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Bank Profitability and Debit Card Interchange Regulation: Bank Responses to the Durbin Amendment

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Abstract

The Durbin Amendment to the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 alters the competitive structure of the debit card payment processing industry and caps debit card interchange fees for banks with over $10 billion in assets. Market participants predicted that debit card issuers would offset the reduction in debit interchange revenue by increases in customer account fees. Some participants also predicted that banks would cut costs in response to the law by reducing staff and shutting down branches. Using a difference-in-differences testing strategy, we show that debit interchange fee income fell for treated banks, leading to a fall in noninterest income. We also find that banks only partially offset this loss with deposit fees. We document that treated banks neither reduced costs nor strategically avoided the $10 billion threshold.

JEL: G21, G23, G28, L51

1 Introduction

The emergence of debit cards has been one of the most notable developments in consumer banking and the retail payments industry in recent decades. Since their introduction in the late 1970s, debit cards have grown to become the most popular noncash retail payment instrument by number of transactions. This growth has been particularly pronounced over the last decade, with both the number and value of debit card transactions growing by approximately 15 percent per year, although this rate has decreased slightly in recent years. In contrast, more traditional payment methods, such as credit cards and checks, have experienced lower growth or outright declines (Federal Reserve System 2013).

This growth has been accompanied by controversy over the fees and terms faced by recipients of debit card payments. As with any payment medium, the success of debit cards has depended on the ability to attract both consumers and merchants (Rochet and Tirole 2002). For consumers, the attractiveness of debit cards reflects their relatively low cost, high speed, ease of use, and wide acceptance (Schuh and Stavins 2011). Widespread merchant acceptance of debit cards would appear to be prima facie evidence that merchants experience similar benefits from cards net of costs. However, merchants have historically, and increasingly, objected to certain aspects of the debit card system.[1]

The most prominent merchant objection is over the merchant discount, the fee a merchant pays to its bank for each debit card transaction.[2] The most significant component of this fee, the interchange fee, is set by a card network and paid by the merchant's bank to the cardholder's bank for its role in processing the transaction. In aggregate, these fees are significant; in 2010, total debit and credit card interchange income was $41 billion for the banks in our data, which constituted about 5 percent of their revenue.

Section 1075 of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (hereafter, the Dodd-Frank Act), commonly known as the Durbin Amendment, represents an attempt at using the legislative and regulatory processes to address this

[1] Similar high-profile debates in the United States have concerned credit cards, although merchants have increasingly drawn attention to issues related to debit cards due to the significant growth in debit card usage.

[2] Additional information about the organization of the debit card industry is provided in the next section.

conflict between merchants, banks, and networks over interchange fees. The provision instructs the Board of Governors of the Federal Reserve System (hereafter, the Board) to regulate interchange fees for certain debit cards. As implemented by the Board's Regulation II (hereafter, Reg II), the new regulation caps debit card interchange fees for certain transactions at 21 cents plus 0.05 percent of the transaction value. This cap, which became effective on October 1, 2011, provides a significant reduction of prevailing interchange fees, about a 45 percent decline per transaction, on average, for covered transactions.[3]

Although the Durbin Amendment was largely motivated by concerns about high interchange and merchant fees, much of the debate over the amendment has focused on its potential effects on cardholder fees. The theoretical literature on interchange fees emphasizes that, just as merchant banks incorporate interchange fees into merchant transaction fees, so too will cardholder banks alter the fees and terms for their customers in response to the revenue generated by interchange fees (Rochet and Tirole 2002; Bedre-Defolie and Calvano 2013). A similar phenomenon has been examined in the telecommunications markets where changes in interconnection fees between fixed and mobile networks can generate changes in network subscriber fees, a possibility which has been termed the "waterbed" effect in that setting (Genakos and Valletti 2011). Agarwal, Chomsisengphet, Mahoney, and Stroebel (2014) consider a similar possibility for credit cards following the implementation of the CARD Act's restrictions on certain credit card fees and various practices of credit card-issuing banks.

In this paper, we examine several effects of the interchange fee restrictions on banks. We do so by considering related revenue and expense measures as reported in regulatory income statement and balance sheet information. Some of these income and expense components that we consider, such as total debit and credit card interchange income, are directly affected by Reg II. Others, such as fees for account holders, are indicative of efforts by banks to mitigate the regulation's effects, akin to the telecommunications "waterbed" effect. We also examine operational statistics, like employee and branch counts, for evidence of mitigation efforts in the form of operational cost cutting. By looking at successively higher levels of aggregation on the income statement, we are able

[3]The regulation also permits an additional 1 cent for fraud-related costs.

to examine the success of various mitigations of lost interchange income, particularly deposit fee changes for account holders.

To identify the regulation's effects, we rely upon the Durbin Amendment's exemption for smaller depository institutions. Under this exemption, the interchange fee cap only applies to banks with consolidated assets (i.e., assets for all affiliates under a holding company) greater than $10 billion. We use this threshold to estimate the effect of the regulation in a differences-in-differences setting where we view banks covered by the cap as "treated" by the regulation and compare their experiences before and after the regulation to those of "control" banks that are exempt from it. To avoid confounding the effect of the interchange fee cap with other size-related factors, we extend our analysis to consider banks with assets in various windows around the $10 billion threshold. To alleviate concerns about the exogeneity of the "treatment," we further examine, and find no empirical evidence to support, the possibility that banks adjusted their assets in order to alter their status under the regulation.

We have three key results. First, Reg II clearly led to significant reductions in interchange income for banks covered by the regulation. While not necessarily surprising given other evidence that card networks decreased debit card interchange fee rates for covered banks to reflect the regulation (Federal Reserve Board 2013), this finding indicates that those banks have been unable to offset the lost interchange income on debit cards by higher debit volumes or by shifting consumers to credit cards that have unregulated interchange fees. Second, we find that covered banks increased their deposit fees in response to the regulation. While these increases are generally insufficient to mitigate all of the lost interchange income, changes in deposit fees offset roughly 30 percent of the lost interchange income. Indeed, income is generally lower for covered banks at more aggregate measures such as total noninterest income, consistent with incomplete mitigation. Third, we do not find evidence that covered banks decreased their noninterest (operating) expenses nor adjusted other aspects of their operations, such as reducing employees or closing branches. Overall, these results are robust to choice of specification and subsample.

The remainder of the paper is organized as follows. Section 2 provides background on the debit card industry, the Durbin Amendment, and Reg II. The last part of section 2

relates the debit card environment and the new debit card regulation to economic theory. Section 3 describes the data and presents some summary statistics. Section 4 shows our various empirical results including our robustness checks. Section 5 concludes.

2 The Debit Card Industry, the Durbin Amendment, and Theory

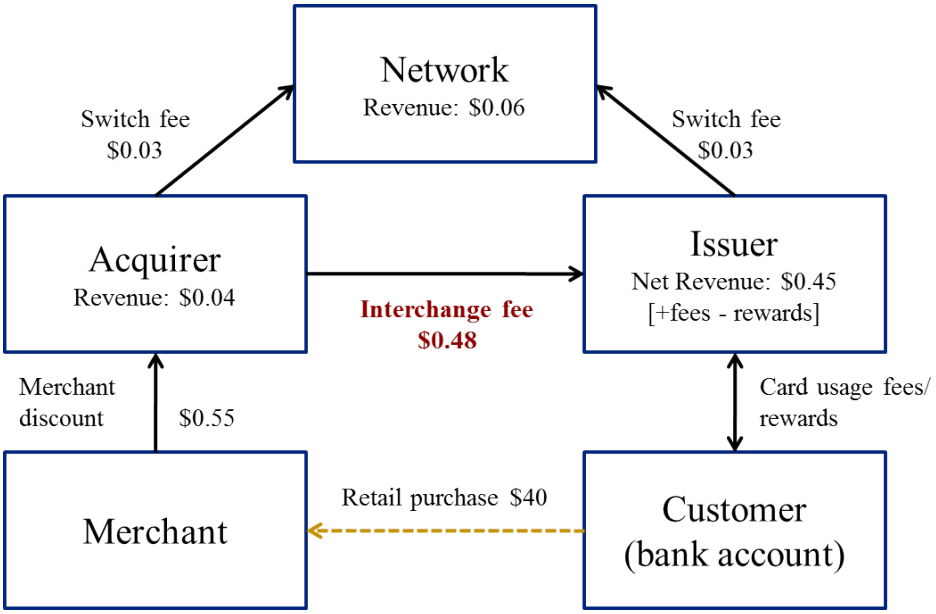
Figure 1 illustrates the basic structure of a debit card system and transaction.[4] A transaction involves five main parties: the consumer, the consumer's bank (the issuer), the merchant, the merchant's bank (the acquirer), and the card network. The banks provide various products and services to their respective customers. The issuing bank offers a deposit account and a debit card to the consumer, and the acquiring bank offers card reader technology and processing activities to the merchant. The network establishes rules for card transactions and coordinates the transmission of information and funds between the two banks.

The typical fees for these activities prior to the adoption of Reg II are shown in figure 1. In particular, the two banks separately establish fees and terms for their respective customers associated with debit cards, debit card transactions, and broader account services. For example, the acquirer typically charges a fee to the merchant, known as the merchant discount, for each transaction. More tangentially, the consumer may face fees less directly tied to transactions, such as monthly maintenance fees on the deposit account associated with the debit card. The network further levies certain fees on the two banks, including network membership fees and switch fees for each transaction.

The fee at the center this study, and the primary focus of the Durbin Amendment, is the interchange fee. In a debit transaction, this fee is paid by the acquirer to the issuer and is generally deducted from the amount transferred from the issuer to the acquirer when settled. Interchange fee schedules are set by the network that carries a transaction,

[4]For a detailed description of the general payment cards industry, see Evans and Schmalensee (2004) and Prager, Manuszak, Kiser, and Borzekowski (2009). Hayashi, Sullivan, and Weiner (2006) provide a detailed description of the debit card industry.

Figure 1: Overview of a Debit Card Transaction



Note: Numbers are illustrative of the types of fees that would be charged in a transaction and their relative magnitudes prior to Reg II.

such as Visa, MasterCard, or one of the PIN debit networks. Prior to Reg II, these fee schedules applied equally to all banks that participate in that network. Economically, as we discuss in more detail later in this section, the interchange fee is a transaction cost for the acquirer and transaction revenue for the issuer when its cardholder uses the card at a merchant.

2.1 Background of the Durbin Amendment

Merchants have long objected to both the existence and level of interchange fees.[5] They argue that the collective setting of interchange fees through networks generates collusive rents for issuers in excess of realistic processing costs. Through the impact of interchange fees on acquirer costs and merchant discounts, merchants argue that interchange fees inflate their costs of debit card transactions above the costs of comparable payment methods, such as checks. In their view, these fees are particularly high for dominant networks whose cards merchants cannot easily refuse. Merchants argue that, because

[5]For example, see the Reg II comment letter National Retail Federation (2011). See also Katz (2001), Frankel (2007), and Prager, Manuszak, Kiser, and Borzekowski (2009) for overviews of merchant concerns about card systems, including concerns about certain rules that networks impose on merchants.

they do not typically set prices that vary by payment method, high merchant transaction fees for cards ultimately generate higher prices for all consumers, including those that utilize other payment methods.

