acceptance costs. Customer backlash creates first-order costs (Stavins, 2018; Caddy et al., 2020), while a standard envelope theorem argument shows gains from price discrimination are second-order in merchant fees (Wang, 2025).

for each payment method, when weighted by the dollar spending on that payment method, equals zero.

Prices are then log-linear in weighted interchange fees:

$$\log p_j = \log \overline{p}_j + \sum_k \mu_{jk} \tau_{jk}, \tag{7}$$

where $Q_j^* = \sum_k \pi_k q_{jk}^*$ equal total sales at merchant j, and $\mu_{jk} = \pi_k q_{jk}^* / Q_j^*$ is the share of sales on k and $\overline{p}_j$ reflects marginal costs. The log-linear form is a first-order approximation under monopolistic competition with CES preferences. Standard models predict near-complete passthrough for common shocks because all competitors face the same cost increase (Amiti et al., 2019). Because almost all merchants accept cards, interchange fee shocks are closer to sector-wide common cost shocks, not idiosyncratic shocks. In section V.C.3 we show that in realistic models that relax this assumption, we obtain similar results.

V.A.3 Card Networks and Rewards

We assume that card networks pass-through merchant fees, net of costs, to lump-sum consumer rewards.[15] We interpret rewards broadly to include any subsidy for card use (e.g., cash back, free checking). The assumption that issuers fully pass through interchange to rewards is supported by evidence: banks recouped lost debit interchange via checking fees (Kay et al., 2018a; Mukharlyamov and Sarin, 2025), credit card issuers pay out a large share of interchagne in the form of rewards expense (Drechsler et al., 2025; **?**). Structural models of network competition also predict that networks pass through interchange caps more than one-for-one into reward cuts (Wang, 2025). In section V.C.3 we show that when we relax this assumption, cash and debit card holders still lose from interchange, but the gains to credit card users are much smaller.

Formally, let $R_j = p_j Q_j$ denote total revenue at merchant j and $\omega_j = R_j / \sum_m R_m$ denote merchant j's share of total revenue, where $\sum_j \omega_j = 1$. We use $\mathbb{E}_R[\cdot]$ to denote expectations weighted by merchant revenue shares ω_j. Rewards are given by

$$f_k = \frac{\sum_j p_j q_{jk}^* \left(\tau_{jk} - c_k\right)}{\sum_m p_m q_{mk}^*}.$$

[15] Lump-sum rewards and merchant-specific or sector-specific rewards have identical first-order welfare effects. By Roy's identity, the welfare impact of reallocating spending across merchants in response to category-based rewards is second-order; the first-order effect is the income change.

V.B Sufficient Statistics Approach

V.B.1 Consumer Welfare

Theorem (Sufficient Statistic for Redistributive Welfare)**.** *Let x_l be any parameter that shifts τ_{jl}. The first-order money-metric welfare effect for consumers of type k is*

$$\frac{1}{\lambda_k}\frac{dV_k}{dx_l} = \pi_k^{-1}\Big(-\mathbb{E}_R\Big[\mu_{jk}\mu_{jl}\frac{\partial\tau_{jl}}{\partial x_l}\Big] + \mathbb{1}\{k=l\}\,\mathbb{E}_R\Big[\mu_{jk}\frac{\partial\tau_{jk}}{\partial x_k}\Big]\Big) + O(\tau_{\max}), \tag{8}$$

where λ_k is the marginal utility of income and $\tau_{\max} = \max_{j,k}|\tau_{jk}|$ denotes the maximum interchange fee across all merchants and payment methods. Multiplying by π_k yields the aggregate dollar welfare effect for group k.[16]

Intuition and Proof Sketch The theorem says that two channels determine how interchange fees redistribute welfare. The first term is the retail-price channel: when interchange fees on payment method l decline, retail prices fall at merchants where method-l users shop. The size of the mechanical price change, holding fixed the composition of payments, is precisely $\mu_{jl}\frac{\partial\tau_j l}{\partial x_l}$. Consumers using payment method k benefit in proportion to their overlap with method-l users, which then yields product $\mu_{jk}\mu_{jl}\frac{\partial\tau_j l}{\partial x_l}$. The second term is the direct reward channel: method-l users receive less in card rewards when their interchange fees fall, affecting only those users. Importantly, redistribution is governed by these overlap moments alone—we do not need to solve for the full general equilibrium of prices, payment choices, and merchant behavior.

As discussed above, the sufficient statistic can be thought of as aggregating the welfare effect of the mechanical retail price changes across merchants when the composition of payments at each merchant stays fixed while the fee schedule τ changes. The non-trivial part of the theorem is showing that the equilibrium changes in retail prices across all merchants are well approximated by these mechanical effects.

In our setting, merchants' prices depend on the composition of consumers at each merchant. As prices change, compositions change as well. While Roy's identity gives that the effects of consumer reallocation can be ignored when studying the welfare change for a given consumer, it leaves open the possibility that consumer reallocation can change retail prices in a way that differs substantially from the mechanical effect of changing interchange fees on retail prices.

In Appendix A, we prove that as long as elasticities solve a dominant diagonal condition and are not too large relative to the level of fees, then these feedback effects of prices on the composition of payments are of order τ. Therefore when evaluating the welfare effects of changes in interchagne fees τ, the error is second order in τ.

[16] Our model holds payment choices fixed, focusing on redistribution rather than efficiency effects. High interchange fees may induce excessive credit card adoption (Wang, 2025), or they may improve efficiency when card acceptance lowers merchant costs (Li et al., 2020). While distortionary payment choice creates social costs, the additional rewards are pure transfers.

Relation to alternative approaches. Our sufficient statistic approach delivers a simple formula requiring only payment shares π_k and overlap moments $\mathbb{E}_R[\mu_{jk}\mu_{jl}]$, and contrasts with fully structural demand estimation, which would require specifying and estimating utility functions, demand elasticities, and merchant pricing behavior across all consumer types and merchants. While structural models offer rich counterfactuals, they impose parametric assumptions and require extensive data on consumer choices. Our approach instead leverages the theoretical insight that redistributive welfare effects depend on a small number of moments—payment shares and overlaps—that are directly observable in transaction data. This makes the analysis transparent and robust to functional form assumptions.

To validate this sufficient statistic approach, Appendix B calibrates a structural model that matches key data moments while allowing for imperfect passthrough. Consumer welfare estimates for the main payment groups change by less than 10% when allowing imperfect passthrough (Table A.1), confirming that the sufficient statistic formula captures the first-order redistributive effects.

V.B.2 Applying the Sufficient Statistic to Changes in the Interchange Fee Schedule

We use our sufficient-statistics approach to quantify the consumer welfare effects of setting all interchange fees to zero. This requires separating the welfare effects of setting each component (baseline, sector, bargaining) of the interchange fee to zero.

Applications to Fee Components. The per-capita welfare effects on consumers who use payment method k of eliminating each component of the interchange fee for payment method l are:

- **Baseline fee $\overline{\tau}_l$:**

$$A_{kl} = -\overline{\tau}_l \times \left(\mathbb{1}\{k = l\} - \pi_k^{-1} \mathbb{E}_R \left[\mu_{jk}\mu_{jl} \right] \right) \tag{9}$$

- **Sector discounts τ_{sl}:**

$$S_{kl} = -\sum_s \tau_{sl} \times P_R\left(s_j = s\right) \mathbb{E}_R \left[\mu_{jk}\mu_{jl} \,|s_j = s \right] \tag{10}$$

- **Negotiated rates δ_l:**

$$B_{kl} = -\delta_l \times P_R\left(b_j = 1\right) \left(\mathbb{1}\{k = l\} - \pi_k^{-1} \mathbb{E}_R \left[\mu_{jk}\mu_{jl} \,|b_j = 1 \right] \right) \tag{11}$$

The total effect of setting all interchange fees on payment method l to zero is $T_{kl} = A_{kl} + S_{kl} + B_{kl}$. Multiplying by π_k yields aggregate dollar welfare effects.

Intuition. The baseline fee formula shows how changes in the overall fee level redistribute across payment types. A decrease in the baseline fees on card l benefits consumers of card

k by lowering retail prices in proportion to how much card k and card l consumers overlap ($\mathbb{E}_R[\mu_{jk}\mu_{jl}]$). Card l consumers are hurt from losing rewards.

The appearance of second moments makes the framework rich enough to nest leading cases in the literature. When consumers with different cards shop at disjoint sets of merchants, as in Gans (2018), $\mu_{jk}\mu_{jl} = 0$ for all j whenever $k \neq l$ and there is no redistribution. Conversely, when merchants are homogeneous, so that $\mu_{jk} = \overline{\mu}_k$ for all merchants j, the redistribution depends on the aggregate share of each card type, consistent with the intuition in Felt et al. (2023). Thus, the sufficient-statistics framework captures a wide range of economic environments—from perfect merchant homogeneity to full segmentation—allowing us to quantify redistribution in the presence of observed heterogeneity in payment behavior.

The sector discount formula says that sector-specific discounts are transmitted sector-by-sector according to consumer overlap in each sector. Intuitively, if debit card and credit card consumers overlap more in groceries than in travel, then a discount for groceries and a higher fee for travel benefits debit card users at the cost of credit card users.

The negotiated rate formula predicts that consumers benefit from the discounts that large merchants to the extent that they shop at such merchants. Because large merchants have a consumer base that covers consumers with different payment preferences, this means that cash and debit consumers are significant beneficiaries of negotiated credit card interchange fees.

V.C Quantifying Redistribution

We utilize our general formulas to examine the welfare effects of different changes to interchange fees, enabling us to understand the distributional impact of interchange fees across consumers. We apply our framework to a cross-section of sales and interchange fees by card type in 2022. To implement our sufficient statistics framework, we simply need to know, at the merchant level, equilibrium payment shares and the corresponding interchange fees, both of which are directly observable in our data.

We recover the fee parameters from regressing firm-level interchange fees on sector dummies and a dummy for having more than $1 billion in sales in the grocery and retail sectors. The regression constant yields the baseline fee $\overline{\tau}_k$; the sector dummy coefficients yield the sector adjustments τ_{sk}; and the bargaining dummy coefficient yields the negotiated discount δ_k. For each payment method, we weight each merchant by the dollar volume on that merchant, which ensures that the dollar-weighted average sector adjustment is zero. This normalization implies that sector adjustments affect welfare only through their differential impact on retail prices (second moments), not through rewards (first moments).

To recover the shares, we use the fact that because incomes are all close to one, $\pi_k = \mathbb{E}_R[\mu_{jk}]$. Thus we can recover these shares as

$$\widehat{\pi}_k = \sum_j \widehat{\omega}_j \, \mu_{jk}, \qquad \widehat{\mathbb{E}_R[\mu_{jk}\mu_{jl}]} = \sum_j \widehat{\omega}_j \, \mu_{jk}\mu_{jl}.$$

V.C.1 Eliminating Interchange Fees and Card Rewards

Eliminating interchange fees and card rewards has two equal and opposite effects on consumers as a whole. On one hand, when interchange fees are set to zero, consumers no longer receive rewards when they pay with debit or credit cards. On the other hand, eliminating interchange fees reduces merchants' transaction costs, which leads to lower prices, benefiting all consumers. Although these effects offset each other in the aggregate, they have large distributional effects. Consumers who use high-reward, and therefore high-interchange credit cards, are worse off, whereas consumers who use low-fee payment methods like cash and regulated debit cards are better off. Moreover, the consumers who use low-fee payment methods at stores that primarily serve other consumers that use high-fee payment methods experience the largest benefits.

We compute the consumer welfare effects of setting interchange fees to zero after accounting for consumer sorting and merchant fee heterogeneity in Table 6. We calculate effects measured both as a percentage of each consumer group's baseline expenditures as well as in terms of overall dollars when the total expenditures across all consumers are scaled up to around $12 trillion. On average, cash-using consumers would be better off by 92 basis points of baseline consumption. Across all cash users, this amounts to approximately $15.6 billion in additional annual consumption. Cash users benefit purely because the decline in interchange fees lowers effective prices, and they are not hurt by the loss of rewards, since they never received them in the first place.

Even though much of the literature focuses on transfers between card and cash users, regulated debit card users also benefit substantially from capping interchange fees. For this group, average consumer surplus would increase by 42 basis points, corresponding to approximately $11.7 billion in additional annual consumption. Although these users lose out on modest card rewards, the associated price reductions more than offset the loss. This is because rewards tied to regulated debit cards are relatively small, especially compared to those from credit cards, and credit card usage is more prevalent. As a result, setting interchange fees to zero yields a significant decline in average prices relative to the value of regulated debit card rewards. These findings indicate that it is not only cash users who subsidize credit card rewards. Regulated debit card users, who face lower fees and receive lower rewards, also contribute to this subsidy.

Whereas cash and regulated debit card users benefit from reductions in interchange fees, both basic and premium credit card users are hurt by the reduction in interchange fees. This is because they are disproportionately hurt by the reduction in rewards while receiving only modest benefits from the reduction in retail prices. On net, basic and premium credit card users lose 50 and 60 bps of consumption, respectively, amounting to $10 and $17.8 billion, respectively.

It is helpful to put these changes in consumption in perspective. One natural benchmark is the sales tax, which serves as a tax on consumption. As of 2024, the average state sales tax

rate in the U.S. was 6%.[17] Our results suggest that the cross-subsidization between cash and credit card users is equivalent to cash users effectively paying a 25 percent higher sales tax than premium credit card users. The numbers also imply that credit card users receive around $30 billion in aggregate from cash and debit card users. These annual transfers are large relative to the outlays of many government social insurance programs, such as SNAP benefits ($120 billion), EITC ($57 billion), and regular unemployment insurance ($40 billion). The transfers here are also large relative to other transfers in consumer financial markets, such as the inter-regional transfer due to the GSE's lack of risk-based pricing ($15 billion), consumers' losses from high-fee index funds ($20 billion), and consumer losses from shrouded credit card fees ($10 billion) (Agarwal et al., 2015; Hurst et al., 2016).

Our estimates of transfers are also large relative to empirical estimates of how much interest payments redistribute across consumers. Several papers argue that banks use interest income to fund rewards (Gabaix and Laibson, 2006; Agarwal et al., 2025). Theoretically, these transfers can arise when issuers cannot distinguish between the sophs (who earn rewards) and the naifs (who pay interest), and thus both types of consumers pool on the same card product. Existing empirical work on this mechanism, such as Agarwal et al. (2025), make the strong assumption that all consumers pool on the same card and estimate annual transfers of $18 billion from low credit score consumers to high credit score consumers.