Payment card networks and banks defend interchange fees as an integral mechanism for supporting the payment card network and driving the vigorous growth in debit card usage over the last decade.[6] They argue that a common interchange fee facilitates the establishment and maintenance of a system in which many disparate banks participate. Moreover, by providing a revenue stream to issuing banks, these parties argue that interchange fees have allowed those banks to offer attractive fee structures and terms to cardholders, as well as funding promotional activities and the significant fixed costs associated with the system. Finally, financial services firms argue that, interchange fees notwithstanding, debit cards offer significant benefits to merchants and point to widespread merchant acceptance of debit cards as prima facie evidence of those benefits.

These disputes, which have been the impetus for past and ongoing antitrust litigation (Wildfang and Marth 2006), culminated in the Durbin Amendment.[7] With respect to interchange fees, the main provision of the Durbin Amendment instructed the Federal Reserve Board to prescribe regulations to establish "standards for assessing" whether debit card interchange fees received by issuers for card transactions are "reasonable and proportional to the cost incurred by the issuer with respect to the transaction."[8] When developing these regulations, the Board was further instructed to consider the "incremental cost" of authorizing, clearing, and settling a "particular" debit transaction, and not to consider other costs which are not specific to a particular transaction. In addition, the Board was instructed to consider the functional similarity between debit cards and checks, noting that the latter clear at par in the Federal Reserve System.

The statute contained a number of exemptions from the interchange fee provisions. Im-

[6]For example, see the Reg II comment letter American Bankers Association et al. (2011). See also Evans and Schmalensee (2004).

[7]The full text of the Durbin Amendment is available on page 2068 of Government Printing Office (2010). The Board's press release and text for the proposed and final regulations are in Federal Reserve Board (2010) and Federal Reserve Board (2011a), respectively. Public comments related to the proposal are available at `www.federalreserve.gov/apps/foia/ViewAllComments.aspx?doc_id=R-1404&doc_ver=1`.

[8]The Durbin Amendment contains various other provisions that are not the central focus of our paper. Hayashi (2012) and Hayashi (2013) discuss these provisions in more detail.

portantly for our analysis, the statute exempts small issuers from the interchange fee restrictions. According to the sponsor of the Durbin Amendment, the exemption was intended to "[preserve] the ability of small banks and credit unions to compete with big banks in issuing cards" by ensuring that "[t]hose institutions would not lose any interchange revenues that they currently receive" (open letter sent by Senator Durbin to Chairman Christopher Dodd and Chairman Barney Frank on May 25, 2010).[9] As a result, under the statute, the interchange regulations established by the Board only apply to issuers that, together with affiliates, have assets in excess of $10 billion.[10]

Following the standard rule-writing process, detailed in appendix A, the Board issued Reg II in June 2011 to implement the Durbin Amendment. Under the regulation, on October 1, 2011, interchange fees for issuers with assets greater than $10 billion were capped at 21 cents plus 0.05 percent of the transaction value. Reflecting a provision in the statute, Reg II further permits covered issuers to receive a 1 cent adjustment for fraud-prevention costs. Together, the interchange fee cap and fraud-prevention adjustment imply a maximum interchange fee of 24 cents for a $38 debit card transaction, a decline of 45 percent from the average value of 44 cents for the same transaction in 2009 prior to the Durbin Amendment (Federal Reserve Board 2011b).

2.2 Theory of Interchange Fees

Beginning with Baxter (1983) and especially following the seminal work of Rochet and Tirole (2002), a substantial theoretical literature has considered the positive and normative implications of interchange fees in payment card markets. Although the models are often highly stylized, the literature provides predictions about the effects of the regulation that we can consider in our data.[11]

[9]The letter is available on Senator Durbin's website `http://www.durbin.senate.gov/public/index.cfm/pressreleases?ID=46431008-9a5c-464c-a961-3156c5062a25`. The statute contains additional exemptions for debit cards issued pursuant to a government-administered payment program (e.g., Supplemental Nutrition Assistance Program cards) and certain reloadable general-use prepaid cards. Lacking detailed information pertaining to these small card programs (Federal Reserve System 2013), we do not exploit these exemptions in our analysis.

[10]Under the language in the statute, the exemption is based on consolidated worldwide assets of a financial institution, including all financial and non-financial affiliates.

[11]Verdier (2011) and Rysman and Wright (2012) provide useful surveys of this literature.

On the merchant-acquirer side of the market, a cap on interchange fees causes a decrease in the cost of the transactions that a merchant processes through its acquirer. The general theoretical result is that competition among acquirers leads to the pass-through of changes in interchange fees to merchant fees. The net effect of the cap on an acquirer will depend on the pass-through rate of merchant fees, the mix of acquirer-provided transaction services, the elasticities of demand for those services, and any substitution between them when merchant fees change.[12]

On the consumer-issuer side of the market, by decreasing the revenue that an issuer receives for each transaction, the interchange cap effectively decreases the issuer's revenue from debit card transactions. As on the merchant side of the market, competition among issuers leads to the pass-through of changes in interchange fees in the fees and terms faced by cardholders. For example, rather than focusing on only transaction-based fees, an issuer could alter fees and terms associated with the debit card or the deposit account associated with the card, such as reward programs, annual card fees, account maintenance fees, higher minimum balances, or changes in interest rates on deposits.[13] Finally, an issuer could look to shift customers to other products, such as credit cards, that are not subject to fee regulation. The net effect of the cap on an issuer will depend on the pass-through of changes in interchange fees on account holder fees, the elasticities of demand for debit card transactions and other products, and any changes in quantities demanded that result from changes in fees.

The effect on any individual bank could depend on the mix of issuing and acquiring that the bank performs. In principle, these multiple activities within a single bank complicate our empirical analysis, particularly as our core data do not identify the extent of issuing or acquiring activity at individual banks. From a practical perspective, however, we view this complication as a relatively minor issue. First, many of the largest acquirers, such as First Data and Heartland Payment Systems, are not actually banks.[14] As a result, much

[12]Ultimately, the change in merchant fees will affect retail prices and merchant profits, but given the bank-centric nature of our analysis, this important issue is beyond the scope of this paper.

[13]Sullivan (2013) looks specifically the impact of Reg II on checking account fees and finds that on net customers have more access to free checking accounts from exempt banks.

[14]Technically, network rules require participants in card networks to be depository institutions. Firms such as First Data enter into sponsorship agreements with banks in which those banks outsource many or all of the acquiring functions to the sponsored processor. See DeGennaro (2006) or Comptroller of the Currency (2001) for more information.

of the movement in merchant discount income and interchange expenses for acquirers will occur for firms that are not in our bank-centric data. Although this data limitation implies that our analysis will not provide a comprehensive view of adjustments in response to Reg II, it also implies that our data will not be significantly corrupted by a co-mingling of issuer and acquirer information. Second, banks that are directly involved in acquiring tend to be huge national banks, reflecting the significant scale economies in the acquiring business. For these firms, our data will reflect effects of lower interchange fees on both issuing and acquiring activities, but any positive effects of imperfect pass-through of lower acquiring costs in merchant discounts will tend to attenuate the negative effects on the issuing parts of the firms. Our robustness checks excluding these largest banks give similar results to those that include them, consistent with a high level of pass-through of acquirer costs to merchants. If pass-through rates were low the benefits of the lower acquiring costs would lead to differential effects for the very large banks.

3 Data

Our analysis uses quarterly data between 2008:Q1 and 2013:Q2 on bank holding companies (BHCs) and standalone commercial banks (i.e., banks that are not part of a holding company). We focus on observations at this level, rather than individual banks under a holding company, for two reasons. First, the asset threshold of the law is tied to an institution's consolidated assets, which correspond to the assets of the top BHC for institutions with that corporate structure or those of the standalone bank when no holding company exists. Second, both BHCs and standalone banks have significant reporting requirements, which enable us to study behavior at the same level of aggregation to which the regulation applies. Hereafter, the term "bank" will be used to describe both BHCs and standalone banks in the data.[15]

A significant portion of our data comes from mandated reports that financial institutions file quarterly with their regulators. For BHCs, we collect data from the quarterly FR

[15]The interchange fee restrictions apply to all depository institutions including thrifts (i.e., savings banks and savings and loan associations) and credit unions. Due to differences in reporting forms for thrifts and credit unions, our data do not generally contain information on these institutions unless a thrift is part of a BHC.

Y-9C, which is filed by BHCs with assets in excess of $500 million. For standalone banks, we gather information from the commercial bank quarterly report (Call Report, form FFIEC 031/041) for banks that are larger than $500 million. Broadly speaking, these reports contain detailed income statement and balance sheet information, and we extract a series of income and expense variables that reflect various levels of aggregation of an institution's activities that may be affected by Reg II.

A bank's income and expenses are broken into interest- and noninterest-related components. The former contains information about the borrowing and lending of a bank, whereas the latter captures information related to other activities, including payment services. Because Reg II does not concern bank lending, we largely focus on the noninterest portions of the regulatory filings. Noninterest income and expense are, in turn, decomposed into various specific line items with all unlisted items captured in a residual item called "other noninterest income" (or expense). Certain specific line items are then reported for other noninterest income (or expense) provided they reach thresholds of materiality.[16] Of these components of other noninterest income, we make novel use of measures relating to interchange income. We further analyze information related to deposit income in the higher-level variable noninterest income. We then consider more aggregate income and expense measures of which interchange and deposit income are components.[17]

The opportunity to view the consequences of Reg II at different levels of aggregation provides several benefits. First, more aggregate measures are less likely to suffer from misclassification or measurement error. Second, higher levels of aggregation provide an opportunity to measure mitigation of Reg II net of progressively more expansive mechanisms to offset its effects.

At the same time, our data are aggregated in certain ways that are not ideal. First, some variables that may be related to debit cards do not have specific line items. For example, the instructions do not give a clear location for reporting the costs of cardholder rewards. A related issue, particularly for items that do not have explicit entries, is that the

[16]In particular, firms are only required to report variables such as interchange income for amounts greater than $25,000 that exceed 3 percent of other noninterest income (or expense).

[17]Appendix B contains more information about the data and our collection processes including a more detailed description of the various income and expense items.

instructions allow for some flexibility: income and expenses can be reported separately, or income can be reported net of related expenses. Finally, the reported data may combine variables that are more or less related to the effects that we wish to study separately. For example, interchange income is reported as the sum of interchange fees from credit and debit cards, which prevents us from evaluating the precise effect of the regulation on the two separate components. Similarly, because the deposit fee variable is quite broad, we cannot measure changes in specific types of fees. Miscellaneous one-time charges add further noise to our data. Despite these difficulties, which are inevitable given that the data are collected for supervisory purposes largely unrelated to payment cards and interchange fees, our data capture much of the information relevant to evaluate the effects of Reg II.