These results also shed light on who receives rewards and who "pays" for those rewards. The orange squares in Figure 14 display each payment type's share of the change in total card rewards when interchange fees are eliminated. These shares represent each card type's contribution to the total change in rewards relative to the total change in retail prices, reflecting both card usage and associated reward levels. The results indicate that premium credit card users account for the largest share of the change in total rewards at 43%. In comparison, basic credit card users account for 25%, and exempt and regulated debit card users account for 13% and 18%, respectively.

The green circles in Figure 14 display the share of interchange costs borne by cash, debit, and credit card users. The results indicate that cash users pay for 12% of interchange fees and thus implicitly pay for 12% of card rewards, representing a transfer from cash users to card users. In contrast, regulated debit and premium credit card users pay for 22% and 30%, respectively, of rewards programs.

Comparing the vertical distance between the share of rewards received and the share of interchange fees paid highlights the extent of cross-subsidization. For example, premium credit card users receive 43% of rewards but pay only 30% of total interchange fees. This 13 percentage point gap represents a transfer from consumers using other payment methods to premium credit card users. Conversely, regulated debit users receive 13% of rewards but pay 22% of interchange fees. This implies that regulated debit cards substantially subsidize the rewards

[17] https://taxfoundation.org/data/all/state/sales-tax-revenue-reliance-breadth/

programs associated with more expensive payment methods such as credit cards. While the literature and policymakers have often emphasized that cash users subsidize rewards programs, our findings suggest that debit users, particularly regulated debit card users, play a quantitatively important role in subsidizing credit card rewards.

V.C.2 Implications of Merchant Heterogeneity

Our sufficient statistics framework shows that the sorting of consumers with different payment preferences across merchants, along with fee heterogeneity across merchants shapes the impact of interchange fees on consumers. We find that accounting for merchant heterogeneity has important implications for two reasons. First, as documented in Section III, we find evidence of consumer sorting: cash, debit card, and credit card users tend to shop at different merchants, which limits cross-subsidization. Second, the merchants frequented by all consumer types, where the potential for redistribution is the greatest, tend to pay the lowest interchange fees, which inherently restricts redistribution.

To evaluate the relative importance of these channels, it is useful to compare our model's results to a counterfactual model that instead assumes all merchants serve the same mix of consumers, and that all cards of a given card type charge all merchants the same fee. The second row of Table 6 shows the results under these two assumptions about merchant homogeneity. If all merchants were homogeneous, the gains to cash users and regulated debit card users from setting interchange fees to zero would be substantially higher. Consumer surplus among cash users would increase by 120 basis points (approximately $20.2 billion). Similarly, surplus among premium credit card users would decrease by 91 basis points (roughly $27.2 billion). In a world of homogenous merchants, the losses for premium card users would be $9.4 larger, and the gains for cash users would be $4.6 billion larger.

Consumer sorting explains most of the difference between our baseline results and the homogeneous-merchant counterfactual. Consumer sorting reduces credit card (basic and premium) surplus by about $8.4 billion relative to the homogeneous world: because cardholders disproportionately shop at card-accepting merchants, they effectively fund a large share of their own rewards through higher prices. Interchange fee heterogeneity further mitigates redistribution by $1.6 billion as the merchants where cash, debit, and credit card users all shop—and where redistribution could be greatest—tend to pay lower interchange fees. The purple triangles in Figure 14 illustrate this quantitatively: if all merchants were homogeneous, premium credit card users would still receive 43% of rewards but pay for only 23% of them, implying they would effectively receive 47% (=(43%-23%)/43%) of their rewards for free. However, due to consumer sorting across merchants by payment method, premium credit card users currently receive only 31% (=(43%-30%)/43%) of their rewards for free. This highlights the crucial role that consumer sorting and variation in interchange rates play in reducing the extent of redistribution across payment types.

V.C.3 Robustness to Imperfect Rewards and Price Passthrough

Our baseline sufficient statistic framework assumes that issuers fully rebate interchange revenues to consumers as rewards. To evaluate incomplete rewards passthrough, we multiply the rewards term in equation (9) by an empirically-informed passthrough ratio. For instance, Drechsler et al. (2025) estimate that around 70% of interchange revenues are rebated as rewards. When we recalculate the redistribution effects using a 70% passthrough ratio for rewards (shown in Table 6), credit card users' net benefits from high interchange fees are substantially reduced. Intuitively, this occurs because their benefit from rewards is substantially reduced, while their losses from higher prices remain unchanged. Under this assumption, eliminating interchange fees benefits almost all consumer groups.

We assume complete passthrough of interchange fees to retail prices because (1) interchange fees are largely sector-level shocks and (2) there is strong empirical evidence that firms fully pass-through sector-level shocks (Amiti et al., 2019). In Appendix B, we simulate from a CES model with granular firms who imperfectly passthrough idiosyncratic cost shocks to evaluate the sensitivity of our results. We find that even substantial levels of imperfect pass-through have small effects on our estimates of redistribution.

V.C.4 Redistribution by Income

We also examine how the redistributive effects of interchange fees and rewards programs vary across household income levels. In Section V.C.1, we showed how much consumers with different payment preferences (e.g., debit or credit) gain or lose from capping interchange fees, expressed as a share of their baseline consumption. To translate these results into distributional effects by income, we combine them with the evidence in Figure 7 on how payment preferences vary with income. At each income level, we calculate the net effect as a weighted average of the consumption impacts across payment types, using as weights the market shares of each payment method among households at that income level. We then map these effects to dollar transfers by assuming consumers of all income levels have the same proportion of purchases to income, and by scaling up total purchases to $12 trillion.

We find that capping interchange would generate a large progressive transfer from households with incomes greater than $\$150,000$ to those with incomes below that level. Figure 15a shows that the highest income households lose around 17 basis points of consumption because they have the highest levels of credit card use. As a result, they would be hurt by the decline in rewards more than they would benefit from lower retail prices. In contrast, the effect is reversed for lower income households who are more likely to use cash and debit cards. In dollar terms, this is a transfer of around $392 per year from households with incomes above $\$150,000$ per year to fund transfers of around $88 to households with incomes below that cutoff. Cumulatively, the high income households lose around $9.2 billion from a cap on interchange fees, whereas the low-income households gain around the same amount.

V.C.5 Effects of the Durbin Amendment

Our framework also sheds light on the redistributive impact of the Durbin Amendment. The Durbin Amendment was designed to limit interchange fees on debit card transactions. Table 7 presents an estimate of the effects of this regulation. The results indicate, unsurprisingly, that regulated debit card users were hurt by the regulation, with their surplus decreasing by 36 basis points of consumption ($10 billion). Intuitively, high debit interchange funded free checking accounts for such consumers, and these perks went away after the regulation (Mukharlyamov and Sarin, 2025). While debit card users were hurt, credit card users benefitted substantially, with their surplus increasing by around $4.9 billion. This is because they benefited from lower retail prices while earning the same rewards. Thus, regulating interchange fees on debit cards primarily benefited credit card users.

We also examine the redistributive impact of the Durbin Amendment across household income levels. Figure 15b illustrates the effects of the Durbin Amendment. The figure shows that low-income consumers were relatively unaffected, middle-income consumers were hurt the most by the Durbin Amendment, and higher-income consumers benefitted. This pattern arises because low income consumers are likely to use both cash and debit cards. Whereas the low-income debit card users were hurt, low-income cash users benefit from lower retail prices. At the other end of the spectrum, high income households are most likely to use credit cards, and thus they benefit from the lower retail prices while their rewards are unaffected. Ultimately, middle-income consumers who primarily use debit cards bore the brunt of the Durbin Amendment. Cumulatively, this transfer was around $1 billion from middle-income to high-income consumers.

V.C.6 Who Pays for Premiumization?

Lastly, we examine the welfare effects of the rise in premium credit cards. As documented in Section III and Figure 10b, the share of premium credit cards increased from 15% in 2006 to over 60% in 2022. Since the average interchange rate on premium cards is 2.34%, compared to 1.64% for basic cards, this shift has raised total credit card interchange fees by roughly 20%.

Table 8 reports the redistributive effects of the rise in premium credit cards compared to a benchmark where there are no premium credit cards. Figure 15c displays the corresponding redistributive impact of increased premiumization across household income levels. Unsurprisingly, premium cardholders benefit from the increase in premiumization: their surplus increases by 27 basis points of consumption (about $8 billion). By contrast, cash users, exempt debit users, regulated debit users, and basic cardholders are all hurt by the rise in premiumization. Interestingly, the largest costs in dollar terms accrue not to cash users, but to debit card users (both regulated and exempt) and basic credit card users. These groups shop more frequently at the same merchants as premium cardholders, and therefore bear a greater share of the burden from the higher interchange fees associated with premium cards. Moreover, because

all consumers face the same prices regardless of payment method, consumers have incentives to adopt the most expensive card offering the most generous rewards. Consequently, costly payment methods, such as premium credit cards, tend to crowd out cheaper ones, such as basic cards, helping to explain the rise of premiumization.

Section VI Conclusion

We show that interchange fees are not just a technical feature of the payments industry but a pervasive force shaping retail activity and redistributing consumption among consumers. First, using merchant-level data, we document substantial heterogeneity in the composition and cost of payments across stores. This heterogeneity has critical implications for merchants' costs and redistribution. We also show, using the Durbin Amendment as a natural experiment, that interchange fees matter for real outcomes: a one-percentage point decline in interchange rates causally increases card sales by about 7 percent over two years. Finally, through a sufficient-statistics framework, we quantify the overall impact of interchange pricing, finding that interchange fees redistribute approximately $30 billion per year from cash and debit users to credit card users, with consumer sorting attenuating these transfers by about 25 percent. In addition, we document that two recent shifts in the industry, the Durbin Amendment and the rise of premium credit cards, have had regressive impacts. Surprisingly, and likely unintentionally, the Durbin Amendment primarily benefited credit card users. These results highlight that interchange policies affect not only banks and card networks but also prices, market competition, and the distribution of economic surplus across consumers.

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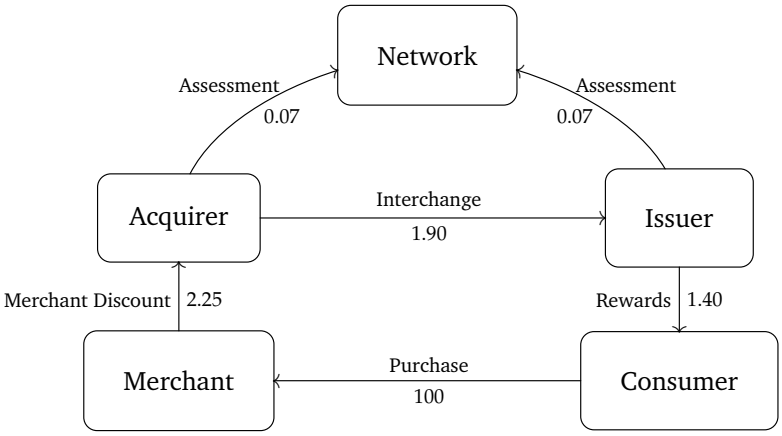
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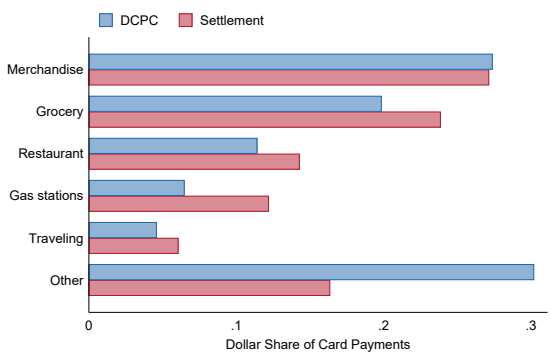
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Figure 1: Illustration of payment flows in a payment network



Notes: Figure 1 displays average fee levels for a credit card transaction in the US, showing how fees flow through the payment system. Merchant fees come from (Nilson, 2023). Interchange fees and rewards are calculated from regulatory data on large banks (Drechsler et al., 2025). Network fees come from acquirer disclosures and Visa's financial statements (Visa, 2020; Helcim, 2021).

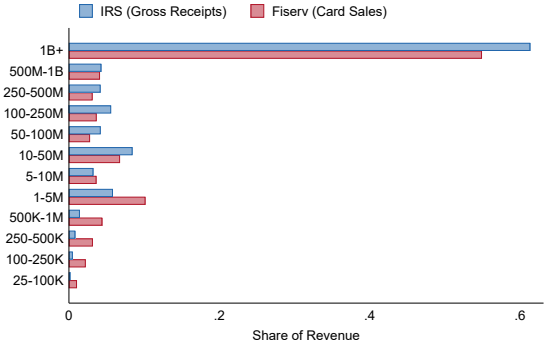
Figure 2: Data Coverage and Representativeness



(a) Sector Composition



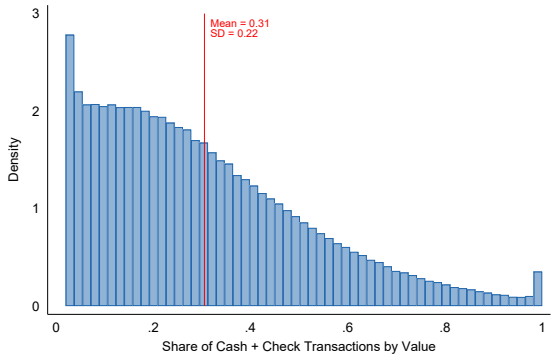
(b) Geographic Composition



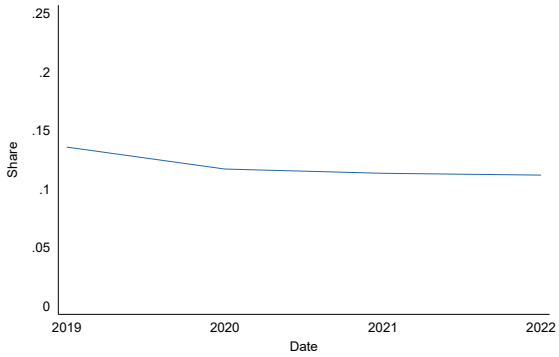
(c) Firm Size

Notes: Panel (a) compares sector composition across datasets: DCPC (Atlanta Fed's Diary of Consumer Payment Choice) versus Fiserv settlement data (which covers both large and small merchants). Both show dollar value shares of card transactions by sector. Panel (b) validates geographic coverage by plotting each state's GDP share against its card transaction share in the Fiserv settlement data. Panel (c) compares firm-size distribution of card spending: IRS data (using Statistics on Income for gross receipts) versus Fiserv settlement data. All shares are measured by dollar value of transactions.