We supplement this information with several other sources. First, the Call Report provides quarterly data about the number of deposit accounts and full-time equivalent employees (FTEs). Second, the Federal Deposit Insurance Corporation (FDIC) Summary of Deposits (SOD) provides annual data on the number of branches for commercial banks. These data are reported at the bank level, and we aggregate information for affiliated banks, when necessary, to obtain consolidated variables. Finally, specific to Reg II, we obtain information about the exempt and covered status of commercial banks from lists that the Board has issued annually since 2011. To establish the status of BHCs, we use relationship data documented by the National Information Center to connect the banks to the controlling BHC. Hereafter, to concisely distinguish the firms that are affected by the regulation from those that are not, we use the term "treated" to refer to covered firms and "untreated" to refer to exempt firms.

Using these data, we construct two families of panels consisting of firms for which a year-over-year log difference (growth rate) of a variable can be calculated for at least four quarters between 2011 and 2012.[18] The first family of panels is the Consistent Panel that includes the 688 firms that report required values for all nine primary income and expense variables.[19] The second family consists of individual panels for each variable we study. For example, one panel in the second family is the Interchange Income Panel that includes

[18]For annual data (SOD and year-to-date income and expense items), the panel requirement is for a firm to at a minimum report valid information for 2010, 2011, and 2012.

[19]The nine primary variables are those listed in table 1.

700 firms that report valid values for $\ln(\text{interchange income}_t) - \ln(\text{interchange income}_{t-4})$ for at least four quarters between 2011 and 2012. The panel sizes for these individual variables range from 700 to 1,047 firms.

The reporting requirements related to dates ensure that firms included are present around the time of the effective date of the interchange restrictions. The Consistent Panel is constructed to maintain the same firms across variables. This makes coefficients comparable across our outcome variables. The larger panels for each variable then include additional information but at the cost of not having a consistent set of firms across the variables.

Key summary statistics for the Consistent Panel are shown in table 1. Quarterly income and expense variables are organized by treatment group. The table presents information about the levels of the variables for two specific quarters: the first quarter that Reg II is in effect (2011:Q4) and the quarter one full year before (2010:Q4).[20]

Table 1: Table of Means

	Levels (000)				**Log Differences**		
	Untreated Firms (407 Firms)		**Treated Firms (47 Firms)**		**Untreated Firms**	**Treated Firms**	**Difference-In-Difference**
	Pre-Law	**Post-Law**	**Pre-Law**	**Post-Law**			
	2010:Q4	**2011:Q4**	**2010:Q4**	**2011:Q4**	**2011:Q4**	**2011:Q4**	
	1	2	3	4	5	6	7
Interchange Income	629	681	115,131	91,717	0.126	-0.261	-0.387
	(1,277)	(1,307)	(302,461)	(238,621)	(0.390)	(0.496)	
Deposit Fees	1,535	1,503	119,741	126,249	-0.043	0.018	0.061
	(3,695)	(3,712)	(279,819)	(297,238)	(0.191)	(0.153)	
Core Other Noninterest Income	984	1,065	141,271	117,339	0.085	-0.121	-0.205
	(1,677)	(1,631)	(345,791)	(283,689)	(0.299)	(0.430)	
Core Total Noninterest Income	3,870	3,850	693,809	591,803	-0.001	-0.072	-0.071
	(6,551)	(6,476)	(2,023,087)	(1,692,371)	(0.214)	(0.192)	
Core Revenue	17,581	17,908	1,916,518	1,806,469	0.014	0.037	0.023
	(18,344)	(18,793)	(4,926,321)	(4,420,012)	(0.094)	(0.190)	
Other Noninterest Expense	4,709	4,556	575,007	586,185	-0.039	0.052	0.091
	(5,341)	(5,213)	(1,556,994)	(1,512,846)	(0.303)	(0.312)	
Total Noninterest Expense	13,451	13,732	1,508,849	1,525,164	0.003	0.093	0.090
	(14,737)	(15,742)	(4,092,742)	(3,844,323)	(0.232)	(0.235)	
Salaries	6,743	7,097	679,379	690,093	0.033	0.092	0.058
	(7,931)	(8,806)	(1,838,340)	(1,817,099)	(0.129)	(0.176)	
Premises	1,675	1,679	165,154	162,124	-0.015	0.057	0.071
	(1,931)	(2,007)	(431,586)	(415,007)	(0.273)	(0.173)	

Standard deviations are in parentheses.

Table 1 illustrates several notable features of the data. First, treated and untreated banks exhibit very different values for the levels of every variable, as seen in columns 1 to 4.

[20]In order to keep a balanced set of firms, only Consistent Panel members that have all the data for both quarters are presented in table 1.

Given that the threshold condition for untreated status is based on firm size, and size is highly positively correlated with many of the variables that we consider, these differences are expected. Second, firms within each group exhibit substantial heterogeneity.

Finally, the last column highlights some of our basic regression results from the next section. In particular, for firms subject to the interchange fee restrictions, interchange income fell sharply, core other noninterest income fell substantially, and deposit fee income rose to partially offset the loss in interchange income. However, core total noninterest income still declined. Additionally, treated banks do not appear to have cut their expenses. The next section documents these findings using data from our full sample and examines the robustness of those results to different samples and specifications.

4 Empirical Results

For our quarterly data, we consider a panel data regression model of the form

$$\ln(y_{i,t}) = \gamma_i + \lambda_t + g_i \cdot t + \tau \cdot Treat_{i,t} + u_{i,t}, \tag{1}$$

where $\ln(y_{i,t})$ is the log of an outcome variable (e.g., interchange income), γ_i is a firm-specific fixed effect reflecting systematic heterogeneity across institutions, λ_t is a common date-specific effect capturing aggregate conditions, g_i is a firm-specific growth trend allowing for systematic heterogeneity in growth across institutions, and $u_{i,t}$ is the error term. The variable $Treat_{i,t}$ is equal to one if firm i is subject to the regulation at time t and zero otherwise, so that the coefficient τ measures the effect of the regulation.

For estimation purposes, we employ year-over-year first differences of this regression to remove the effect of firm-specific heterogeneity. The estimated regression is therefore

$$\Delta \ln(y_{i,t}) = \widetilde{\lambda}_t + g_i + \tau \cdot \Delta Treat_{i,t} + \Delta u_{i,t}, \tag{2}$$

where $\Delta \ln(y_{i,t}) = \ln(y_{i,t}) - \ln(y_{i,t-4})$ is the year-over-year difference in the outcome variable (e.g., approximate percentage change in interchange income), $\widetilde{\lambda}_t = \lambda_t - \lambda_{t-4}$ is

the change in aggregate conditions from $t-4$ to t, g_i measures the effect of firm-specific growth, and $\Delta u_{i,t}$ is the change in the error term. The variable $\Delta Treat_{i,t}$ reflects the change in a firm's status from $t-4$ to t and equals one if firm i is subject to the regulation at t and not at $t-4$.[21] In the presentation of our results, we decompose the date specific effects, $\widetilde{\lambda}_t$, into an average growth rate and time fixed effects which serve as date-specific deviations from that average growth.

For each of our primary variables, we estimate (2) using data from the Consistent Panel as well as data from each variable-specific panel. The latter allows us to exploit additional information from data that are less complete. We also vary our regressions based on whether we include the term g_i to allow for firm-specific growth trends. The result for each variable is a set of four estimates corresponding to a combination of a particular sample and handling of firm-specific growth.

4.1 Income Reactions

Interchange Income

We begin by analyzing the variable most directly related to the regulation, namely total interchange income, with our regression results reported in table 2. Because interchange income is only reported above certain thresholds, the two panels are subsamples of firms likely to be affected by the law. However, because interchange income is reported as the combination of debit card and credit card interchange income and because underlying transactions of both types grow over time and fluctuate in size, the overall effect of the cap does not immediately follow from the implied decline in average interchange rates for treated firms.

Table 2 documents a number of findings that are robust to both the panel used and the inclusion of time fixed effects.[22] First, based on the estimated constant, we find that,

[21] Because $Treat_{i,t} = 0$ for all time periods before the effective date of the regulation, $\Delta Treat_{i,t} = 1$ in 2011:Q4 for all firms that are initially covered by the regulation (i.e., the variable is an interaction between treated time and treated firm).

[22] Some firms report interchange income even if reporting thresholds for the variable are not met. To check for possible reporting bias, we ran the regressions in table 2 excluding voluntary reporters, which lowers the number of firms in the Consistent and Interchange Income panels by 36 and 38 firms, respectively. The results of this exercise, as reported in appendix C.1, are similar to those in table 2.

Table 2: Interchange Income Regressions

Variables	Consistent 1	Interchange Inc. 2	Consistent 3	Interchange Inc. 4
Durbin×Treat	-0.412***	-0.420***	-0.405***	-0.409***
	(0.0492)	(0.0541)	(0.0490)	(0.0508)
Constant	0.142***	0.141***	0.149***	0.149***
	(0.0274)	(0.0272)	(0.0264)	(0.0263)
Fixed Effects?	No	No	Yes	Yes
Observations	10,169	10,330	10,169	10,330
Firms	688	700	688	700
R-squared	0.023	0.024	0.215	0.218
Adj. R-squared	0.021	0.023	0.157	0.160

Robust standard errors in parentheses are clustered at the firm level.
Year-quarter dummies are suppressed.
*** p<0.01, ** p<0.05, * p<0.10

aside from the effect of the interchange cap, total interchange income grew at an average rate of 15 percent per year.[23] This base growth is largely stable over time, as our (unreported) estimates of date-specific deviations from that average are generally not statistically different from zero. The robust and stable growth in interchange income, when other income sources for banks were performing poorly due to the financial crisis, provides evidence for why banks viewed interchange as a valuable revenue stream and potential regulation as a threat. Moreover, our estimates suggest that, although credit card interchange rates tend to be significantly higher than debit interchange rates, debit interchange averaged approximately 75 percent of pre-law total interchange income for treated firms.[24] The significance of debit interchange income out of the overall interchange income stream further indicates why banks voiced substantial opposition to this particular regulation, as seen in various comment letters from financial institutions during

[23]Because many of the coefficient estimates are outside the range of ± 0.30 in which $100 \times \ln(1+r) \approx 100 \times r$ is a reasonable approximation of the percent growth rate, we convert our estimates to percentages with $\beta = 100 \times \left(e^{\beta} - 1\right)$ throughout our discussion.

[24]Our model implies that total interchange income for treated banks evolves according to

$$(D_{t+1} + C_{t+1}) = (1+g)(1+\xi)(D_t + C_t)$$

where $(1+g)$ is base growth and $(1+\xi)$ is the treatment effect of the regulation. Based on our estimates, $(1+g) \approx \exp(0.14) = 1.15$ and $(1+\xi) \approx \exp(-0.41) = 0.66$. The regulation implies that the average debit interchange fee per transaction declined by approximately $\delta = 0.45$. If we assume that the similar recent growth rates in aggregate debit and credit card transactions (Federal Reserve System 2013) imply that debit and credit interchange grow at the same rate, then $D_{t+1} = (1-\delta)(1+g)D_t$ and $C_{t+1} = (1+g)C_t$ for treated issuers. Equating the sum of these expressions to the estimated change in total interchange income allows us to impute the average debit share of total interchange income as 75 percent.

the Board's initial comment period.[25]

With respect to the effect of the regulation, we find a highly significant and large negative estimate for the treatment effect τ (i.e., Durbin×Treat). In particular, the estimated effect of the Durbin Amendment on treated firms' interchange income ranges between a log difference of -0.41 and -0.42. This translates into average interchange income being approximately 34 percent lower for treated firms than it would have been otherwise. Given the overall upward trend in interchange income, our estimates imply that, rather than experiencing an average increase of 15 percent in interchange income over the year in which the regulation became effective, treated firms experienced an approximate 24 percent decline ($\approx 100 \times (\exp(0.14 - 0.41) - 1)$) under the cap.

The results of this analysis demonstrate that the regulation clearly had an effect on a certain component of treated banks' income. On the one hand, this result is expected—given the known magnitude of the cut in interchange fees for average debit transactions at treated firms, it would be surprising to find no evidence of a decline in their overall interchange income. On the other hand, we view the existence and magnitude of this effect as providing three useful pieces of information. First, despite various difficulties with our data, the data are detailed enough, and the impact is large enough, for us to detect an effect at a fairly granular level in the banks' income statements. Second, and more substantively, our estimates suggest that various offsetting changes did not occur to fully negate an effect. In aggregate, efforts to raise debit volumes and increase credit card interchange income were insufficient to offset the lower debit interchange rate. Finally, the magnitude of the estimated effect gives us a benchmark against which to evaluate the effectiveness of potential offsets elsewhere in the banks' operations.

Deposit Fees

As introduced in 2, the theoretical literature proposes that a change in interchange fees, by reducing the profitability per transaction for a card-issuing bank, will generally induce the bank to alter fees and terms for its accountholders. In practice, there are a few key channels for adjustment.

One possibility, which was widely discussed by the press and industry participants in

[25]For example, see Reg II comment letter American Bankers Association et al. (2011).

the context of Reg II, is that banks could curb or end rewards programs under which cardholders receive airline miles, cash rebates, or similar perquisites for using their debit cards. The main regulatory data that we use do not clearly identify the costs associated with rewards, nor are we aware of other datasets that contain bank-level information about rewards for treated and untreated banks. As a result, we are unable to perform a complete analysis of rewards behavior around the effective date of the regulation. Our estimates of the degree of offset for other channels about which we do have information should correspondingly be viewed as a lower bound on the overall pricing responses of treated firms.

However, other information suggests that changes in rewards programs could not completely offset Reg II. Data collected by the Board from treated issuers as part of its responsibilities under the Durbin Amendment indicates that rewards for such issuers averaged approximately 5 cents per transaction in 2009 before implementation of Reg II (Federal Reserve Board 2011b). This value is generally consistent with other estimates of industry-wide average rewards prior to the enactment of the Durbin Amendment.[26] Thus, even the elimination of such rewards would yield a savings that is only a quarter of the 20 cent cut in average interchange fees under Reg II's cap. Moreover, subsequent data collected by the Board documents that, in 2011, treated issuers did not completely eliminate rewards but rather reduced them to an average of roughly 2 cents per transaction (Federal Reserve System 2013). Although these data are limited to treated issuers and do not specifically report rewards costs for the portion of 2011 during which Reg II was in effect, they suggest that both potential and realized cuts in rewards are insufficient to offset the decrease in interchange fees under the cap.

A second possibility, and one we can test, is that banks alter accountholder fees and prices in response to the decreased revenue for card transactions. This information is captured in regulatory filings in the line item "Service charges on deposit accounts in domestic offices" (hereafter, deposit fees).[27] Moreover, market research indicated that

[26] citet*RefWorks:372 and citet*RefWorks:373 report that, for the industry as a whole, prevailing debit card rewards averaged about 0.25 percent of debit dollar volume for cards enrolled in rewards programs. Moreover, other estimates suggest that only about a third of debit cards had rewards programs before the law (Hayashi, Sullivan, and Weiner 2006; Hayashi 2009; Sidel and Lieber 2005).

[27] Deposit fees include overdraft fees and account minimum fees among others. See appendix B.4 for the list of 12 categories of fees in the form instructions.

accountholders were extremely hostile to per transaction fees (TSYS and Mercator Advisory Group 2011). Therefore, relatively opaque charges like account fees may be more effective at mitigating lost revenues from Reg II than directly increasing card-related fees. Indeed, the press prominently reported banks announcing their intention to raise fees to offset lost interchange revenue. However, the press later reported the high profile retreats of Bank of America, Wells Fargo, and others over such announced fees. Banks may announce deposit fee increases and not implement them or implement deposit fee increases without widely publicizing them.

Table 3: Deposit Fees Regressions

Variables	Consistent 1	Deposit Fees 2	Consistent 3	Deposit Fees 4
Durbin×Treat	0.0401**	0.0334*	0.0262	0.0469*
	(0.0177)	(0.0198)	(0.0192)	(0.0253)
Constant	-0.00156	0.00102	0.00278	0.00825
	(0.00800)	(0.00879)	(0.00767)	(0.00884)
Fixed Effects?	No	No	Yes	Yes
Observations	11,425	16,630	11,425	16,630
Firms	688	1,019	688	1,019
R-squared	0.028	0.017	0.245	0.229
Adj. R-squared	0.027	0.016	0.195	0.178

Robust standard errors in parentheses are clustered at the firm level.
Year-quarter dummies are suppressed.
*** p<0.01, ** p<0.05, * p<0.10

In table 3, we examine whether treated firms increased their revenues from deposit fees in response to the regulation. Our estimation uses the same specifications as our interchange regressions where we consider both the Consistent Panel and the Deposit Fees panel specific to this variable.

Two results stand out. First, in contrast with interchange income, there is no secular trend in deposit fees for banks overall; the constants in the regressions are economically small and statistically insignificant. Second, treated firms increased their deposit fees following the imposition of the interchange fee cap. Our point estimates indicate treated firms increased deposit fees 3 to 5 percent in response to Reg II.

To put these estimates in context given the magnitude of the estimated decline in interchange income, table 4 shows the sizes of deposit fees and interchange income relative to

Table 4: Relationship Between Income Items, Consistent Panel (2010)

	Deposit Fees as a % of:			Interchange as a % of:			Interchange as a % of:		
	Interchange	Core Total Nonint Inc	Core Revenue	Core Other Nonint Inc	Core Total Nonint Inc	Core Revenue	Other Nonint Inc	Total Nonint Inc	Revenue
Treated Firms									
Mean	279	36	9	71	20	5	37	15	4
St dev.	(234)	(15)	(4)	(21)	(15)	(4)	(35)	(12)	(3)
Untreated Firms									
Mean	733	46	8	58	16	3	36	15	3
St dev.	(2,513)	(48)	(6)	(62)	(11)	(3)	(23)	(29)	(3)
All Firms									
Mean	694	45	8	59	17	3	36	15	3
St dev.	(2,407)	(46)	(6)	(59)	(12)	(3)	(25)	(28)	(3)

each other as well as relative to various higher-level income statement items for the Consistent Panel in the year prior to the regulation.[28] Since revenues from deposit fees were, on average, approximately three times higher than interchange income prior to the regulation for treated firms, we estimate that treated banks were able to offset approximately 30 percent of the lost interchange income through higher deposit fees.[29] This finding is consistent with the general prediction from standard theoretical models regarding the response of cardholder fees to changes in interchange fees.

Broader Income Categories

Viewing the effect of the law on broader income measures allows us to assess its fuller impact. For instance, other noninterest income includes alternative income sources like ATM and safe deposit box fees that could have been increased to mitigate Reg II. More broadly, banks may have made various adjustments that are not reported in interchange income or deposit fees. By considering broader income measures, we are able to look for evidence of such adjustments, even if we cannot pinpoint their exact nature.

However, higher level measures contain volatile and large components unrelated to interchange income, debit cards, or deposit accounts. To avoid extraordinary items flowing through the income statement, we define "core" income categories by stripping out other noninterest income that is not reported as a standard line item. We also exclude trading

[28]The next subsection provides a detailed discussion of these higher-level items.

[29]Using the estimates from column 1 of tables 2 and 3, interchange income and deposit fees for treated firms were approximately 34 percent lower and 4 percent higher, respectively, than they would have been absent the regulation. Based on the values in table 4, the ratio of deposit fees to interchange income for treated firms was 2.79 prior to the regulation. Absent the regulation, this ratio would have decreased to 2.43 given the lack of growth in deposit fees and the 15 percent growth in interchange income for untreated firms. The extent to which changes in deposit fees offset the decline in interchange fees is then given by $2.43 \times 0.04/0.34 = 0.285$.

revenue, gains (or losses) on asset sales, and changes from fair-value-option accounting. The exact line items defining our core measures are provided in table 12 in appendix B. These definitions focus on the revenues from financial services for which banks might plausibly adjust their prices in response to the law.[30]

Table 5: Core Income Category Regressions

	Core Other Noninterest Income		**Core Total Noninterest Income**		**Core Revenue**	
	Consistent	Core Other Nonint Inc	Consistent	Core Total Nonint Inc	Consistent	Core Revenue
Variables	1	2	3	4	5	6
Durbin×Treat	-0.240***	-0.245***	-0.0722***	-0.0646***	-0.00268	-0.0127
	(0.0407)	(0.0432)	(0.0207)	(0.0193)	(0.0175)	(0.0150)
Constant	0.167***	0.137***	0.0160	0.00880	0.0301***	0.0247***
	(0.0217)	(0.0197)	(0.0113)	(0.0104)	(0.00659)	(0.00690)
Observations	11,100	15,225	11,400	16,928	11,435	17,060
Firms	688	976	688	1,043	688	1,047
R-squared	0.021	0.011	0.007	0.004	0.012	0.012
Adj. R-squared	0.019	0.010	0.005	0.003	0.011	0.011

Robust standard errors in parentheses are clustered at the firm level.
Year-quarter dummies are suppressed.
*** p<0.01, ** p<0.05, * p<0.10

Table 5 shows the regression results on these core measures of broader income. For space considerations, only specifications without firm fixed effects are reported for the Consistent and variable-specific panels. The results for models with firm fixed effects are similar. When evaluating the results, it is important to note the hierarchical nature of the variables: interchange income $\subset$ core other noninterest income $\subset$ core total noninterest income $\subset$ core revenue.