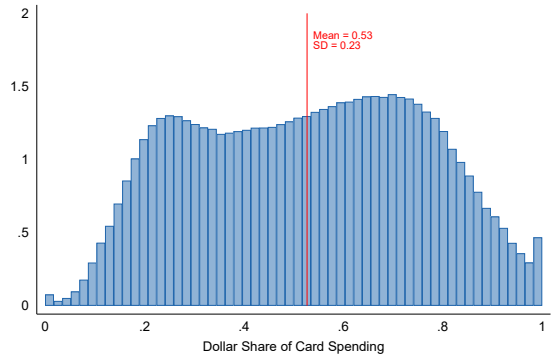
Figure 3: Heterogeneity in the Payment Mix Across Merchants



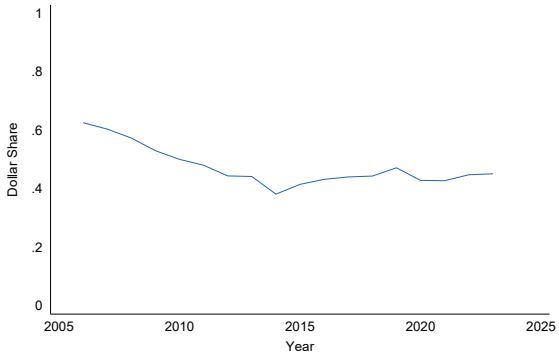
(a) Cash Share



(b) Cash Share over Time



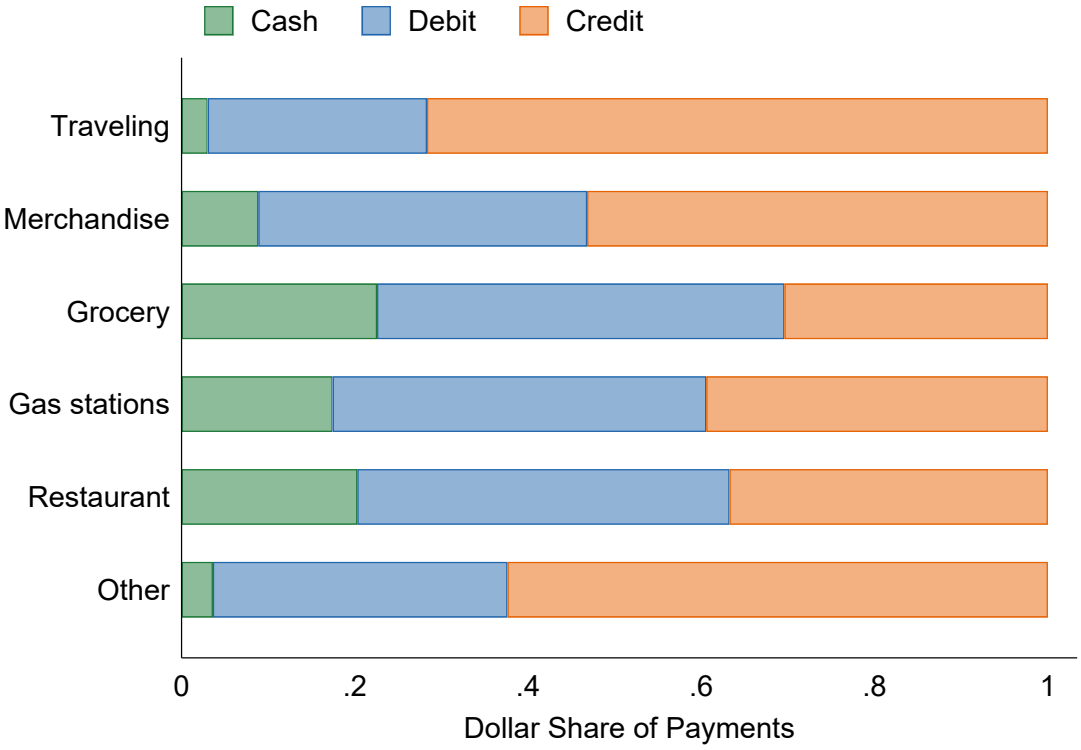
(c) Credit Card Share of Card Payments



(d) Credit Card Share over Time

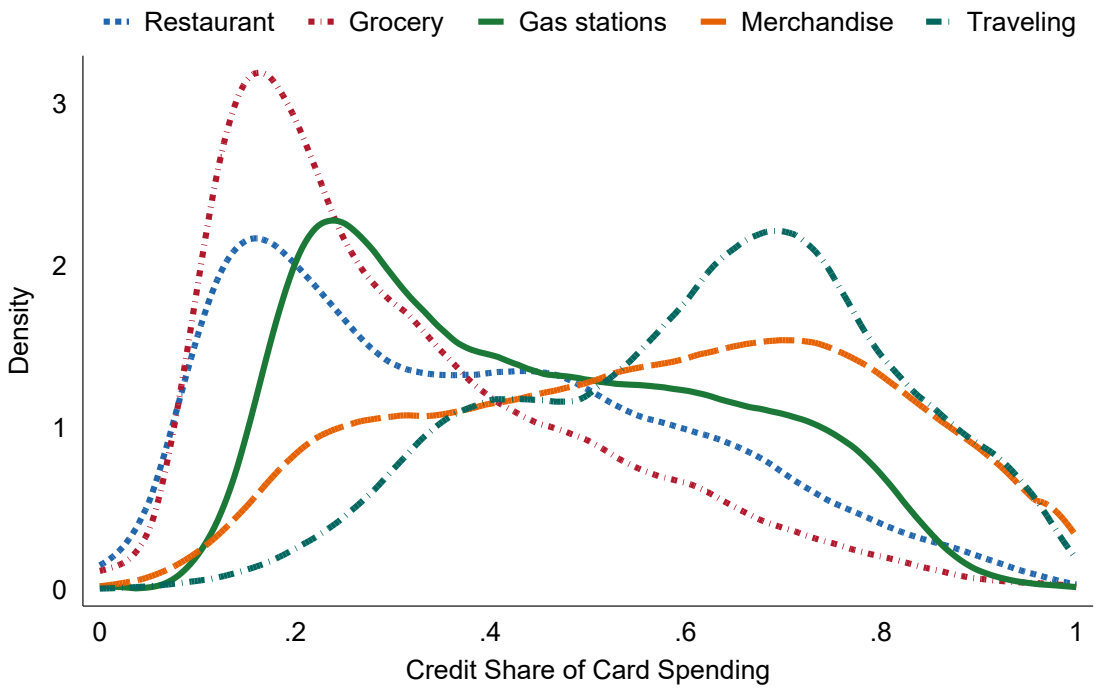
Notes: Panel (a) shows the distribution of cash and check share across merchants in the Clover sample, conditional on at least 2% cash/check payments; note that two-thirds of merchant-year observations have $\leq$ 2% cash (nearly all record 0%), and are excluded from the plot (equally weighted, merchant-year level). Panel (b) displays the dollar-weighted average cash share over time, computed annually. Panel (c) shows the distribution of credit card share of total card transactions in 2022 for merchants with more than $100,000 in annual card sales in the broader settlement data. Panel (d) displays the dollar-weighted average credit card share over time, excluding large retailers (grocery/retail >$1 billion) to avoid entry/exit effects on trends.

Figure 4: Heterogeneity in the Payment Mix Across Sectors



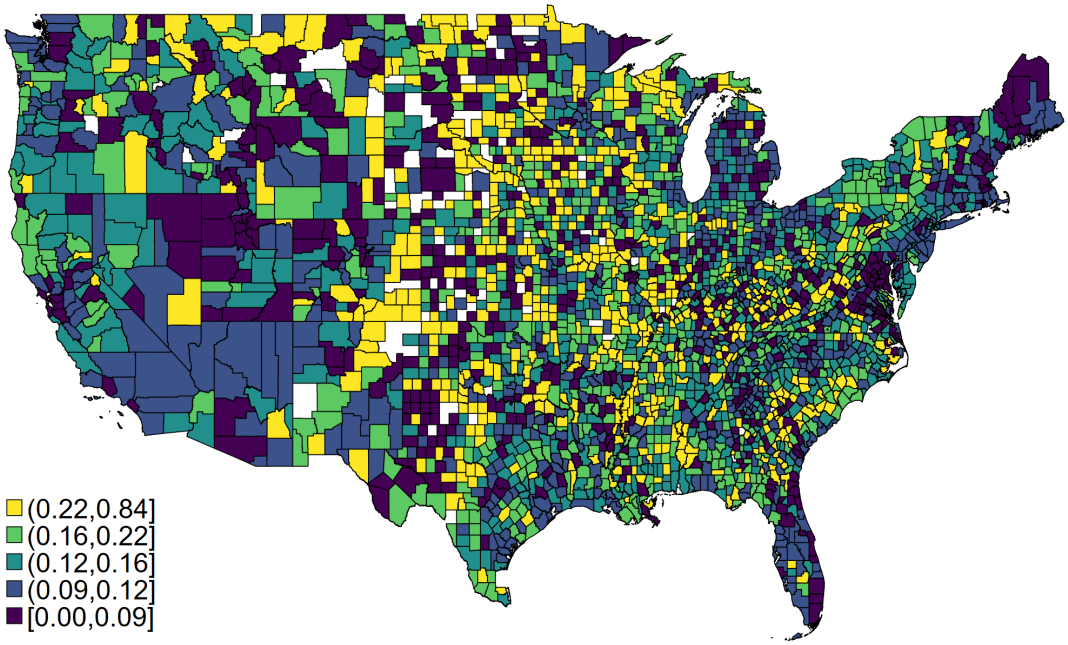
Notes: Each bar shows the dollar share of cash, debit, and credit card transactions across major merchant sectors in the Clover merchant data spanning 2019–2022.

Figure 5: Variation in Composition of Card Payments Within Sectors

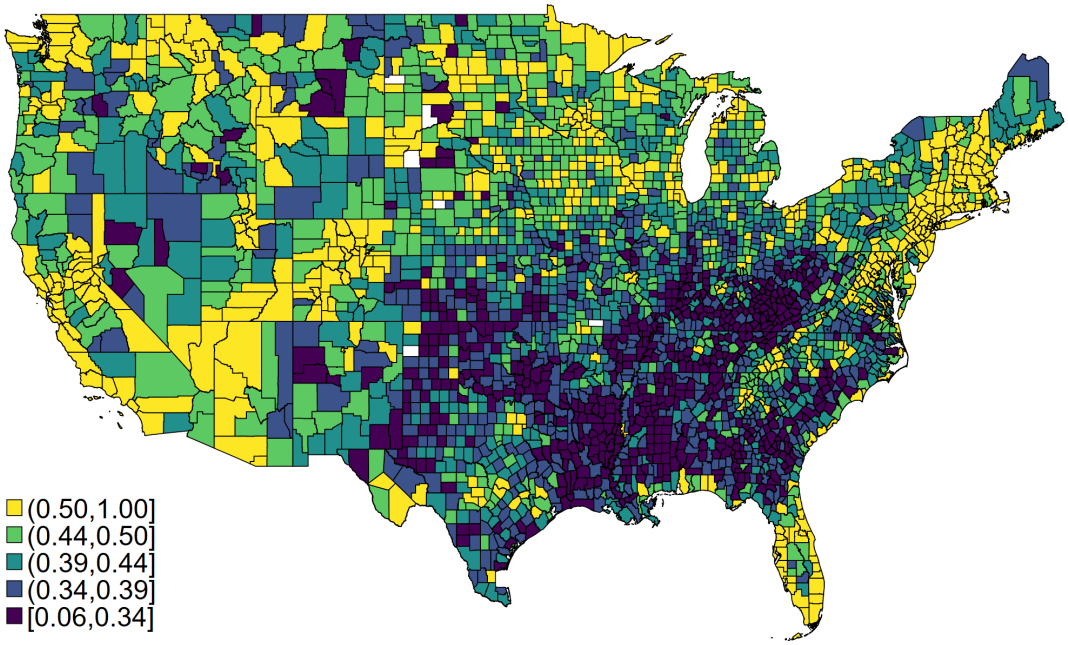


Notes: Each density plot shows the distribution of credit card share of total card transactions across firms in the broader settlement data, separately by merchant sector.

Figure 6: Geographic Variation in the Payment Mix



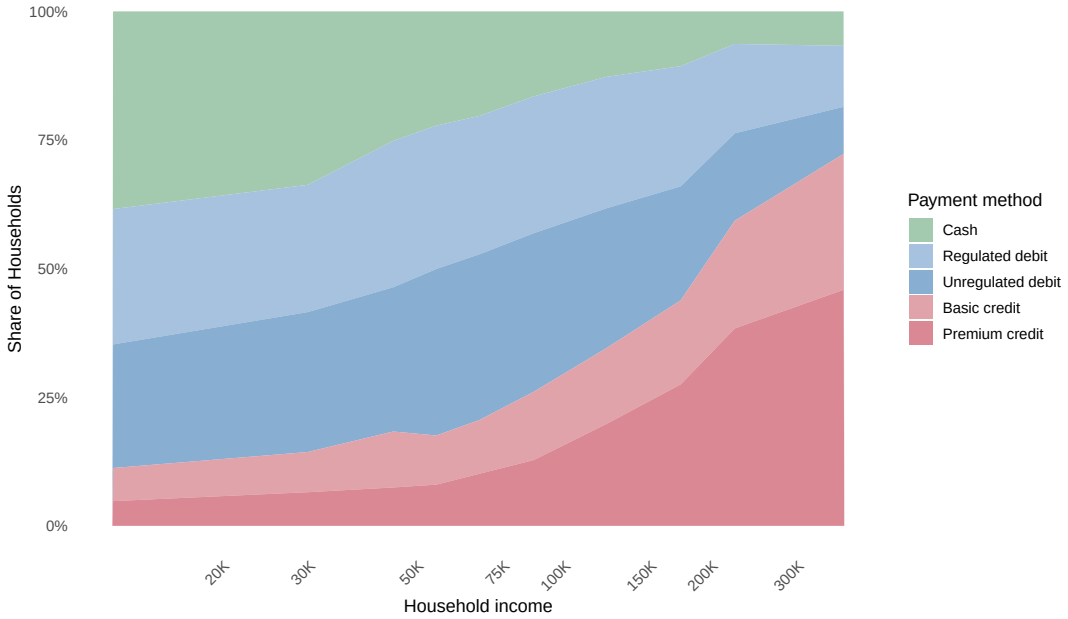
(a) Cash Share



(b) Credit Card Share of Card Payments

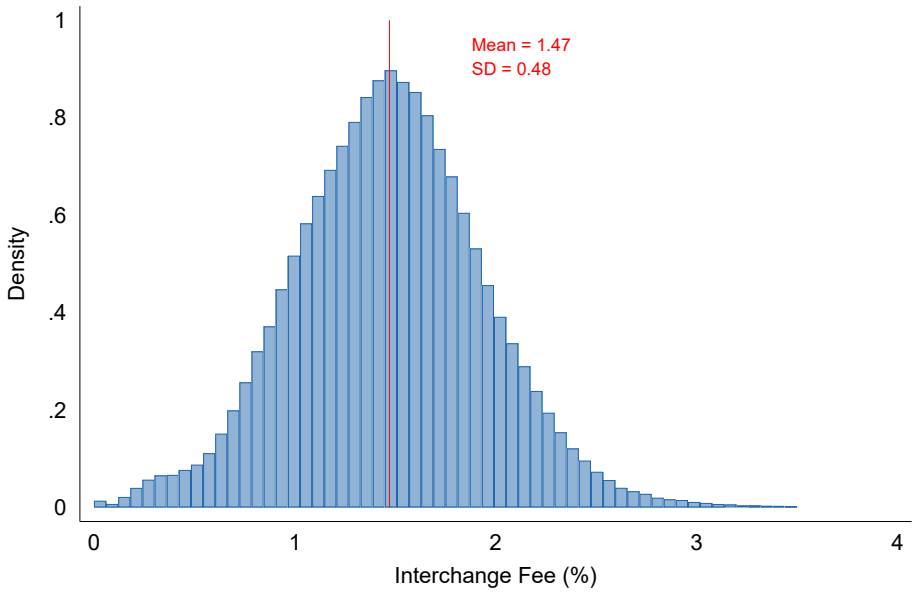
Notes: Panel (a) shows the county-level share of all transactions conducted in cash (equally weighted across Clover merchants in the county). Panel (b) shows the county-level share of card transactions made using credit cards (equally weighted across merchants in the county in the settlement data). Brighter colors indicate higher shares.