The estimated causal effects on core other noninterest income and core total noninterest income are negative and significant. Moreover, they are close to and statistically indistinguishable from the predicted effects of actual changes in interchange income without mitigation. In particular, if interchange income were the only component of core other noninterest income to change, then our estimate of the regulation's effect on interchange income would imply that core other noninterest income for treated firms would be ap-

[30]The regression results using income measures that include non-core income are reported in appendix B.2 table 15. As described in the appendix, the estimates from those regressions are larger than what is predicted given the relative size of interchange income and the broader income measures. Stripping out non-core activity corrects this anomaly.

proximately 24 percent lower under the regulation.[31] That is not statistically different than the point estimate of 21 percent ($\exp(-0.240) - 1 = -0.213$), so we fail to reject zero mitigation at this level. An important caveat is that while the t-tests have plenty of power to distinguish effects from zero (i.e., we can reject full mitigation), a modest amount of mitigation on core total noninterest income (like that found in the prior section on deposit fees) cannot be rejected.

Turning to the most aggregate variable, revenue, the point estimates from the core revenue regressions are negative, but the results are quantitatively low and not statistically significant. This result could be suggestive of successful mitigation of lost interchange income by treated banks through other income streams. Alternatively, and perhaps more likely, banks were unable to mitigate all of the lost interchange income, but we are unable to precisely estimate this effect in our data. In particular, because interchange income was only 5 percent of core revenue for treated firms in the Consistent Panel before the law, core revenue would have had to grow (or shrink) by 3.4 percent in the Consistent Panel to detect a significant effect. Even with no mitigation, the expected effect is 2 percent, which is well below the threshold for a significant finding. However, the sign and magnitudes of the estimated effects are consistent with this estimate.

4.2 Expense Reactions and Changes to Operations

Expense

Another way to pass on the revenue loss is to adjust (lower) quality. For example, landlords will allow property to go into disrepair when faced with rent controls (Moon and Stotsky 1993). Perhaps banking service quality declined in response to the law. Lower expenditures on salaries, bank facilities (premises), other noninterest expenses, and total noninterest expenses would all be consistent with firms cutting back on costs (and likely quality) in response to the reduced revenue per transaction from the law.

[31] From table 4, in the year prior to the regulation, interchange income was approximately 71 percent of core other noninterest income for treated firms. The estimates from tables 2 and 5 imply that, absent the regulation, interchange income and core other noninterest income would have grown by approximately 15 percent and 18 percent, respectively. Because interchange income is estimated to be 34 percent lower under the regulation, the predicted change in core other noninterest income due to lower interchange income is $-0.34 \times 1.15/1.18 \times 0.71 = -0.235$.

Table 6: Expense Regressions

	Salaries		**Premises**		**Other Noninterest Exp**		**Total Noninterest Exp**	
	Consistent	Salaries	Consistent	Premises	Consistent	Other Nonint Exp	Consistent	Total Nonint Exp
Variables	1	2	3	4	5	6	7	8
Durbin×Treat	0.0168	0.00941	0.0299	0.0118	0.0417*	0.00445	0.0308*	0.0161
	(0.0127)	(0.0102)	(0.0183)	(0.0153)	(0.0242)	(0.0244)	(0.0174)	(0.0155)
Constant	0.0176***	0.0110**	0.0543***	0.0494***	0.178***	0.181***	0.0859***	0.0841***
	(0.00656)	(0.00520)	(0.00697)	(0.00603)	(0.00901)	(0.00823)	(0.00970)	(0.00785)
Observations	11,434	17,080	11,434	17,071	11,424	17,040	11,432	17,080
Firms	688	1,048	688	1,048	688	1,047	688	1,048
R-squared	0.013	0.011	0.008	0.004	0.098	0.074	0.017	0.016
Adj. R-squared	0.012	0.010	0.006	0.003	0.097	0.073	0.015	0.015

Robust standard errors in parentheses are clustered at the firm level.
Year-quarter dummies are suppressed.
*** p<0.01, ** p<0.05, * p<0.10

Table 6 reports the results of these regressions using the Consistent and variable-specific panels with no firm fixed effects. All of the point estimates are positive, but most are not statistically different from zero. There is no evidence that treated banks lowered their expenses in response to Reg II.

Branches and Full-Time Equivalent Employees

The expense regressions did not find evidence that treated firms used cost reductions to mitigate lost interchange income. We next consider branch counts and the number of FTEs to confirm those results. Restructurings through layoffs and branch closures may have increased expenses in the short run, and treated firms may still be repositioning product quality given the new environment.

Table 7 reports the regression results for annual branch growth and quarterly bank FTE growth where we report specifications with and without bank fixed effects.[32] Under the hypothesis that banks looked to decrease operating costs to mitigate lost interchange income, the expected sign of the interaction variable is negative for both outcome variables. However, none of the estimated effects have the expected sign with all of the estimates statistically indistinguishable from zero. Based on these results, we find no evidence that banks adjusted branches or FTEs in response to Reg II.

[32]As discussed in 3, the data for branches and FTEs come from different sources than our other data. As a result, variable-specific panels are the only relevant data for those variables.

Table 7: Branch Count and FTE Regressions

	Branches		**FTEs**	
Variables	1	2	3	4
Durbin×Treat	0.0165	0.0114	0.0472	0.0322
	(0.0194)	(0.0241)	(0.0316)	(0.0257)
Constant	0.0331***	0.0369***	0.0121**	0.0157***
	(0.00417)	(0.00430)	(0.00504)	(0.00468)
Fixed Effects?	No	Yes	No	Yes
Observations	3,998	3,998	9,548	9,548
Firms	852	852	571	571
R-squared	0.004	0.286	0.009	0.312
Adj. R-squared	0.003	0.092	0.007	0.267

Robust standard errors in parentheses are clustered at the firm level.
Year dummies are suppressed for branch regressions, and
year-quarter dummies are suppressed for FTE regressions.
*** p<0.01, ** p<0.05, * p<0.10

Number of Accounts

Given that many treated banks cut their debit card rewards programs, as discussed earlier, and that we find evidence that deposit fees increased at those banks, one possible effect of Reg II could be customers of treated banks switching to untreated banks. To test this possible effect, we use data on the number of deposit accounts reported by commercial banks in the Call Report. We use quarterly data beginning in 2010:Q1 for three types of deposit accounts: accounts ≤$250,000 (small accounts), accounts >$250,000 (large accounts), and their sum (total accounts).[33]

Table 8 shows the regression results, both with and without bank fixed effects. Across all specifications, the coefficient on the variable of interest (Durbin×Treat) is the wrong sign and is statistically significant at the 10 percent level for two of the specifications. Using the point estimate, the results indicate that large banks gained customers following the implementation of Reg II, and the gain was driven by small accounts. J.D. Power and Associates (2011) found that about 9 percent of consumers switched accounts in 2010, so these estimates of 2 to 3 percent additional account growth are economically large. This non-decline is also consistent with TSYS and Mercator Advisory Group (2011) research on debit customers which found none of their focus group participants indicated they

[33]Our data begin in 2010 because banks only had to report account data in their June filing prior to 2010.

Table 8: Number of Accounts Regressions

Variables	Total Accounts 1	Small Accounts 2	Large Accounts 3	Total Accounts 4	Small Accounts 5	Large Accounts 6
Durbin×Treat	0.0308*	0.0297*	0.116	0.0220	0.0224	0.0823
	(0.0178)	(0.0179)	(0.0915)	(0.0252)	(0.0253)	(0.0793)
Constant	-0.0107	-0.0110	0.0499***	-0.00959	-0.00989	0.0523***
	(0.00808)	(0.00822)	(0.0131)	(0.00770)	(0.00788)	(0.0123)
Fixed Effects?	No	No	No	Yes	Yes	Yes
Observations	5,480	5,480	5,479	5,480	5,480	5,479
Firms	569	569	569	569	569	569
R-squared	0.002	0.002	0.019	0.269	0.267	0.414
Adj. R-squared	0.000	0.000	0.017	0.183	0.181	0.345

Robust standard errors in parentheses are clustered at the firm level.
Year-quarter dummies are suppressed.
*** p<0.01, ** p<0.05, * p<0.10

would switch banks if their debit rewards were eliminated.

4.3 Robustness Checks on Income and Expense Reactions

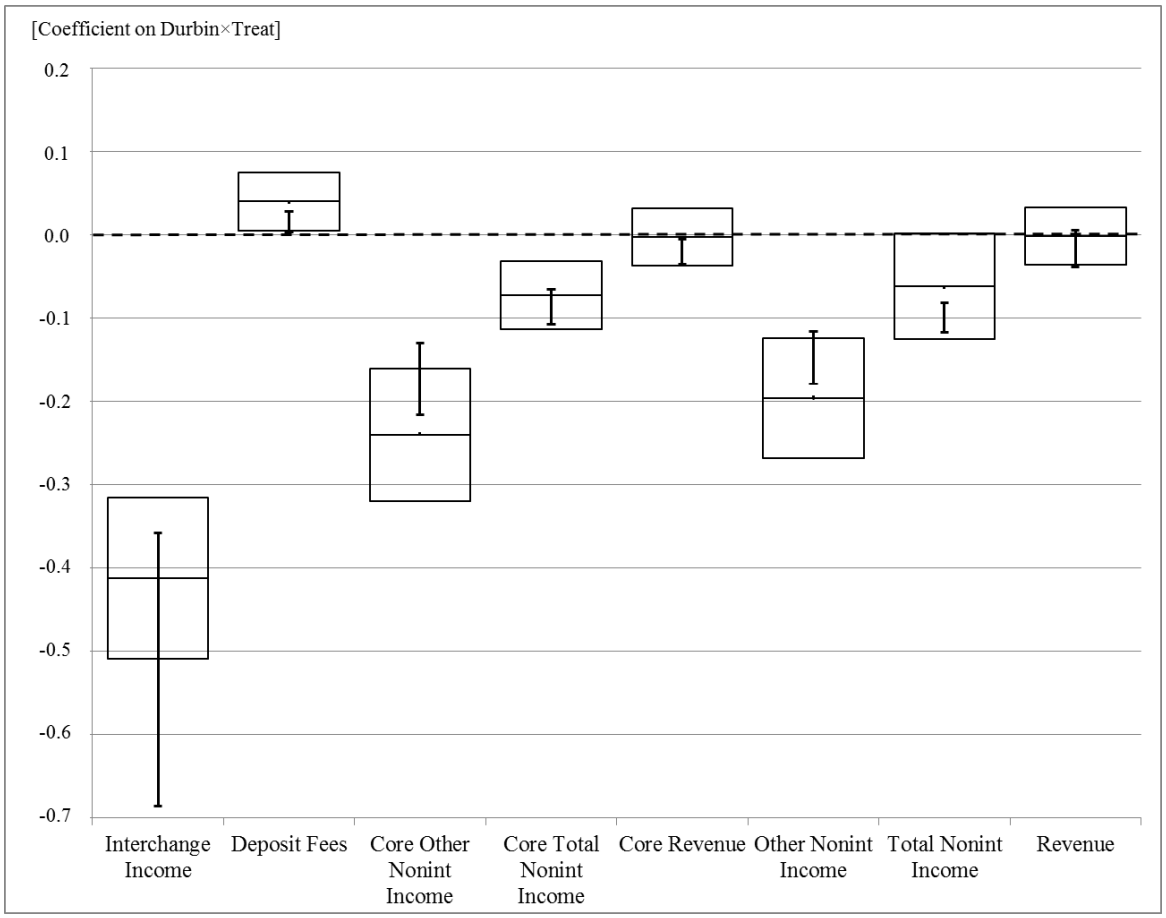
Limiting Sample to Firms Around the $10 Billion Threshold

Identification with the difference-in-differences methodology hinges on constant trends in the treated and untreated firms in the absence of the Durbin Amendment. However, since the analysis is in log differences, in this setting, the relevant trend is in growth rates. This also raises issues of external validity. If firms differ substantially along unobservables, when moving far away from the treatment threshold, it may not be plausible to interpret τ (treatment effect) as a good estimate of the effect a Durbin-like reduction on interchange fees for much smaller and larger banks.

To address these concerns, we re-estimated our earlier regressions but restricted the data to banks in the Consistent Panel with assets in various ranges around the $10 billion threshold. We specifically considered thirty-six asset ranges with a minimum asset size of $3 billion to $8 billion (by intervals of $1 billion) and a maximum asset size of $15 billion to $40 billion (by intervals of $5 billion).[34] Given that few banks have assets around

[34]We classify banks according to their total assets as of December 31, 2010.

Figure 2: Coefficient Sensitivity to Changing Sample, Near $10 Billion Threshold



Note: The y-axis is the point estimate of the coefficient on the interacted term (Durbin×Treated). The range of point estimates for a coefficient based on running thirty-six different asset size regressions is designated by the vertical line. The minimum asset size ranges from $3 billion to $8 billion (by intervals of $1 billion), and the maximum asset size ranges from $15 billion to $40 billion (by intervals of $5 billion). The original estimate is designated by the middle horizontal line in the box. The box outline shows statistical significance at the 5 percent level for the original estimate.

the $10 billion threshold, the resulting sample sizes fall significantly, ranging from 25 firms for the narrowest range ($8 billion to $15 billion) to 101 firms for the widest ranges ($3 billion to $40 billion).

Figure 2 summarizes the point estimates of these regressions and relates them to our estimates from the complete dataset. The vertical bars present the range of point estimates across the various restricted samples. The boxes represent the original estimate and statistical significance at the 5 percent level using our estimates without bank fixed effects.

Despite the limited number of firms, the primary results hold. Interchange income declines for treated firms. The upper bound is a 30 percent drop ($\exp(-0.358)-1 = -0.301$).

Core total noninterest income also declines with point estimates ranging from a 6 to 10 percent decrease. If only statistically significant results at the 5 percent level are considered, the range is a 7 to 10 percent decrease. The sign of the point estimate for the revenue regression is consistently negative across asset groups, ranging from a 0 to 3 percent decline, but none are statistically different from zero. The sign of the point estimate for the deposit fees regression is consistently positive, but again the results are not statistically different from zero. However, given the reduction in sample size, a large loss in power is to be expected. We fail to reject that the restricted and full sample estimates are the same.

Annual Data

Income statement items are reported year-to-date (YTD), are sometimes censored by reporting thresholds, and may contain measurement error due to restatements across quarters and lumpiness in reporting.[35] In addition, window dressing of accounting statements can further complicate the comparison of measures between quarters. In an attempt to ensure these issues are not driving our results, we ran the same tests using annual data (year-to-date income and expense values from the fourth quarter of each year) for the full sample of firms. Using annual data helps handle these issues because it groups together flows across quarters in a consistent year-to-date time period. Table 9 reports the results for our primary income variables.[36] An important caveat is that, since 2011 contains only a single treated quarter while 2012 contains four, the estimates of the 2011 effects should be roughly tripled to compare with 2012 effects.[37] To help capture this, Treat×y2011 = 1 for treated firms, and Treat×y2012 = 3.

Adjusting for the number of quarters to get an annual growth rate, we find estimates that are largely consistent with our earlier results. We again find a significant decrease of approximately 40 percent in interchange income. The coefficients on the interacted terms in the deposit fees regressions are not statistically different from zero and have mixed signs. However, core other noninterest income broadly confirms the previous results

[35]For example, if interchange income for a bank does not reach the reporting thresholds until Q4 of a given year, our quarterly data will attribute all of that income, and any growth from the previous year, solely to the fourth quarter.

[36]For these YTD panels, the Consistent Panel requires annual data for at least the time period 2010-2012 for all dependent variables. Each individual variable panel requires annual data for at least 2010-2012 for the relevant dependent variable.

[37]Because our outcome variable is differenced, the 2012 data contain three times the effect of 2011.

with reductions of approximately 25 percent. Core total noninterest income also declines by approximately 5 percent. There is still insufficient power to detect changes in core revenue. The coefficients on the expense regressions continue to be positive but generally have no statistical significance. For space considerations, these results are not reported.

Table 9: Year-to-Date Income Regressions

	Interchange Income		**Deposit Fees**		**Core Other Noninterest Income**		**Core Total Noninterest Income**		**Core Revenue**	
	Consistent	Interchange	Consistent	Deposit Fees	Consistent	Core Oth Nonint Inc	Consistent	Core Tot Nonint Inc	Consistent	Core Revenue
Variables	1	2	3	4	5	6	7	8	9	10
Treat×y2011	-0.185***	-0.168***	-0.0100	-0.0183	-0.111**	-0.0970**	-0.0568**	-0.0598*	-0.0155	-0.00296
	(0.0468)	(0.0496)	(0.0203)	(0.0226)	(0.0465)	(0.0449)	(0.0262)	(0.0355)	(0.0251)	(0.0271)
Treat×y2012	-0.103***	-0.105***	0.00865	0.00629	-0.0648***	-0.0704***	-0.0132**	-0.0103**	0.00235	-0.0207
	(0.0139)	(0.0151)	(0.00542)	(0.00476)	(0.00991)	(0.0127)	(0.00554)	(0.00520)	(0.00340)	(0.0215)
Constant	0.141***	0.144***	0.00524	0.00688	0.123***	0.121***	0.0151*	0.0248***	0.0359***	0.0414***
	(0.0204)	(0.0203)	(0.00747)	(0.00761)	(0.0153)	(0.0142)	(0.00915)	(0.00909)	(0.00515)	(0.00591)
Observations	2,225	2,261	2,361	3,523	2,334	3,303	2,361	3,600	2,361	3,615
Firms	616	626	616	930	616	887	616	953	616	956
R-squared	0.031	0.031	0.023	0.008	0.036	0.015	0.004	0.002	0.009	0.010
Adj. R-squared	0.029	0.029	0.021	0.006	0.034	0.014	0.002	0.000	0.007	0.009

Robust standard errors in parentheses are clustered at the firm level.
Year dummies are suppressed.
*** p<0.01, ** p<0.05, * p<0.10

4.4 Balance Sheet Reaction

In this section, we consider and rule out the possibility that firms managed their assets in recognition of the $10 billion threshold that determines a firm's status under the Durbin Amendment. To avoid the interchange fee restrictions, firms just above the threshold may have an incentive to shrink their assets to get below it, whereas firms just below the threshold may have an incentive to limit their growth to avoid crossing it. If the benefits of avoiding the interchange fee restrictions outweigh any costs of adjusting assets, this behavior would be a natural response to the threshold. In addition to further illustrating the significance of the interchange fee restrictions, evidence of asset management would provide an interesting example of efforts to avoid differential regulation based on this type of threshold. However, the absence of this sort of behavior is important for the identification strategy we employ in our other analyses. If firms adjusted their assets to affect their status under the Durbin Amendment, then the assumption that treatment was exogenous from the perspective of the firms would be in doubt.

To investigate this issue, we first consider whether patterns of transitions from below the

Table 10: Probability of Nominal Assets Exceeding $10 Billion at Year-End

		Range of Nominal Asset Values at Previous Year-End ($ in Billions)			
		<5	**[5,10)**	**[10,15)**	**≥15**
Year		1	2	3	4
2009	Prob ≥ 10B	0.000	0.083	1.000	1.000
	N	505	36	12	36
2010	Prob ≥ 10B	0.000	0.057	0.800	1.000
	N	536	35	15	37
2011	Prob ≥ 10B	0.000	0.053	0.923	1.000
	N	576	38	13	39
2012	Prob ≥ 10B	0.000	0.054	1.000	1.000
	N	574	37	13	40

Note: The first entry (P ≥ 10B) for each year (rows) provides the empirical frequency that firms have nominal assets in excess of $10 billion at the end of that year conditional on having nominal assets in a particular range (columns) at the end of the previous calendar year. The second entry (N) provides the number of firms with nominal assets in the relevant range at the end of the previous calendar year. This analysis uses the Consistent Panel.

$10 billion threshold to above it, or vice versa, changed over time.[38] In particular, for 2009 through 2012, table 10 shows the empirical probability of exceeding the threshold at the end of a year conditional on having assets in a certain range at the end of the previous year, i.e.,

$$P\left(A_{i,t} \geq 10 \,|\, A_{i,t-1} \in A\right),$$

where $A_{i,t}$ is firm i's nominal assets at time t.[39] The second entry reports the number of firms in that asset range at the end of the previous year. For example, 36 firms in our data had nominal assets between $5 billion and $10 billion at the end of 2008 of which 3 grew above $10 billion by the end of 2009, yielding an estimated probability of 0.083 for that group.[40]

Table 10 documents three key results. First, the threshold is only relevant for firms in a relatively narrow range of assets around $10 billion. No firms below $5 billion grew above

[38]In addition to the non-parametric analysis presented here, we also considered parametric models in which we used probit models, for example, to estimate the probability of assets in excess of $10 billion conditional on previous year-end assets. That analysis yielded similar conclusions to those in tables 10 and 11.

[39]The asset size exemption in the Durbin Amendment is not adjusted for inflation. Our results are largely unchanged if we consider real asset growth relative to the nominal threshold to remove growth due to inflation.

[40]Throughout this section, we use fourth quarter data from the Consistent Panel for 2008 to 2012, although our findings are robust to alternative samples from the data.

the threshold during the time period that we consider, and no firms above $15 billion shrank below it. Second, for firms in the range of $5 billion to $15 billion, transitions above or below the threshold are relatively rare events. Finally, and most importantly for our overall analysis, if we take year-end 2011 as the first post-amendment date, we see little evidence that firms with assets between $5 billion and $10 billion were less likely to grow above $10 billion and no evidence that firms with assets between $10 billion and $15 billion became more likely to fall below the threshold.[41]

The analysis in table 10 examines the exact criterion for a bank's status under the interchange fee restrictions and, therefore, directly addresses the concern over firm treatment endogeneity. However, the lack of any change in the probability of crossing the threshold is necessary but arguably not sufficient to demonstrate the absence of any response. Asset growth may have adjusted in response to the amendment without altering the probabilities in table 10 given the rare nature of the underlying event. Moreover, any conclusions that we might draw about asset growth based on the threshold analysis are complicated by the fact that we cannot distinguish the effects of the Durbin Amendment from other broad factors, such as overall macroeconomic and financial conditions.