Figure 7: Payment Choice and Income



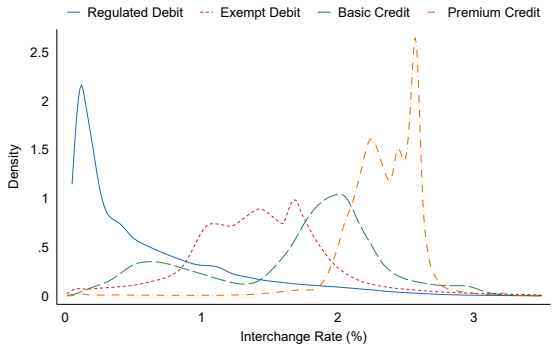
Notes: Figure 7 shows data from the Atlanta Federal Reserve's Diary of Consumer Payment Choice (DCPC) and MRI's Ultimate Survey of Americans (USA) on consumer's primary payment methods by income. Cash, credit, and debit consumers are determined by consumers' preferred in-person payment methods from the DCPC. Within debit cards, we use the MRI data to estimate the exempt debit card users as a share of total debit card users, calculated separately for each income group, by estimating the share of consumers who report having an account at a community bank or credit union, conditional on reporting positive debit card expenditures. Within credit cards, we use the MRI data to estimate the share of premium credit consumers as the share of consumers who own a Visa Signature, MC World Elite, or American Express card conditional on reporting positive credit card spending.

Figure 8: Distribution of Avg. Transaction Fees (Excluding Cash)

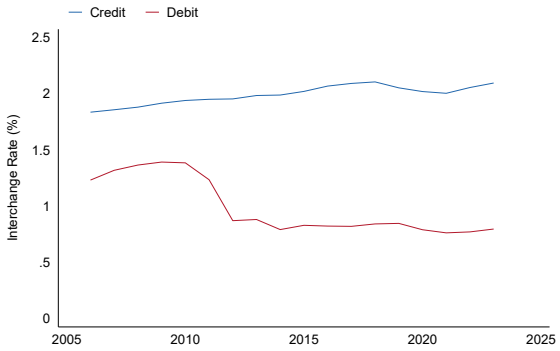


Notes: Figure 8 shows the distribution of average interchange fees across merchants. The sample covers merchants in 2022 with more than $100,000 in card sales.

Figure 9: Interchange Fees by Instrument



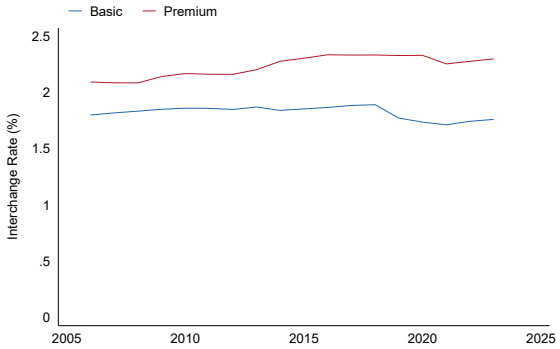
(a) Distribution of Fees by Instrument



(b) Average Debit and Credit Fees over Time



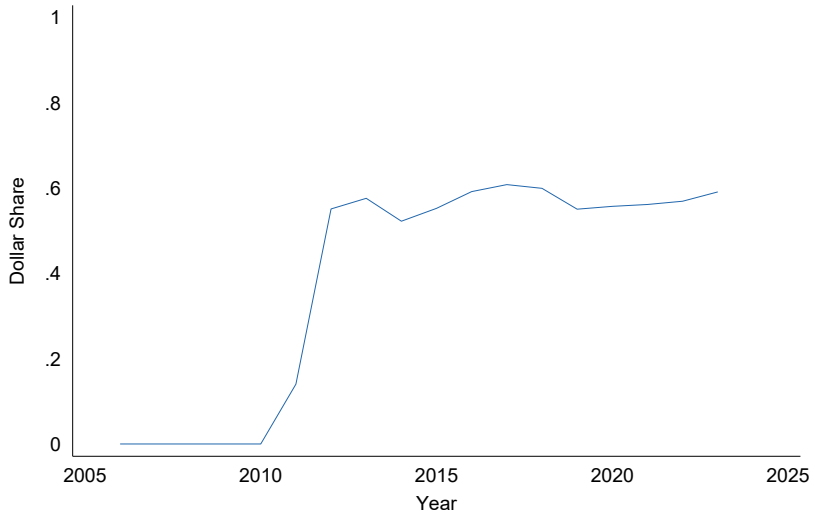
(c) Debit Card Fees over Time



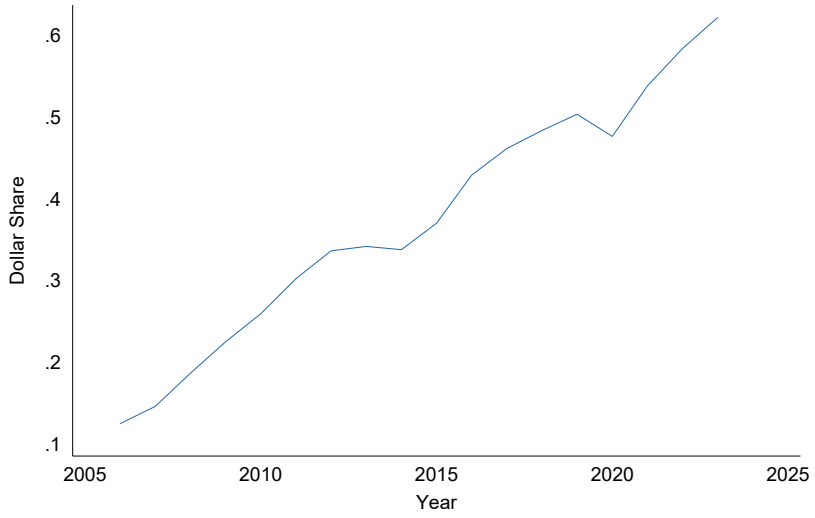
(d) Credit Card Fees over Time

Notes: Panel (a) shows kernel density plots of average interchange fees by card type in 2022 for merchants with >$100,000 in sales: regulated debit (leftmost), exempt debit (dotted red), basic credit (dashed green), and premium credit (peaked orange). Panel (b) shows dollar-weighted average interchange fees over time for debit and credit cards combined. Panel (c) shows dollar-weighted debit fees by type over time; the *Regulated* line reflects the Durbin Amendment cap implemented in 2011. Panel (d) shows dollar-weighted credit fees by type over time; premium cards earn higher fees. All time series exclude large retailers (merchandise/retail >$1 billion) to eliminate entry/exit effects.

Figure 10: Composition of Card Payments



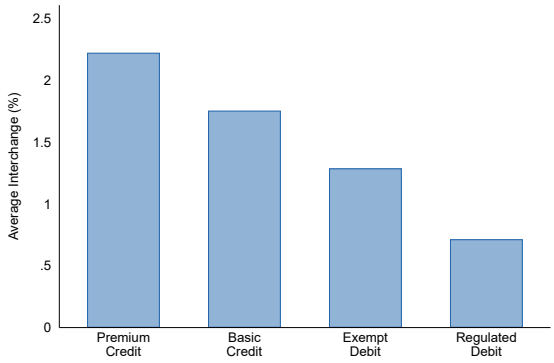
(a) Share of Debit that is Regulated



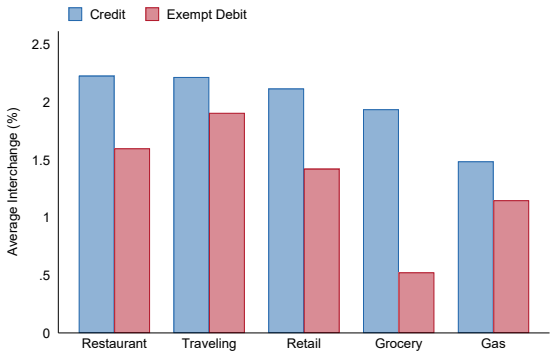
(b) Share of Credit that is Premium

Notes: Data source: Fiserv settlement data. Panel (a) shows the dollar-weighted share of debit card transactions that receive capped interchange rates under the Durbin Amendment, over time. Panel (b) shows the dollar-weighted share of credit card transactions that are premium tier, over time. Both time series exclude large retailers (merchandise/retail >$1 billion) to avoid entry/exit effects on trends.

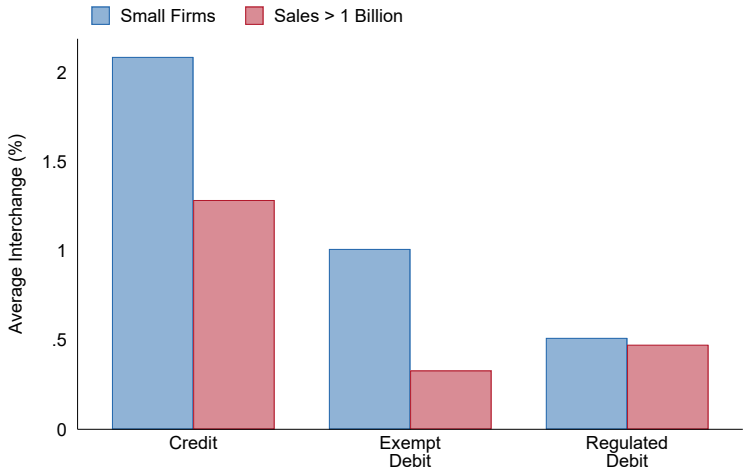
Figure 11: Variation in Interchange Fees by Card Type, Merchant Sector, and Size



(a) Interchange Fees by Card Type



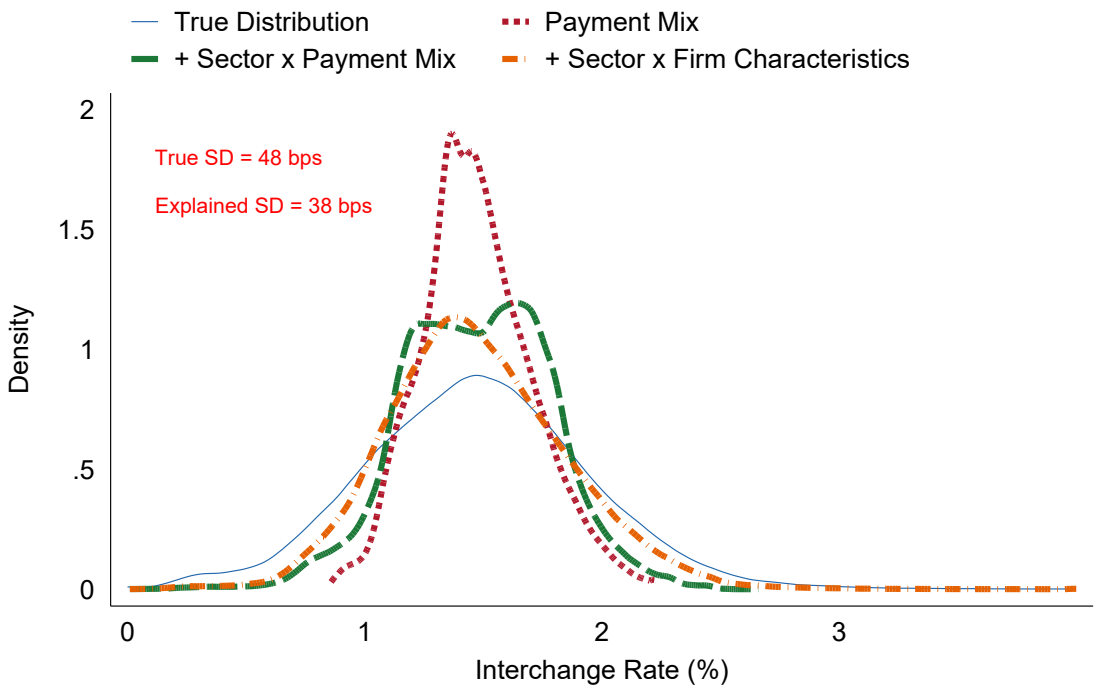
(b) Interchange Fees by Sector



(c) Interchange Fees by Merchant Size

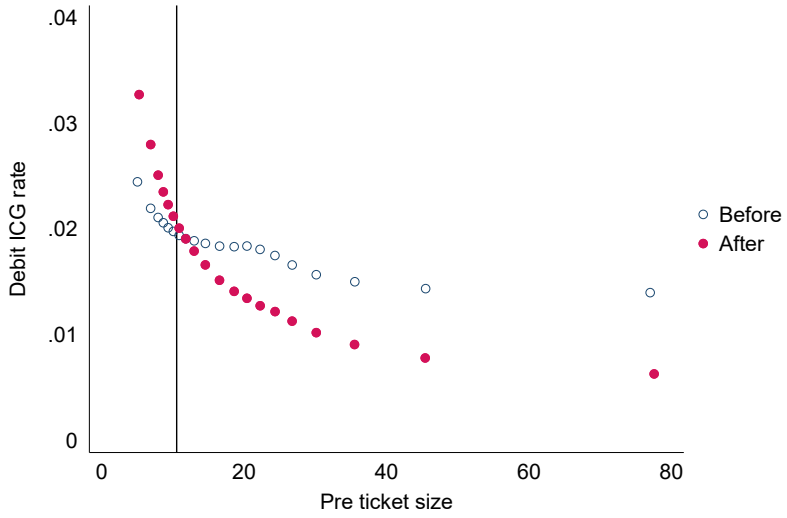
Notes: Panel (a) shows dollar-weighted interchange fees by card type in 2022 for merchants with more than $100,000 in sales (excluding those with volume discounts). Regulated debit: cards from banks with >$10 billion assets. Exempt debit: cards from smaller banks. Premium credit: Visa Signature/Infinite and Mastercard equivalents. Panel (b) shows average interchange fees across merchant sectors for credit and exempt debit cards (excluding firms that receive volume discounts). Panel (c) shows evidence of volume discounts by plotting average interchange fees by merchant size in grocery and merchandise sectors, including both large merchants (with volume discounts) and smaller merchants (size = total card sales across all merchant establishments).

Figure 12: Variation in Merchant Interchange Fees Explained by Different Factors

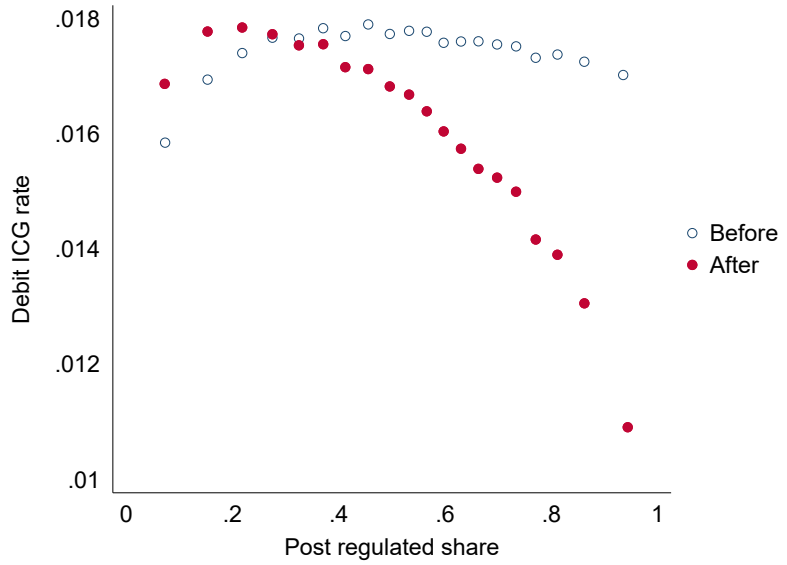


Notes: Figure 12 shows the distribution of average interchange fees across merchants in solid blue, and then shows how much of the variation in interchange fees can be explained by different factors.

Figure 13: Explaining the Heterogeneous Impact of the Durbin Amendment Across Restaurants



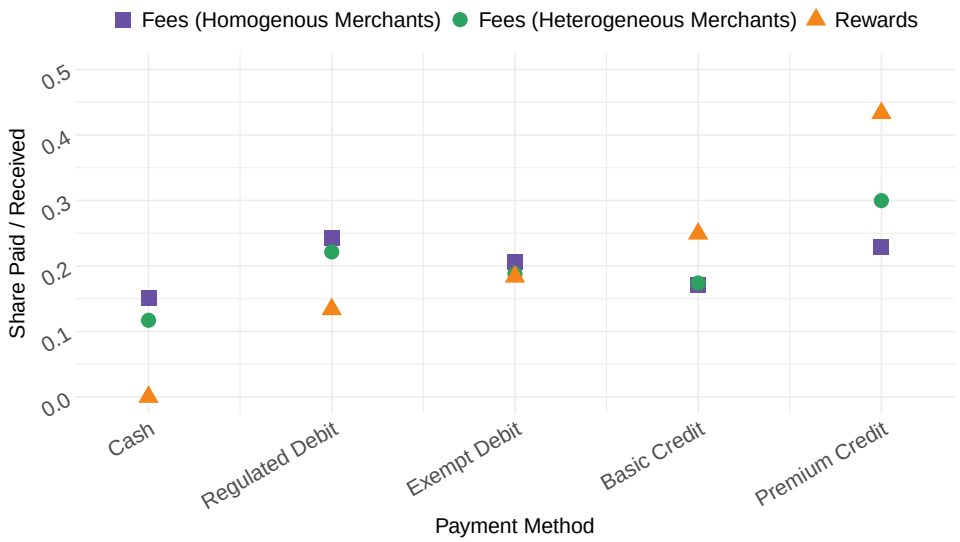
(a) Variation by Ticket Size



(b) Variation by Share of Regulated Debit Cards

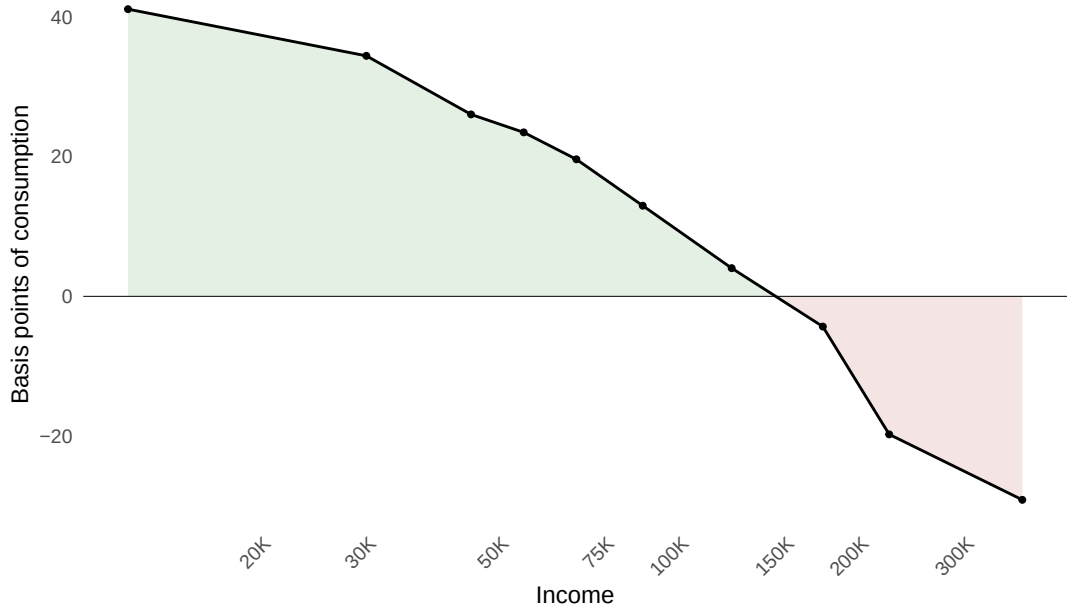
Notes: Figure 13 illustrates the heterogeneous impact of the Durbin Amendment across merchants in the restaurant sector (MCC codes 5812 and 5814) and across regions. Panel 13a shows a binscatter of pre-Durbin average ticket size against pre- and post-Durbin debit interchange rates. Ticket size is calculated as the total dollar value of debit card transactions divided by the total count of debit card transactions in the October 2010–September 2011 window preceding the Durbin Amendment; observations are at the merchant-year level. Panel 13b shows a binscatter of the ZIP-code-level post-Durbin share of debit cards that earn regulated interchange against pre- and post-Durbin debit interchange rates.

Figure 14: Who Pays for and Receives Rewards

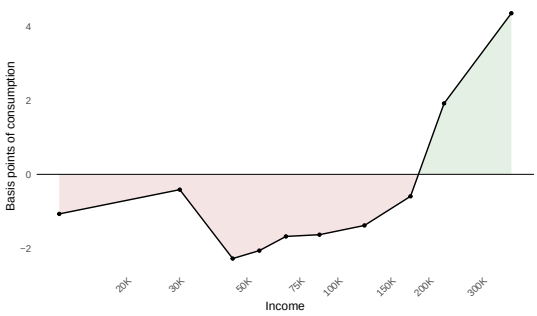


Notes: Figure 14 shows the share of interchange fees paid and rewards received by consumers across different payment methods (cash, regulated debit, exempt debit, basic credit, premium credit). The figure incorporates merchant heterogeneity in both payment composition and interchange fees. Assumes all merchants pass through interchange fees into prices on a one-to-one basis.

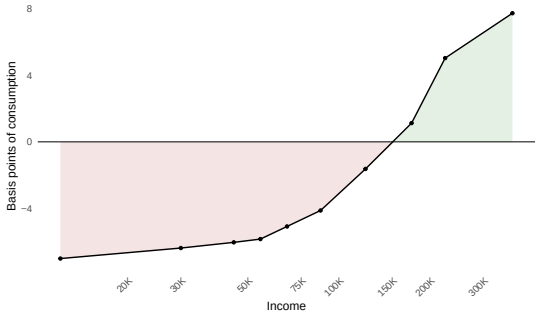
Figure 15: Redistribution Across Household Income



(a) Eliminating Interchange Fees



(b) Durbin Amendment



(c) Rise of Premium Credit Cards

Notes: Figure 15 illustrates the impact of policy changes on household surplus by income. Panel (a) shows the change in household surplus if interchange fees and card reward programs were banned. Panel (b) shows the change in household surplus if the Durbin Amendment were repealed. Panel (c) shows the change in household surplus if premium credit cards were banned.

Table 1: Summary of Fiserv Data

(a) Settlement Data Cross Section from 2022

	N	Mean	SD	P10	Median	P90
Regulated Debit	1,410,173	0.27	0.22	0.00	0.23	0.57
Exempt Debit	1,410,173	0.17	0.19	0.00	0.12	0.43
Basic Credit	1,410,173	0.28	0.24	0.03	0.19	0.63
Premium Credit	1,410,173	0.28	0.25	0.00	0.22	0.65
Annual Card Sales (M)	1,410,173	1.33	182.60	0.01	0.09	0.84
Average Interchange (%)	1,410,173	1.49	0.57	0.80	1.47	2.20

(b) Restaurant Settlement Panel 2010–2013

	N	Mean	SD	Median
Annual Sales (M)	268,143	0.65	1.48	0.38
Share of Sales on Debit	268,143	0.66	0.19	0.71
Regulated Share of Debit in Zip Code	171,736	0.49	0.20	0.49
Average Ticket Size of Debit Transactions	268,143	19.21	16.71	12.65

(c) Summary of Clover Data

	Count	Mean	SD	Median
Cash + Check > 2%	1,416,857	0.36	0.48	0.00
Conditional Cash + Check Share	509,738	0.31	0.22	0.26
Debit as Share of Card Spend	1,416,857	0.52	0.27	0.53
Annual Card Sales (M)	1,416,842	0.27	0.82	0.08
Annual Sales (M)	1,416,857	0.31	0.86	0.09

Notes: Panel (a) shows summary statistics from the 2022 cross-section at the merchant-sector level. The payment-method variables refer to the share of card sales at the merchant on each payment method. Regulated debit cards are issued by large banks. Exempt debit cards are issued by small banks. Premium credit refers to high-interchange credit cards in the Visa Signature and Visa Infinite (and the Mastercard equivalent) interchange tiers. Average interchange is calculated as total interchange paid divided by total card sales. Transaction size is the total card dollar volume divided by the number of transactions. Panel (b) shows summary statistics at the merchant-year level from our 2010–2013 panel of restaurant sales. Regulated debit statistics are computed for 2011 and onward, for merchant-years with valid ZIP codes and positive debit transaction volume. Interchange rates are calculated as total interchange within a category divided by total sales in that category. Panel (c) shows summary statistics of the Clover data from 2019–2022 at the merchant-year level. The cash and check share is defined as the dollar value of cash and check transactions divided by the total value of transactions for the merchant in that year.

Table 2: Spatial and Firm Determinants of Payment Mix

	Cash	Cash	Cash	Credit	Credit	Credit
Share Online	-3.76***	-3.81***	-3.79***	2.63***	3.28***	3.58***
	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Log Ticket Size	-5.55***	-4.40***	-4.38***	9.11***	8.29***	8.20***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log Sales	1.37***	1.05***	1.05***	-1.42***	-1.16***	-1.08***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log Population (Std. Dev.)		-0.61***			1.46***	
		(0.02)			(0.02)	
Median Income (Std. Dev.)		-0.14***			1.58***	
		(0.02)			(0.02)	
Pct. Hispanic (Std. Dev.)		-0.02			2.03***	
		(0.02)			(0.02)	
Pct. College (Std. Dev.)		-1.07***			3.79***	
		(0.02)			(0.02)	
Pct. 65+ (Std. Dev.)		0.19***			3.35***	
		(0.02)			(0.02)	
Pct. Black (Std. Dev.)		0.63***			0.12***	
		(0.02)			(0.02)	
Observations	1,416,842	1,416,839	1,416,793	2,172,044	2,172,030	2,172,038
R2	0.20	0.23	0.25	0.27	0.33	0.35
DV Mean	11	11	11	51	51	51
Sector FE		X	X		X	X
County FE			X			X

Notes: Dependent variables are firm-level transaction shares. Columns (1)–(3): Cash and check share, estimated on Clover data. Columns (4)–(6): Credit card share of card transactions, estimated on Fiserv settlement data. Independent variables include firm characteristics (sector, size), and local demographics. All regressions estimated at the establishment level.

Table 3: Summary Statistics on Interchange Rates by Card Type Across Firms

	N	Mean	SD	P10	Median	P90
Regulated Debit	1,225,787	0.60	0.62	0.09	0.36	1.50
Exempt Debit	1,115,701	1.43	0.54	0.82	1.43	2.02
Basic Credit	1,272,668	1.64	0.70	0.57	1.80	2.42
Premium Credit	1,206,011	2.34	0.28	2.06	2.36	2.60

Notes: Data source: Fiserv settlement data, 2022. Interchange rates calculated as total net interchange divided by total net sales for each card type. Rates are missing if a payment method had no transactions for that merchant. Merchants are equally weighted (not dollar-weighted), which explains differences with dollar-weighted averages in Figure 11.

Table 4: Interchange rates from Visa's 2022 interchange publication.