To address these concerns, we examine features of the distribution of asset growth by looking at realized growth for firms in different asset ranges around $10 billion. Specifically, using data for 2009 to 2012, we consider a regression of the form

$$\ln\left(A_{i,t}\right) - \ln\left(A_{i,t-1}\right) = \alpha_t + \beta_{1t} d_{1i,t} + \beta_{2t} d_{2i,t} + \varepsilon_{i,t},$$

where $d_{1i,t} = 1$ if $A_{i,t-1} \in [5B, 10B)$ and $d_{2i,t} = 1$ if $A_{i,t-1} \in [10B, 15B)$. By considering the growth of firms at different distances from the threshold, this analysis arguably allows us to compare the experience over time of firms for which the threshold was relevant to those for which it was not in order to isolate the potential effects of the Durbin

Table 11: Estimates of Mean Growth in Nominal Assets

		Range of Nominal Asset Values at Previous Year-End ($ in Billions)		
		[5,10)	**[10,15)**	**All**
2009	Mean	0.008	0.007	0.040
	SE	(0.023)	(0.049)	(0.004)
2010	Mean	-0.030	-0.004	0.013
	SE	(0.028)	(0.041)	(0.004)
2011	Mean	0.023	0.027	0.023
	SE	(0.027)	(0.023)	(0.007)
2012	Mean	0.016	0.038	0.041
	SE	(0.016)	(0.017)	(0.004)

Note: Growth is measured as log differences of year-end assets from $t-1$ to t. The entries for each year (rows) provides the sample mean and standard error (SE) of asset growth for firms having nominal assets in a particular range (columns) at the end of the previous calendar year. These estimates are generated by regressing log differences on year and asset size dummy variables. R-squared value is 0.070.

Amendment.[42]

Table 11 presents the results of this regression and illustrates a number of findings. First, we see a substantial decline in growth from 2009 to 2010, both for firms as a whole and particularly for firms in the two ranges around $10 billion. Notice that the latter effects are generally far from statistically significant. Average growth then recovered substantially in 2011 and 2012 for firms overall. Second, we do not see any significant differences across groups or over time within a group that are indicative of a Durbin Amendment effect. For example, growth in 2011 for firms with assets between $5 billion and $10 billion was higher than growth for firms as a whole and, more importantly, was higher than growth for analogous firms in 2010. We obtain similar results for firms with assets between $10 billion and $15 billion. Although these differences are generally statistically insignificant, their signs are not consistent with firms near the threshold slowing their asset growth to avoid crossing it or shrinking their assets to avoid it. These

[41]Recall that the interchange fee restrictions became effective in the fourth quarter of 2011. A firm's status in that quarter was based on its assets as of year-end 2010. However, firms were unlikely to anticipate that their 2010 assets would govern their exempt status in 2011:Q4, as this relationship was not specified in the Durbin Amendment, but was established when the implementing regulation was finalized in mid-2011. As a result, year-end 2011 is arguably the first date at which firms might consider their assets relative to the amendment's threshold.

[42]We also considered non-parametric kernel estimators to allow even more flexibility in growth around the threshold. That analysis yielded similar conclusions to those in table 11.

findings should be somewhat intuitive. Average bank return on assets is about one percent. We find treated firms would have had about $30 million in high interchange income in the absence of Reg II. So firms should have been willing to shrink at most about $3 billion dollars to avoid the law.[43]

The results in tables 10 and 11 provide no evidence that firms have engaged in significant management of their assets to affect their status under the Durbin Amendment. To the extent that banks continue to grow over time, the threshold in the amendment will become relevant for an increasing number of firms. As this occurs, it will be interesting to revisit and extend this analysis to examine whether firms appear to respond to this regulatory threshold.

5 Conclusion

In aggregate, we estimate that Reg II reduced income at large banks by nearly $14 billion a year or more than 5 percent of core total noninterest income. As multi-product oligopolists, banks had multiple margins on which to ameliorate this effect: raising revenue on other products, reducing the quality of related services, and strategically altering their balance sheets to avoid being treated by the law. Indeed, they said so. Several financial institutions referred to lost interchange revenue and related mitigation in earnings conference calls or public communications, including Fifth Third Bank, PNC Financial, Regions Financial, TD Bank, and US Bancorp. For example, during the fourth quarter 2011 earnings conference call for Fifth Third Bank, the bank's CFO made the following comment with regard to interchange fee regulation:

> We have a multi-pronged mitigation approach that would include such actions as reducing the cost associated with debt card offers, changes and eliminations to rewards, selected fees, incorporation of debit usage in the bundled deposit product offerings, and the implementation of new products. We are consulting with our customers about their preferences for our services

[43] Assuming more mitigation implies an even smaller adjustment.

> and how they pay for those services. (Source: FactSet CallStreet and provided by SNL Financial. The conference call was on January 20, 2012.)

In practice, raising revenue on other products was important. Banks were able to offset approximately 30 percent of lost interchange revenue with higher fees on deposit services. Assessing the effect of Reg II on higher level income measures allows us to reject full mitigation of the law up to the level of core total noninterest income. Mitigation consistent with the observed higher deposit fees cannot be rejected. Bank expenses like salaries, premises, and noninterest expenses do not diminish in response to the law. The number of branches and bank headcount also do not decline. As measured by changes in balance sheets, banks are neither less likely to grow to above $10 billion in assets the law uses as a threshold, nor do banks below the threshold grow more slowly.

We find that these results are robust to numerous variations in the composition of the panel. Restricted subsamples focusing on banks near the $10 billion threshold also give similar results. Finally, we obtain similar results using yearly rather than quarterly data.

In light of these results and their limitations, better data would allow a more fulsome analysis of debit and credit card markets and the effects of Reg II and related regulations. Three specific examples come to mind. First, disaggregated information about debit and credit card interchange income, along with more complete information about transaction volumes, would allow analysis of substitution across products in response to the regulation. Second, detailed data about rewards programs and account fees would provide a more complete picture of banks' pricing changes. Finally, data on merchant acquiring income would provide information about pass-through of interchange fees on that side of the market with implications for both banks and merchants.

These last data also speak to a further margin of adjustment, namely the effect of reduced interchange fees on retail prices. A full evaluation of regulation in this market requires examination of the responses of and effects on all of the participants in the system, including banks, merchants, and consumers. In this paper, we provide an analysis for one part of the system with potential implications for bank customers. To understand how much consumers benefit or lose from the law requires summing the costs of higher bank

fees with savings from lower retail prices from passed-through reductions in merchant discounts. This remains important future work.

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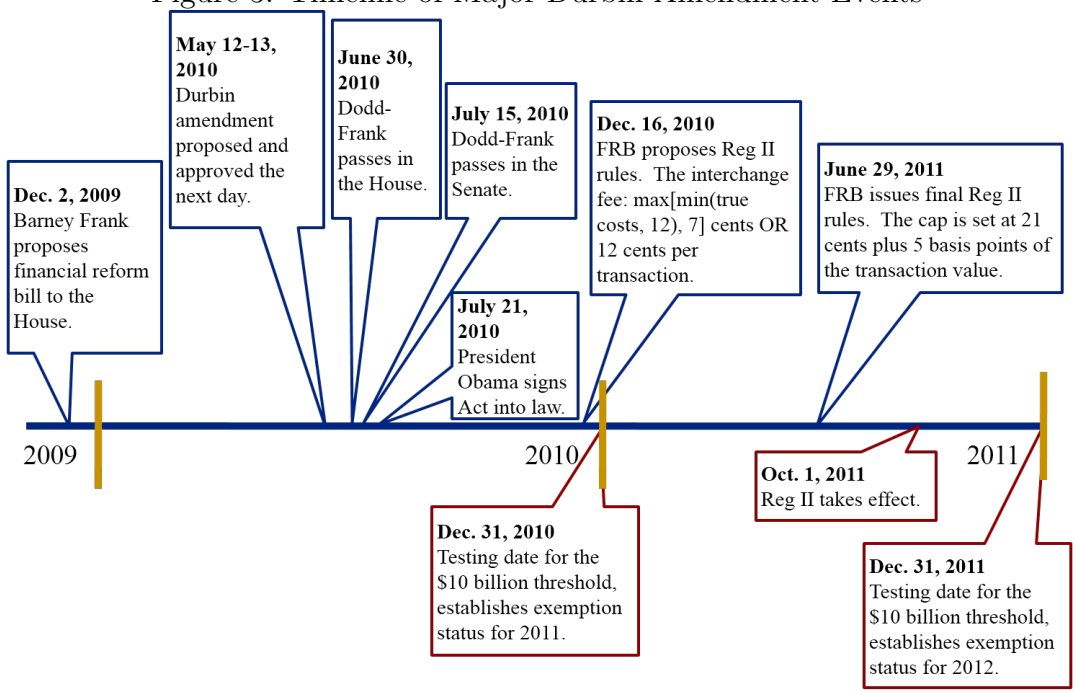
A Details on Reg II and the Durbin Amendment

The statute instructed the Board to issue final regulations related to the interchange fee restrictions within nine months of the passage of the Dodd-Frank Act, with an effective date of July 21, 2011. Figure 3 shows a timeline of major events related to the interchange fee regulation and, more broadly, the Dodd-Frank Act and the Durbin Amendment. In line with standard practice, the Board issued a proposed interpretation of the statute on December 16, 2010 and invited public comment. That interpretation contained two proposals for interchange fee restrictions. The first permitted a covered issuer to receive an interchange fee equal to its allowable per-transaction costs up to a cap of 12 cents per transaction with a "safe harbor" of 7 cents per transaction and the second specified a cap of 12 cents per transaction for all covered issuers.

Figure 3: Timeline of Major Durbin Amendment Events



Following a period of robust public comment, during which interested parties submitted a large number of comments on the proposal (Mui 2011) and legislation to delay the rule was not successful (Farnam 2011; Mui and Podkul 2011), the Board issued Reg II on June 29, 2011, which codified the final rules concerning the Durbin Amendment. In recognition of delays in the rule-writing process and the need to provide industry participants with time to comply, the regulation altered the effective dates for various provisions in the Durbin Amendment and specifically established October 1, 2011 (2011:Q4) as the effective date for the restrictions on interchange fees.

With respect to those restrictions, Reg II includes a single cap equal to 21 cents per

transaction applicable to all covered issuers.[44] Moreover, in recognition of the risk of fraud losses faced by an issuer, the interchange cap also permits covered issuers to receive up to 0.05 percent of the transaction value through interchange fees. Finally, as authorized by the Durbin Amendment, the regulation allows covered issuers to receive up to 1 cent per transaction for fraud-prevention costs provided an issuer meets the fraud-prevention standards established by the Board.[45]

B Data Appendix

B.1 Construction of Testing Panels

As described in section 3, we collect data from a variety of sources, which we then combine to yield a series of panel data sets. Our first data source, commonly known as the Y-9C based on the title of the associated reporting form, is the Consolidated Financial Statements for Holding Companies, which are regulatory data reported quarterly by BHCs with assets of $500 million or more. From these reports, we collect the income and expense items listed in schedule HI. Notably, these variables are related hierarchically. For example, interchange income is a component of other noninterest income along with items that we do not examine, such as safe deposit rent. Other noninterest income is, in turn, a component of noninterest income, as are deposit fees, another variable in our data. Tables 12 and 13 provide more detail about the relationship between variables in the Y-9C filings and the variables used in regressions (bolded).