(a) By Sector and Card Type

Card Category	Gas Station	Supermarket	Merchandise	Restaurant
Regulated Debit Card	$0.05\% + 0.22$	$0.05\% + 0.22$	$0.05\% + 0.22$	$0.05\% + 0.22$
Exempt Debit Card	$0.80\% +$ \$0.15 (cap \$0.95)	\$0.30	$0.80\% + 0.15$	$1.19\% + 0.10$
Basic Credit	$1.15\% +$ \$0.25 (cap \$1.10)	$1.50\% + 0.07$	$1.51\% + 0.10$	2.10% (floor \$0.04)
Premium Credit	1.15% + \$0.25 (cap \$1.10)	$2.00\% + 0.07$	$2.10\% + 0.10$	2.60% (floor \$0.04)

(b) By Firm Size

Supermarket Size Category	Premium Credit Rate
Tier 0 ($\geq$ \$19.6 Bn)	$1.40\% +$ \$0.05
Tier 1 ($\geq$ \$10.65 Bn)	$1.55\% +$ \$0.05
Tier 2 ($\geq$ \$4.2 Bn)	$1.65\% +$ \$0.05
Tier 3 ($\geq$ \$0.95 Bn)	$1.75\% +$ \$0.05
All Other (Smallest)	$2.00\% +$ \$0.07

Notes: Data source: Visa's 2022 interchange schedule (publicly available). Fees are shown as variable (percent) plus fixed (\$) components. Example: "0.05% + \$0.22" means 0.05% of transaction value plus 22 cents. Premium credit = Visa Infinite Spend Qualified Cards. Basic credit = All Other Products category. Regulated debit = debit cards from banks with >\$10 billion assets (subject to Durbin Amendment).

Table 5: The Effects of Changes in Interchange Fees on Sales and Prices

	1Y Sales		2Y Sales		1Y Price		2Y Price	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Change in average ICG	-10.61***	-6.24***	-13.36***	-6.95***	-2.92***	1.24***	-3.64***	1.20**
	(0.32)	(0.58)	(0.47)	(0.93)	(0.14)	(0.26)	(0.19)	(0.37)
Debit share in pre-period	-0.02***	-0.01***	-0.01	-0.00	0.01***	0.02***	0.03***	0.04***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Predicted change in debit fees	11.68***	8.92***	16.13***	12.83***	2.68***	0.05	2.66***	0.16
	(0.23)	(0.39)	(0.30)	(0.51)	(0.10)	(0.17)	(0.12)	(0.20)
Constant	0.14***		0.20***		0.01***		0.01***	
	(0.00)		(0.00)		(0.00)		(0.00)	
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	94,872	94,872	76,240	76,240	94,872	94,872	76,240	76,240
1st Stage F Stat		35,722		22,599		35,722		22,599

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: Table 5 presents difference-in-differences estimates of the effects of interchange fee changes on restaurant sales and prices in the 1 and 2 year windows after the Durbin Amendment. The specification compares merchants in areas with and without large, regulated banks. Key controls for the difference-in-differences strategy include: (1) the predicted change in debit fees based on the fee schedule and pre-Durbin transaction size, (2) pre-Durbin debit share, and (3) their interaction, which allows the relationship between merchant characteristics and predicted savings to differ between treated and control regions. Log ticket size is measured as the log of the ratio of sales to number of transactions and serves as a proxy for prices. Instrumental variable estimates use predicted fee changes based on pre-policy merchant characteristics (transaction size, debit share) and local regulated bank exposure.

Table 6: Effects of Capping Interchange Fees

(a) As Basis Points of Baseline Consumption

Mechanism	Consumer Group				
	Cash	Regulated Debit	Exempt Debit	Basic Credit	Premium Credit
Full Model	92	42	2	−50	−60
Homogeneous	120	53	10	−52	−91
Difference	27	11	8	−2	−32
Consumer Sorting	16	7	13	−2	−26
Merchant Fee Heterogeneity	−12	−3	5	0	5
Partial Reward Passthrough (70%)	92	62	35	2	4

(b) In Dollar Terms ($Bn)

Mechanism	Consumer Group				
	Cash	Regulated Debit	Exempt Debit	Basic Credit	Premium Credit
Full Model	15.6	11.7	0.6	−10	−17.8
Homogeneous	20.2	14.6	2.9	−10.5	−27.2
Difference	4.6	2.9	2.4	−0.5	−9.4
Consumer Sorting	2.7	2	3.7	−0.5	−7.9
Merchant Fee Heterogeneity	2	0.9	−1.3	0	−1.5
Partial Reward Passthrough (70%)	15.6	17.2	9.9	0.4	1.1

Notes: Shows the estimated consumer welfare effects of eliminating all interchange fees. Panel (a) presents effects as basis points of baseline consumption. Panel (b) shows effects in dollar terms (normalized to $12 trillion in total purchases, from the Nilson Report). "Full model" incorporates heterogeneity in both payment composition and costs across merchants. "Homogeneous merchants" assumes uniform payment composition. "Difference" shows the combined attenuation effect of merchant heterogeneity. "Consumer Sorting" and "Merchant Fee Heterogeneity" represent separate counterfactuals (each relative to the full model) isolating different mechanisms; they are not additive components due to interaction effects between payment composition and fee heterogeneity.

Table 7: Effects of the Durbin Amendment

Change in Consumption	Consumer Group				
	Cash	Regulated Debit	Exempt Debit	Basic Credit	Premium Credit
Basis Points	12	−36	11	12	8
Dollars ($Bn)	2.1	−10	3.1	2.5	2.4

Notes: Shows estimated consumer welfare effects of the Durbin Amendment, which capped interchange fees on regulated debit cards. Welfare effects account for both capping baseline interchange fees and also eliminating fee heterogeneity.

Table 8: The Rise of Premium Credit Cards

Change in Consumption	Consumer Group				
	Cash	Regulated Debit	Exempt Debit	Basic Credit	Premium Credit
Basis Points of Consumption	−9	−9	−9	−8	27
Dollars (billions)	−1.5	−2.4	−2.4	−1.7	8

Notes: Table 8 summarizes the consumer-welfare effects of the increase in interchange fees on premium credit cards relative to a world in which premium cards charged the same interchange fees as basic cards. Welfare effects account for both the increase in overall fees as well as different levels of merchant heterogeneity in premium credit.

A Theory Appendix: Proofs and Details

This appendix provides the formal derivation of Theorem 1 from Section V. We show that under regularity conditions on consumer demand, the welfare effects of interchange fee changes can be summarized by the sufficient statistic in equation 8, with composition feedback effects contributing only at order $O(\tau_{\max})$.

I.A Setup and Notation

We define the following objects to characterize the equilibrium response of prices to interchange fee changes:

- Let $\log p \in \mathbb{R}^J$ be the vector of log prices across merchants.
- Let $q^k \in \mathbb{R}^J$ be the vector of quantities purchased from each merchant by consumers using payment method k, and stack these into $q \in \mathbb{R}^{JK}$.
- Let $E^k \in \mathbb{R}^{J\times J}$ denote the matrix of cross-price elasticities for consumers using method k, with entries $E^k_{ij} = \frac{\partial \log q^k_i}{\partial \log p_j}$. Stack these as $E = \begin{bmatrix} E^1 \\ \vdots \\ E^K \end{bmatrix} \in \mathbb{R}^{JK\times J}$.
- Let $G \in \mathbb{R}^{J\times K}$ denote the matrix of income semi-elasticities, with $G^k_j = \frac{\partial \log q^k_j}{\partial y_k}$.
- Define the composition matrix for merchant j as the row vector $F_j = [(\tau_{j1} - \hat{\tau}_j)\mu_{j1}, \ldots, (\tau_{jK} - \hat{\tau}_j)\mu_{jK}]$, where $\hat{\tau}_j = \sum_k \mu_{jk}\tau_{jk}$ is the average fee at merchant j. Stack these into a block-diagonal matrix $F = \text{blkdiag}(F_1, \ldots, F_J) \in \mathbb{R}^{J\times JK}$.
- Let $\tau_{\max} = \max_{j,k} |\tau_{jk}|$ denote the maximum interchange fee across all merchants and payment methods.
- Following the main text, let $\omega_j = R_j / \sum_m R_m$ denote merchant j's revenue share, where $R_j = p_j Q_j$ is absolute revenue. We use $\mathbb{E}_R[\cdot]$ to denote expectations weighted by revenue shares ω_j. In the proofs below, we normalize total revenue to 1, so R_j directly represents the revenue share ω_j.

I.B Assumption on Demand Elasticities

We impose the following regularity condition on the elasticity matrix:

Assumption. *Elasticities are finite and satisfy a dominant diagonal condition. There exist constants $M, m > 0$ such that for each k and j:*

$$|E^k_{jj}| < M \quad \textit{and} \quad \sum_{i\neq j} |E^k_{ji}| < m|E^k_{jj}|.$$

This assumption ensures that own-price elasticities dominate cross-price elasticities and that all elasticities are bounded. For example, in a CES system with $\sigma > 1$, $M = \sigma, m = 2$.

Lemma (Rewards Approximation)**.** *In equilibrium, rewards for payment method k satisfy*

$$f_k = \pi_k^{-1}\mathbb{E}_R[\mu_{jk}(\tau_{jk} - c_k)] + O(\tau_{\max}^2).$$

Proof. From the exact definition of rewards,

$$f_k = \frac{\sum_j p_j q_{jk}^*(\tau_{jk} - c_k)}{\sum_m p_m q_{mk}^*}.$$

Since consumers of type k spend their entire income $1 + f_k$, the denominator equals $\sum_m p_m q_{mk}^* = \pi_k(1 + f_k)$. Therefore,

$$f_k = \frac{\sum_j p_j q_{jk}^*(\tau_{jk} - c_k)}{\pi_k(1 + f_k)} = \frac{\pi_k^{-1}\sum_j \omega_j \mu_{jk}(\tau_{jk} - c_k)}{1 + f_k},$$

where we use $p_j q_{jk}^* = \pi_k^{-1}\omega_j \mu_{jk}$ and $\sum_j \omega_j = 1$. Multiplying both sides by $(1 + f_k)$ gives

$$f_k(1 + f_k) = \pi_k^{-1}\mathbb{E}_R[\mu_{jk}(\tau_{jk} - c_k)].$$

Since $f_k = O(\tau_{\max})$, the term $f_k^2 = O(\tau_{\max}^2)$. Therefore,

$$f_k = \pi_k^{-1}\mathbb{E}_R[\mu_{jk}(\tau_{jk} - c_k)] + O(\tau_{\max}^2).$$

□

Lemma (Price Pass-Through Mapping)**.** *Suppose Assumption I.B holds and $(1 + m)M\tau_{\max} < 1$. Then for any change in card-specific interchange fees $d\tau_{jk}$ (with direct effect on average fees $d\hat{\tau}_j = \sum_k \mu_{jk} d\tau_{jk}$) and dy in incomes, the equilibrium change in log prices satisfies*

$$d\log p = d\hat{\tau} + O(\tau_{\max}),$$

where $d\hat{\tau}$ is the vector of direct effects on average fees holding composition fixed.

Proof. We consider a change in primitive card-level fee parameters (e.g., the baseline fee $\overline{\tau}_l$ for card type l, sector adjustments $\tau_{s,l}$, or negotiated discounts δ_l). Such a change induces $d\tau_{jk}$ for each card k at merchant j. The key insight is that the average fee $\hat{\tau}_j = \sum_k \mu_{jk}\tau_{jk}$ changes through two channels: (i) the *direct effect* $\sum_k \mu_{jk} d\tau_{jk}$ from changing card fees holding composition μ_{jk} fixed, and (ii) the *indirect effect* $\sum_k \tau_{jk} d\mu_{jk}$ from composition changes induced by price responses. We show that the indirect effect is $O(\tau_{\max})$ under the dominant diagonal condition.

The equilibrium relationship between prices and quantities is given by

$$d\log q = E\, d\log p + G\, dy.$$

The product rule applied to the pricing equation $\log p_j = \log \overline{p}_j + \sum_k \mu_{jk}\tau_{jk}$ gives

$$d\log p_j = \sum_k \mu_{jk} d\tau_{jk} + \sum_k \tau_{jk} d\mu_{jk} = d\hat{\tau}_j + \sum_k \tau_{jk} d\mu_{jk},$$

where $d\hat{\tau}_j = \sum_k \mu_{jk} d\tau_{jk}$ is the direct effect on average fees. Using the quotient rule, $d\mu_{jk} = \frac{dq_j^k}{Q_j} - \mu_{jk}\frac{dQ_j}{Q_j}$, we obtain

$$\sum_k \tau_{jk} d\mu_{jk} = \sum_k (\tau_{jk} - \hat{\tau}_j)\mu_{jk} d\log q_j^k.$$

Stacking across merchants yields the matrix equation

$$d\log p = FE\, d\log p + FG\, dy + d\hat{\tau}.$$

Rearranging, $(I - FE)d\log p = d\hat{\tau} + FG\, dy$.

By the dominant diagonal condition, $\|E\| \le (1+m)M$. By construction, $\|F\| \le \tau_{\max}$. Thus $\|FE\| \le \|F\|\|E\| \le (1+m)M\tau_{\max} < 1$ by hypothesis. Hence we can invert using the Neumann series:

$$d\log p = (I - FE)^{-1}(d\hat{\tau} + FG\, dy) = d\hat{\tau} + FG\, dy + \sum_{m=1}^{\infty} (FE)^m (d\hat{\tau} + FG\, dy).$$

Since $\|FG\| \le \|G\|\tau_{\max}$ and the Neumann series converges, all terms beyond $d\hat{\tau}$ are $O(\tau_{\max})$. □

I.C Proof of Theorem 1

Proof. By Roy's identity, the money-metric welfare effect is

$$\frac{1}{\lambda_k}\frac{dV_k}{dx_l} = \frac{df_k}{dx_l} - \sum_j q_{jk}^* \frac{dp_j}{dx_l}.$$

By Lemma I.B, $\frac{dp_j}{dx_l} = p_j \mu_{jl}\frac{\partial \tau_{jl}}{\partial x_l} + O(\tau_{\max})$ to first order. By Lemma I.B, rewards satisfy $f_k = \pi_k^{-1}\mathbb{E}_R[\mu_{jk}(\tau_{jk} - c_k)] + O(\tau_{\max}^2)$. Differentiating with respect to x_l gives $\frac{df_k}{dx_l} = \mathbb{1}\{k = l\}\pi_k^{-1}\mathbb{E}_R[\mu_{jk}\frac{\partial \tau_{jk}}{\partial x_k}] + O(\tau_{\max}^2)$, where the $O(\tau_{\max}^2)$ error is higher order than the $O(\tau_{\max})$ terms we track.

Substituting:

$$\begin{aligned}
\frac{1}{\lambda_k}\frac{dV_k}{dx_l} &= \mathbb{1}\{k=l\}\pi_k^{-1}\mathbb{E}_R\left[\mu_{jk}\frac{\partial\tau_{jk}}{\partial x_k}\right] - \sum_j q^*_{jk}p_j\mu_{jl}\frac{\partial\tau_{jl}}{\partial x_l} + O(\tau_{\max}) \\
&= \mathbb{1}\{k=l\}\pi_k^{-1}\mathbb{E}_R\left[\mu_{jk}\frac{\partial\tau_{jk}}{\partial x_k}\right] - \sum_j \pi_k^{-1}\omega_j\mu_{jk}\mu_{jl}\frac{\partial\tau_{jl}}{\partial x_l} + O(\tau_{\max}) \\
&\quad \text{(using } q^*_{jk}p_j = \pi_k^{-1}\omega_j\mu_{jk}\text{)} \\
&= \pi_k^{-1}\left(\mathbb{1}\{k=l\}\mathbb{E}_R\left[\mu_{jk}\frac{\partial\tau_{jk}}{\partial x_k}\right] - \sum_j \omega_j\mu_{jk}\mu_{jl}\frac{\partial\tau_{jl}}{\partial x_l}\right) + O(\tau_{\max}) \\
&= \pi_k^{-1}\left(-\mathbb{E}_R\left[\mu_{jk}\mu_{jl}\frac{\partial\tau_{jl}}{\partial x_l}\right] + \mathbb{1}\{k=l\}\mathbb{E}_R\left[\mu_{jk}\frac{\partial\tau_{jk}}{\partial x_k}\right]\right) + O(\tau_{\max}),
\end{aligned}$$

where the last line uses $\sum_j \omega_j = 1$ and the definition $\mathbb{E}_R[\cdot] = \sum_j \omega_j(\cdot)$. □

I.D Proof of Fee Component Formulas

We derive the formulas in V.B.2 by applying Theorem 1 to specific counterfactual changes in the fee structure. The welfare effect of any fee change equals the magnitude of the change multiplied by the derivative from Theorem 1.

Baseline Fees. Consider eliminating the baseline fee $\overline{\tau}_l$ by setting it to zero, a change of $\Delta\overline{\tau}_l = -\overline{\tau}_l$. From the fee decomposition $\tau_{jl} = \overline{\tau}_l + \tau_{s_j,l} + b_j\delta_l$, we have $\frac{\partial\tau_{jl}}{\partial\overline{\tau}_l} = 1$ for all merchants. Applying Theorem 1:

$$\begin{aligned}
\frac{1}{\lambda_k}\frac{dV_k}{d\overline{\tau}_l} &= \pi_k^{-1}\left(-\mathbb{E}_R[\mu_{jk}\mu_{jl}] + \mathbb{1}\{k=l\}\mathbb{E}_R[\mu_{jk}]\right) \\
&= \pi_k^{-1}\left(-\mathbb{E}_R[\mu_{jk}\mu_{jl}] + \mathbb{1}\{k=l\}\pi_k\right)
\end{aligned}$$

where the second line uses $\mathbb{E}_R[\mu_{jk}] = \pi_k$. The total effect of eliminating the baseline fee is:

$$A_{kl} = \Delta\overline{\tau}_l \times \frac{1}{\lambda_k}\frac{dV_k}{d\overline{\tau}_l} = -\overline{\tau}_l \times \pi_k^{-1}\left(-\mathbb{E}_R[\mu_{jk}\mu_{jl}] + \mathbb{1}\{k=l\}\pi_k\right).$$

Sector Adjustments. Consider eliminating all sector adjustments by setting $\tau_{sl} = 0$ for all sectors. From the fee decomposition, $\frac{\partial\tau_{jl}}{\partial\tau_{sl}} = \mathbb{1}\{s_j = s\}$. The key insight is that by the normalization $\sum_s \omega_{sl}\tau_{sl} = 0$, where ω_{sl} is sector s's share of spending on payment method l, the reward term vanishes:

$$\mathbb{E}_R[\mu_{jk}\tau_{s_j,l}] = \sum_s P_R(s_j = s)\mathbb{E}_R[\mu_{jk}|s_j = s]\tau_{sl} = 0.$$

Therefore, when we apply Theorem 1 to changes in sector adjustments, the first-moment (reward) effect is zero, and only the second-moment (price) effect remains:

$$\sum_s \tau_{sl} \times \frac{1}{\lambda_k} \frac{dV_k}{d\tau_{sl}} = -\pi_k^{-1} \sum_s \tau_{sl} P_R(s_j = s) \mathbb{E}_R[\mu_{jk}\mu_{jl} | s_j = s].$$

The total effect of eliminating all sector adjustments (changing each τ_{sl} by $-\tau_{sl}$) gives:

$$S_{kl} = -\sum_s \tau_{sl} \times P_R\left(s_j = s\right) \mathbb{E}_R\left[\mu_{jk}\mu_{jl} \,|s_j = s\right].$$

Negotiated Rates. Consider eliminating the negotiated discount δ_l by setting it to zero, a change of $\Delta\delta_l = -\delta_l$. From the fee decomposition, $\frac{\partial \tau_{jl}}{\partial \delta_l} = b_j$ (equals 1 for large merchants, 0 otherwise). Applying Theorem 1:

$$\frac{1}{\lambda_k} \frac{dV_k}{d\delta_l} = \pi_k^{-1} \left(-\mathbb{E}_R[\mu_{jk}\mu_{jl} b_j] + \mathbb{1}\{k = l\} \mathbb{E}_R[\mu_{jk} b_j]\right).$$

Factoring out $P_R(b_j = 1)$ and conditioning:

$$= \pi_k^{-1} P_R(b_j = 1) \left(-\mathbb{E}_R[\mu_{jk}\mu_{jl} | b_j = 1] + \mathbb{1}\{k = l\} \mathbb{E}_R[\mu_{jk} | b_j = 1]\right).$$

The total effect of eliminating the negotiated discount is:

$$B_{kl} = \Delta\delta_l \times \frac{1}{\lambda_k} \frac{dV_k}{d\delta_l} = -\delta_l \times \pi_k^{-1} P_R(b_j = 1) \left(-\mathbb{E}_R[\mu_{jk}\mu_{jl} | b_j = 1] + \mathbb{1}\{k = l\} \mathbb{E}_R[\mu_{jk} | b_j = 1]\right).$$

B Comparison of Sufficient Statistic and Structural Approaches

Our main analysis uses a sufficient-statistics approach that relies on two key assumptions: full passthrough of interchange fees to retail prices and complete passthrough of interchange revenues to consumer rewards. While these assumptions are grounded in prior empirical work and our own estimates from Section IV, a natural question is whether relaxing these assumptions would materially affect our welfare conclusions.

To address this question, we develop and calibrate a quantitative structural model of the payment system. This model explicitly incorporates consumer demand, merchant pricing decisions, and network fee-setting, allowing us to compute exact equilibrium welfare effects when consumers can reallocate spending across merchants in response to price changes. The model serves two purposes. First, it allows us to assess whether the sufficient statistic's linear approximation—which ignores second-order utility losses from consumer reallocation—introduces meaningful error. Second, it enables us to evaluate how imperfect passthrough, arising from strategic complementarities in merchant pricing, would affect our distributional conclusions.

We calibrate two versions of the model. The first version features perfect passthrough ($j^* = 50$ firms per market, each effectively small due to negligible market share) and validates the accuracy of our first-order approximation. The second version introduces imperfect passthrough ($j^* = 3$ large firms per market with market power) and quantifies the sensitivity of our results to this margin. Both versions are disciplined to match key moments from the Fiserv data on payment composition across merchants and sectors.

The remainder of this appendix proceeds as follows. We first describe consumer preferences, merchant pricing, and network fee-setting. We then explain our parameterization strategy and calibration procedure. Finally, we compare the sufficient statistic estimates to exact welfare calculations from the structural model, demonstrating that our simplified approach accurately captures the full equilibrium effects. We calibrate two versions of the model: the first version (with $j^* = 50$) features perfect passthrough and allows us to assess whether the sufficient statistic's linear approximation introduces meaningful error by omitting second-order utility losses from consumer reallocation; the second version (with $j^* = 3$) introduces imperfect passthrough with strategic complementarity in price setting, allowing us to evaluate how realistic deviations from full passthrough affect our main conclusions.

II.A Consumer Preferences

We model consumer demand using a nested CES structure that allows for rich heterogeneity in shopping patterns across payment methods. The key feature of this demand system is that consumers with different payment preferences (cash, debit, credit) can have systematically different tastes over merchants. This heterogeneity is essential for matching the observed variation in payment composition across merchants documented in Section III. The nested structure—with Cobb-Douglas aggregation across sectors and CES aggregation within sectors—

provides tractability while allowing the model to match both the level and dispersion of payment shares across different merchant types.

Formally, consumers who use different payment methods solve an optimal consumption problem across merchants in different sectors. Consumers who use payment method $k = 1, \ldots, K$ have Cobb-Douglas preferences over sectors $s = 1, \ldots, S$.

$$\log U_k = \sum_{s=1}^{S} \alpha_{ks} \log U_{ks}, \sum_{s=1}^{S} \alpha_{ks} = 1$$

Utility in a sector is a Cobb-Douglas aggregator across M markets in that sector. By introducing markets, we can rationalize the market power of large firms despite their small revenue share in the overall sector.

$$\log U_{ks} = \frac{1}{M} \sum_{m=1}^{M} \log U_{ksm}$$

Utility from a sector-market is a constant-elasticity of substitution (CES) aggregator of the J firms in the sector-market. We will use tildes to denote variables for the large firm. Thus utility from the sector-market is given by

$$U_{ksm}^{\frac{\sigma_{ks}-1}{\sigma_{ks}}} = \sum_{j=1}^{J} a_{kjsm}^{\frac{1}{\sigma_{ks}}} q_{kjsm}^{\frac{\sigma_{ks}-1}{\sigma_{ks}}}$$

where the a_{kjsm} are shifters that will allow us to match the distribution of payment shares and firm size. Consumers solve an optimal consumption problem, where their budget constraint reflects their rewards

$$\max_{q_k} U_k$$
$$\text{s.t.} \sum_s \sum_m \sum_j q_{kjsm} p_{jsm} \leq 1 + f_k$$

The standard solution yields that

$$q_{kjsm} = \alpha_{k,s} \times (1 + f_k) \times \frac{1}{M} \times \frac{a_{kjsm} p_{jsm}^{-\sigma_{k,s}}}{P_{ksm}^{1-\sigma_{k,s}}}$$
$$P_{ksm}^{1-\sigma_{k,s}} = \sum_{j=1}^{J} a_{kjsm} p_{jsm}^{1-\sigma_{k,s}}$$

II.B Merchant Problem

Merchants set a uniform price for all consumers, regardless of payment method, consistent with the institutional reality that most U.S. merchants do not surcharge by payment type. A critical feature of our model is that we allow for discrete numbers of firms within each market, so that individual merchants internalize the effect of their pricing decisions on the sectoral price index. This departure from the standard monopolistic competition assumption serves two purposes. First, it allows large merchants to have market power and incomplete passthrough, which is empirically realistic for sectors like grocery and merchandise retail. Second, it generates strategic complementarities in pricing: when one merchant raises prices in response to higher interchange fees, this partially shifts demand to competitors, dampening their incentive to also raise prices. By varying the number of firms per market (j^*), we can control the degree of passthrough and thereby assess the sensitivity of our welfare results to this margin.

Formally, merchants pick a uniform price for all of their consumers in order to maximize their own profits. Let the measure of consumers who use payment method k equal μ_k. For convenience, we normalize all merchants' marginal costs to equal 1, as CES models do not differentiate between low costs and high taste shifters a.

$$p_{jsm} = \underset{p}{\operatorname{argmax}} \sum_k \mu_k q_{kjsm} \left(p \left(1 - \tau_{kjs} \right) - 1 \right)$$

Because firms are discrete, they internalize the effect of their own price on the price index. This lets large firms exert market power and have higher markups and incomplete passthrough. Define ρ_{kjsm} to be the revenue-share of firm j among all firms in that sector-market, i.e.

$$\rho_{kjsm} = \frac{a_{kjsm} p_{jsm}^{1-\sigma_{ks}}}{\sum_i a_{kism} p_{ism}^{1-\sigma_{ks}}}$$

then elasticities are given by

$$\frac{\partial \log q_{kjsm}}{\partial \log p} = -\sigma_{ks} \left(1 - \rho_{kjsm} \right) - \rho_{kjsm}$$
$$\rho_{kjsm} = \frac{q_{kjsm} p_{kjsm}}{\sum_l q_{klsm} p_{klsm}}$$

Optimal prices are thus

$$p_{jsm} = \frac{\sum_k \mu_{kjsm} \sigma_{ks} \left(1 - \rho_{kjsm} \right)}{\sum_k \mu_{kjsm} \left(\left(1 - \rho_{kjsm} \right) \sigma_{ks} - 1 \right) \left(1 - \tau_{kjs} \right)}$$
$$\mu_{kjsm} = \frac{\mu_k q_{kjsm}}{\sum_l \mu_l q_{ljsm}}$$

II.C Network Problem

Card networks collect interchange fees from merchants and rebate them to consumers (through issuing banks) in the form of rewards, net of processing costs. We model this passthrough as mechanical, consistent with our assumption in the sufficient-statistics framework and with empirical evidence that changes in interchange fees translate nearly one-for-one into changes in rewards (Wang, 2025; Drechsler et al., 2025). The interchange fee schedule mirrors the empirical structure documented in Section III: fees vary by card type (regulated debit, exempt debit, basic credit, premium credit), by merchant sector, and by merchant size (with discounts for large firms).

Formally, networks mechanically pass on merchant fees net of costs in the form of rewards. Thus

$$f_k = \frac{\sum_s \sum_j q_{k,j,s} p_{j,s} \left(\tau_{k,j,s} - c_k\right)}{\sum_s \sum_j q_{k,j,s} p_{j,s}}$$

Then merchant fees at each firm are based on card type, sector, and firm size. The firm size discount is implemented by an indicator δ_j for whether the firm has more than 1 billion in sales and a card-specific discount $b_k < 0$.

$$\tau_{k,j,s} = \tau_k + \tau_{k,s} + \delta_j b_k$$

II.D Parameterization

Our parameterization strategy aims to match the key empirical patterns documented in Section III while maintaining tractability. The central modeling choice is to allow for heterogeneity in firm size and in the composition of payment methods across merchants. We accomplish this by specifying that each market contains j^* large firms (which may have market power and receive negotiated discounts on interchange fees) and a competitive fringe of small, differentiated firms. Variation in payment composition across merchants is generated through payment-method-specific taste shifters that are drawn from a distribution calibrated to match the observed dispersion in payment shares. Large firms are calibrated to match the payment mix and market share of merchants with over $1 billion in annual sales in the grocery and merchandise sectors, while small firms are calibrated to match all other merchants.

More specifically, our parameterization allows us to treat each market m as featuring j^* large firms and a fringe of small differentiated firms that vary in the composition of their payments. We parameterize the taste shifters as

$$\log a_{kjsm} = \log \frac{\overline{a}_s}{j^*} \times I\left\{j \leq j^*\right\} + \log \frac{1 - \overline{a}_s}{J - j^*} \times \times I\left\{j > j^*\right\} + \log z_{kjsm}$$

The special intercept $\overline{a}_s$ for the first j^* firms allows us to model the first firms as large. The

$\log J - j^*$ term is a normalization so that the sum of the small firms has a revenue share of approximately $1 - \bar{a}_s$.

We model variation in payment composition by allowing consumers with different payment preferences to vary in their preferences over merchants. We then set the payment-type taste adjustments to $\left(z_{1jsm}, \ldots, z_{Kjsm}\right) \sim N\left(\bar{z}_{js}, \Sigma_{js}\right)$. For small firms with $j > j^*$, we set $\bar{z}_{js} = \mathbf{0}$ and impose a common covariance Σ_s. For large firms with $j \leq j^*$, we impose a common mean and variance, $\bar{z}_{jsm} = \bar{z}_s^*$, $\Sigma_{js} = \Sigma_{js}^*$.

II.E Welfare

To evaluate the welfare effects of eliminating interchange fees, we compute compensating variation for each consumer type. Since networks mechanically pass through fees to rewards and do not earn economic profits in our model, the welfare analysis focuses on consumers and merchants. The key welfare metric for consumers is the change in the sectoral price indices they face, which captures both the direct effect of lower retail prices (from eliminating merchant fees) and the indirect effect of lost rewards.

Formally, in this framework, network profits are constant. Compensating variation for consumers of type k can be expressed in terms of percentage of baseline expenditure as

$$\Delta \log W_k = \frac{1}{M} \sum_s \sum_m \alpha_{k,s} \Delta \log P_{ksm}$$

Total merchant profits can be computed as

$$\frac{1}{M} \sum_s \sum_m \sum_j \sum_k \mu_k q_{kjsm} \left(p\left(1 - \tau_{kjs}\right) - 1\right)$$

II.F Calibration

Having specified the model's functional forms, we now discipline the parameters using the Fiserv data. Our calibration strategy targets moments that capture both the level and heterogeneity of payment composition across merchants and sectors. The key idea is that if the model can match the observed distribution of payment shares and merchant characteristics, then it should provide a reliable laboratory for evaluating the welfare effects of interchange fee policies. We calibrate most parameters sector-by-sector to allow for the substantial cross-sector heterogeneity documented in Section III.

In practice, given a set of parameters, we can simulate 300 markets per sector and 100 firms per market, and then compute the resulting equilibrium. We then match the following moments.

- We set $\alpha_{k,s}$ to match the share of spending of each payment method in each sector. This mechanically makes it so that we match the average composition of payments in each sector.

- Outside of the merchandise and grocery sectors, we set $j^* = 0$ and $\bar{a} = 0$. This makes all the firms in those markets small. We calibrate Σ_s to match the revenue-weighted second-moment matrices.

- For the merchandise and grocery sectors, we set $j^* = 3$. We set $\bar{a}_s$ to match the revenue share of the firms with more than \$1 billion in revenue in those markets. We set $\bar{z}_s^*$ and Σ_s^* to match the revenue-weighted average composition of payments of firms with more than \$1 billion in revenue in those sectors.

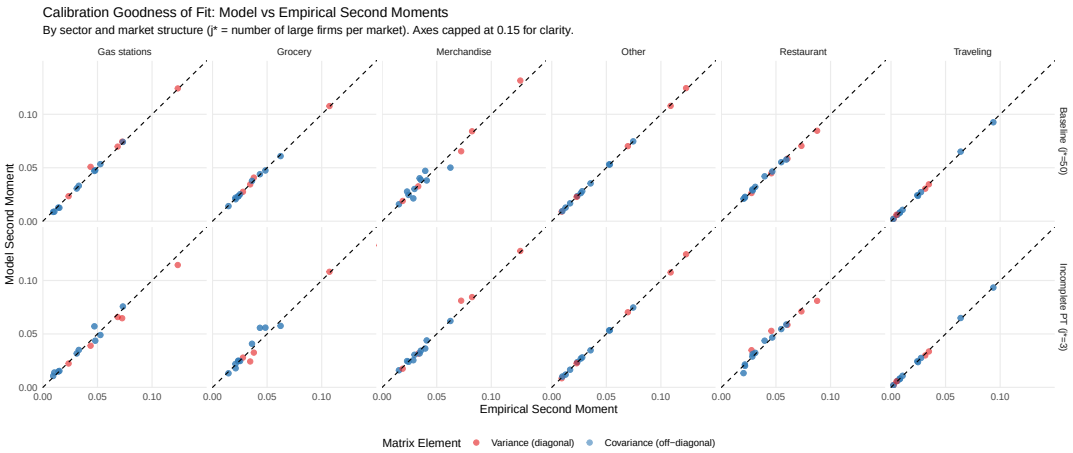
  - With this calibration, the large grocers pass on 60% of their own costs and 40% of the average price change at other merchants. Large merchandise retailers pass on 75% of their own costs and 25% of the price increases of all other retailers.

- We set all sector elasticities $\sigma_{k,s} = 5$. This value is consistent with the demand elasticities of 4-5 estimated from the Durbin analysis in Section IV, and generates realistic pass-through rates for small and large firms. In any case, the aggregate elasticity does not affect the validity of the sufficient statistic approach.

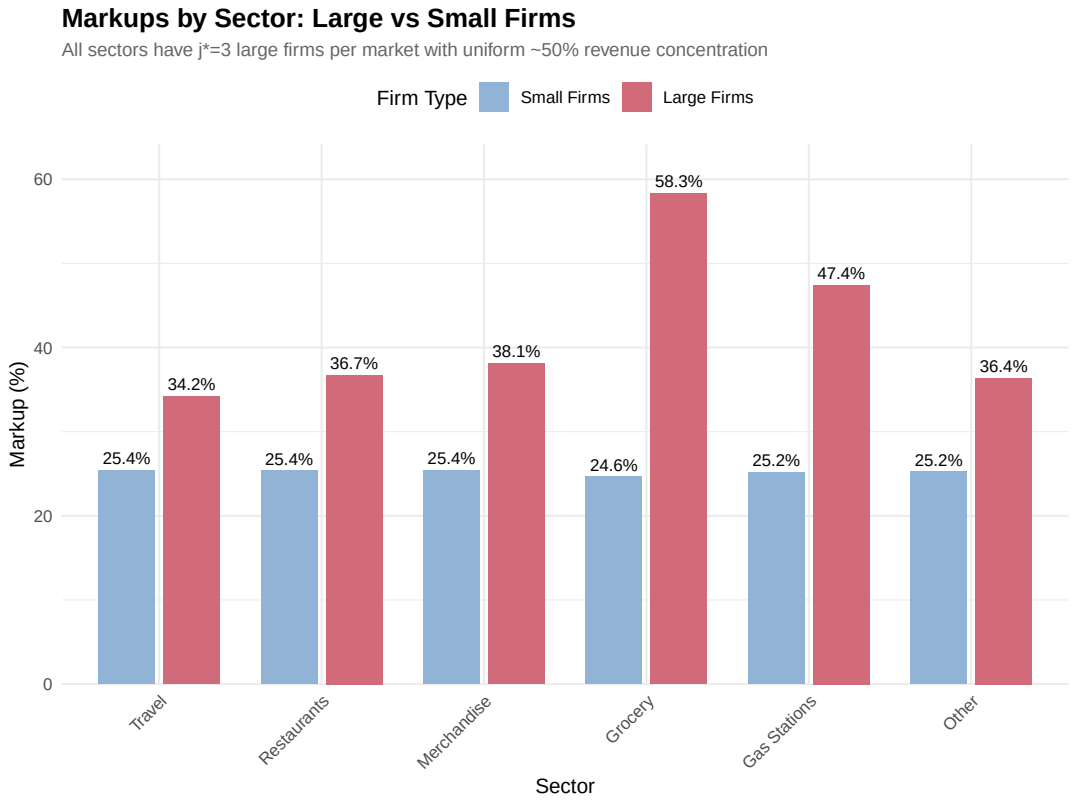
- We also have all the inputs into the fee formulas given the data.

Figure A.1 demonstrates the quality of the calibration fit. Panel (a) shows that the model successfully replicates the revenue-weighted second moments of payment shares across sectors—the key statistics that govern the extent of cross-subsidization in our sufficient-statistics framework. The close alignment between model-generated moments (y-axis) and data moments (x-axis) confirms that the calibration captures the observed covariance structure of payment methods across merchants. Panel (b) validates that the model generates realistic markups by sector, which is important for ensuring that merchant pricing behavior is empirically grounded. Together, these panels confirm that the calibrated model provides a credible quantitative laboratory for evaluating the welfare effects of interchange fee policies.

Figure A.1: Goodness of Fit: Model Calibration Results



(a) Second Moments by Sector



(b) Markups by Sector

Notes: Figure A.1 demonstrates that the model calibration successfully matches the targeted moments from the data. Panel (a) shows the matching of revenue-weighted second moments for both large and small firms across sectors, a key component of the model's calibration strategy. Panel (b) displays markups by sector, showing the model's ability to match empirical markup patterns. Together, these figures provide visual evidence that the calibration is working as intended.

II.G Comparing the Calibrated Model with Sufficient Statistics Approach

We now use the calibrated structural model to validate the sufficient-statistics approach employed in the main text. Table A.1 presents a four-way comparison that systematically evaluates two potential sources of error in the sufficient statistic: the linear approximation that ignores consumer reallocation, and the assumption of full passthrough of interchange fees to prices.

Understanding the Four Columns Column (1) reports our baseline sufficient statistic estimates computed directly from the Fiserv data, as presented in Table 6. These estimates use the actual observed distribution of payment shares and interchange fees across merchants, combined with the assumption of full passthrough.

Column (2) applies the same sufficient statistic formula to synthetic data generated from the calibrated structural model with perfect passthrough ($j^* = 50$ firms per market, each effectively small due to negligible market share). The close similarity between columns (1) and (2) serves as a validation check: it confirms that our calibration successfully replicates the key features of the empirical data, including the distribution of payment shares across merchants and the structure of interchange fees.

Column (3) reports the *exact* equilibrium welfare effects from the structural model with perfect passthrough. Unlike the sufficient statistic, which holds consumption patterns fixed, the structural model allows consumers to fully re-optimize their spending across merchants in response to the price changes induced by eliminating interchange fees. Comparing columns (2) and (3) therefore isolates the approximation error from using the sufficient statistic rather than solving the full equilibrium. The near-identity of these columns demonstrates that the second-order utility losses from consumer reallocation are negligible. This validates the envelope theorem intuition underlying our sufficient-statistics approach: since consumers are optimizing, the marginal benefit of reallocating consumption is zero, so the welfare effect is well-approximated by the mechanical effect of price and reward changes evaluated at baseline consumption.

Column (4) reports exact equilibrium welfare effects from an alternative calibration with imperfect passthrough ($j^* = 3$ large firms per market with substantial market power). In this version, large grocery and merchandise retailers pass through only 60-75% of their own cost shocks and partially absorb the remainder. Comparing columns (3) and (4) reveals how sensitive our distributional conclusions are to incomplete passthrough. The results show that the welfare effects are highly similar regardless of the amount of imperfect passthrough, with both the qualitative patterns and quantitative magnitudes remaining nearly identical across specifications.

It is crucial to interpret this robustness result with care. The model is calibrated to produce imperfect passthrough of *idiosyncratic* cost shocks—shocks that affect individual firms differently—consistent with empirical evidence on how retailers respond to firm-specific cost

changes. However, a change in interchange fees is fundamentally a *common* cost shock that affects all merchants accepting a given payment method simultaneously. Standard models of imperfect competition, including the one we calibrate, predict substantially higher passthrough rates for common shocks than for idiosyncratic shocks. Intuitively, when all competitors in a market face the same cost increase, they have weaker incentives to absorb the shock through reduced margins, because doing so would not preserve their relative competitive position. Moreover, interchange fees affect the entire retail sector with limited outside options: there are no major retailers that remain unaffected by interchange fees and could constrain passthrough through competitive pressure. Therefore, while our model features incomplete passthrough of idiosyncratic shocks (calibrated to $j^* = 3$), the effective passthrough of an economy-wide policy change like eliminating interchange fees remains close to complete. This explains why columns (3) and (4) show such similar welfare effects: the relevant passthrough rate for this policy experiment is much closer to the full passthrough case, even though the model allows for substantial absorption of firm-specific shocks.

Interpretation and Implications The four-column comparison yields two main conclusions. First, the sufficient statistic provides an accurate approximation to the exact equilibrium welfare effects, even when consumers can fully reallocate spending. This justifies our use of the simpler sufficient-statistics framework in the main analysis, which has the advantage of being transparent and directly interpretable in terms of observable payment shares. Second, imperfect passthrough has minimal impact on our distributional conclusions. Cash and regulated debit users continue to subsidize premium credit users by economically meaningful amounts, and consumer sorting continues to play a quantitatively important role in mitigating these transfers.

Overall, this appendix demonstrates that our sufficient-statistics approach—grounded in the specific institutional features of the U.S. payment system (uniform pricing, full passthrough, competitive rewards markets)—provides a robust and reliable guide to the welfare effects of interchange fees.

Table A.1: Comparison of Sufficient Statistic and Structural Approaches

(a) Effects in Basis Points

Payment Type	Effects			
	Sufficient Statistic (Data)	Sufficient Statistic (Model)	Model, Complete Passthrough	Model, Incomplete Passthrough
Cash	92.3	94.1	95	96.5
Regulated Debit	42.4	40.6	42.1	45
Exempt Debit	2	3.9	4.9	7.5
Basic Credit	-49.7	-50.3	-49	-50
Premium Credit	-59.6	-58.9	-57.5	-59.3
Merchant Profit			0.6	-1.2

(b) Effects in Dollars

Payment Type	Effects			
	Sufficient Statistic (Data)	Sufficient Statistic (Model)	Model, Complete Passthrough	Model, Incomplete Passthrough
Cash	15.6	15.7	16	16.3
Regulated Debit	11.7	11.1	11.6	12.4
Exempt Debit	0.6	1.1	1.4	2.1
Basic Credit	-10	-10.2	-9.9	-10.1
Premium Credit	-17.8	-17.7	-17.1	-17.7
Merchant Profit			0.7	-1.5