As noted in the text, we collect bank-level data from two sources. First, we obtain information about the number of deposit accounts and full time equivalent employees for an institution from the quarterly Consolidated Reports of Condition and Income (Call Report) filed by commercial banks. Second, we collect annual counts of bank branches from the SOD published by the FDIC as of the end of the second quarter of each year. We aggregate these bank-level variables to the level of the topholder BHC. To do so, we use ownership and institutional information collected by the Federal Reserve System to

[44]The higher value in the final regulation reflects a somewhat broader definition of allowable costs than were considered in the original proposal. The numerical values for interchange fees in both the proposed and final regulation were based on information about debit card transaction costs that the Board collected through a survey of covered issuers in the fall of 2010. The survey instrument and a summary of the findings are available at `www.federalreserve.gov/paymentsystems/regii-data-collections.htm`.

[45]The Durbin Amendment required the Board to establish fraud prevention standards for debit card transactions, and issuers meeting those standards would be eligible to receive an additional fee to offset their costs of compliance.

Table 12: Income & Core Income Items (Schedule HI/RI item numbers*)

Income
Revenue
Total interest income (1.h/1.h)
-Total interest expense (2.f/2.e)
+Total noninterest income (5.m/5.m)
Revenue
Noninterest income
Income from fiduciary activities (5.a/5.a)
+Service charges on deposit account in domestic offices–"**Deposit fee**" (5.b/5.b)
+Trading revenue (5.c/5.c)
+Fees and commissions from securities brokerage (5.d.(1)/5.d.(1))
+Investment banking, advisory, and underwriting fees and commissions (5.d.(2)/5.d.(2))
+Fees and commissions from annuity sales (5.d.(3)/5.d.(3))
+Underwriting income from insurance and reinsurance activities (5.d.(4)/5.d.(4))
+Income from other insurance activities (5.d.(5)/5.d.(5))
+Venture capital revenue (5.e/5.e)
+Net servicing fees (5.f/5.f)
+Net securitization income (5.g/5.g)
Not applicable [sic] (5.h/5.h)
+Net gains (losses) on sales of loans and leases (5.i/5.i)
+Net gains (losses) on sales of other real estate owned (5.j/5.j)
+Net gains (losses) on sales of other assets (excluding securities) (5.k/5.k)
+**Other noninterest income** (5.l/5.l)
Total noninterest income (5.m/5.m)
Other noninterest income
Fee from printing and sale of checks (M.6.a/1.a)
+Earnings from life insurance (M.6.b/1.b)
+ATM income (M.6.c/1.c)
+Rent and other income from other real estate owned (M.6.d/1.d)
+Safe deposit rent (M.6.e/1.e)
+Net change in financial instruments accounted for under a fair value option (M.6.f/1.f)
+Bank card and credit card interchange fees–"**Interchange income**" (M.6.g/1.g)
+Gains on bargain purchases (M.6.h/1.h)
+Three text spaces to provide further items (M.6.i-M.6.k/1.i-1.k)
Other noninterest income (5.l/5.1)

Core Income Definitions (using Y-9C items)
Core other noninterest income = M.6.a + M.6.b + M.6.c + M.6.d + M.6.e + M.6.g
Core total noninterest income = 5.a + 5.b + 5.d.(1-5) + 5.e + 5.f + 5.g + Core other nonint inc
Core revenue = Total interest income - Total interest expense + Core total nonint inc

* The HI schedule is part of the Y-9C, and the RI schedule is part of the Call Report. Items that are memorandum items ("M") in the Y-9C appear in schedule RI-E of the Call Report.

identify the topholder BHC for each bank.[46] We then combine the bank-level data for all subsidiaries of a given topholder BHC. For example, the number of a BHC's branches reflects the number of total branches for its bank affiliates as reported in the SOD. We then merge the resulting BHC-level data with the data for topholder BHCs from the

[46] Most of this relationship data is available through the National Information Center website at `www.ffiec.gov/nicpubseb/nicweb/SearchForm.aspx`.

Table 13: Expense Items (Schedule HI/RI item numbers*)

Expense
Total noninterest expense
Salaries and employee benefits–"**Salaries**" (7.a/7.a)
+Expenses of premises and fixed assets–"**Premises**" (7.b/7.b)
+Goodwill impairment losses (7.c.(1)/7.c.(1))
+Amortization expense and impairment losses for other intangible assets (7.c.(2)/7.c.(2))
+**Other noninterest expense** (7.d/7.d)
Total noninterest expense (7.e/7.e)
Other noninterest expense
Data processing expenses (M.7.a/2.a)
+Advertising and marketing expenses (M.7.b/2.b)
+Directors' fees (M.7.c/2.c)
+Printing, stationery, and supplies (M.7.d/2.d)
+Postage (M.7.e/2.e)
+Legal fees and expenses (M.7.f/2.f)
+FDIC deposit insurance assessments (M.7.g/2.g)
+Accounting and auditing expenses (M.7.h/2.h)
+Consulting and advisory expenses (M.7.i/2.i)
+ATM and interchange expenses–"**Interchange Expense**" (M.7.j/2.j)
+Telecommunications expenses (M.7.k/2.k)
+Three text spaces to provide further items (M.7.l-M.7.n/2.l-2.n)
Other noninterest expense (7.d/7.d)

* The HI schedule is part of the Y-9C, and the RI schedule is part of the Call Report. Items that are memorandum items ("M") in the Y-9C appear in schedule RI-E of the Call Report.

Y-9C.

To determine the exemption status of firms in our data, we obtain information about the status of individual banks from the lists of exempt and non-exempt depository institutions that the Board has issued annually since 2011.[47] Per the regulation, the lists base an institution's status for a given year on its consolidated year-end assets for the previous year. For example, an institution's status for 2011 reflects assets for itself and all of its affiliates from regulatory filings for December 31, 2010. The regulation allows firms that become newly non-exempt to come into compliance with the interchange restrictions by the third quarter of the year of the transition. The status variables that we use account for this lag. The status of a standalone bank follows from its categorization on the lists, whereas a topholder BHC inherits the status of its subsidiary banks.[48]

We clean these data in several ways. First, for most of our analysis, we convert the year-to-date income statement items into quarterly data.[49] Second, we adjust the data for mergers and acquisitions that occur during a year to avoid distortions to the quarterly data of a BHC that absorbs a purchased bank during the course of a year.[50] Finally, to clean up data errors, we exclude observations of income statement items that are negative.[51] Negative items are rare and generally occur with the same frequency across treated and untreated BHCs. Occurrences of negatives are summarized in table 14.

Table 14: Occurrences of Negative Values, by Treatment Group

	Interchange	Deposit Fee	Other Nonint Income	Total Nonint Income	Revenue	Salaries	Premises	Other Nonint Expense	Total Nonint Expense	All Obs
Negative Observations										
Treated Firms	18	7	84	56	12	4	3	6	3	1,755
Untreated Firms	209	17	306	699	33	7	9	23	8	18,509
All Firms	227	24	390	755	45	11	12	29	11	20,264
Percent of Observations (by group)										
Treated Firms	1	0	5	3	1	0	0	0	0	
Untreated Firms	1	0	2	4	0	0	0	0	0	
All Firms	1	0	2	4	0	0	0	0	0	

[47]The most recent lists are available at `www.federalreserve.gov/paymentsystems/regii-interchange-fee-standards.htm`.

[48]Because exemption status depends on total consolidated assets, a BHC cannot control both exempt and non-exempt banks.

[49]As we discuss in more detail in section 3, we perform some analysis using annual data.

[50]Under reporting rules, the income statement items of a purchased bank for quarters prior to the completion of a merger are not included in the regulatory filings of the purchaser. Merger adjustment adds income statement flows for the target bank to those of the purchaser by using the target's financials from filings earlier in the year. Because income statement items are reported year-to-date, these adjustments are larger in later quarters.

[51]Note that expense items are reported as positive numbers. Negative numbers can occur due to true losses, reporting errors, restatement adjustments, or items that are not reported every quarter because a threshold is not met.

B.2 Reasons for Using Core Income Measures

Table 15 reports the law's effect on aggregated measures of bank income that include core and non-core income. As reported in columns 1 and 2 of table 15, other noninterest income is substantially reduced by the law, in the range of 15 to 18 percent ($\exp(-0.196) - 1 = -0.18$; $\exp(-0.158) - 1 = -0.15$). Because interchange income is about 37 percent of other noninterest income for treated firms in the Consistent Panel (table 4), the regression result actually implies that other noninterest income fell more than if interchange income fell as observed but everything else remained unchanged (18 percent $> 0.34 \times 0.37 =$ 12.6 percent).

Table 15: Broader Income Category Regressions

	Other Noninterest Inc		**Total Noninterest Inc**		**Revenue**	
	Consistent	Oth Nonint Inc	Consistent	Tot Nonint Inc	Consistent	Revenue
Variables	1	2	3	4	5	6
Durbin×Treat	-0.196***	-0.158***	-0.0618*	-0.107***	-0.00168	-0.0383*
	(0.0365)	(0.0392)	(0.0325)	(0.0322)	(0.0176)	(0.0222)
Constant	-0.00238	-0.0188	0.00993	-0.00282	0.0341***	0.0178**
	(0.0215)	(0.0187)	(0.0159)	(0.0148)	(0.00781)	(0.00812)
Observations	11,174	16,371	10,904	15,529	11,415	17,024
Firms	688	1,029	688	983	688	1,047
R-squared	0.008	0.005	0.018	0.014	0.007	0.007
Adj. R-squared	0.007	0.004	0.017	0.013	0.006	0.005

Robust standard errors in parentheses are clustered at the firm level.
Year-quarter dummies are suppressed.
*** p<0.01, ** p<0.05, * p<0.10

The estimated effect on total noninterest income is also negative and statistically significant. Using the point estimate, the effect is again more than expected based on the decrease in interchange income and the relative size of interchange income to total noninterest income (6.2 percent $> 0.34 \times 0.15 = 5.1$ percent), implying no mitigation at this level. In general, banks were unable to make broader income sources offset the Durbin Amendment, otherwise the effects from table 2 would be attenuated rather than amplified.

Finally, the revenue regression results also show a decrease for treated firms, but results are quantitatively low and only the one specification has weakly significant results. These results are sensible given that interchange income was only 4 percent of revenue for the Consistent Panel before the law (table 4).

It is somewhat puzzling that treatment effects on higher level income measures are too

large relative to what we would expect. That is, in the absence of mitigation,

$$\Delta\text{interchange} \times \frac{\text{interchange}}{\text{broader income}} \quad = \quad \Delta\text{broader income},$$

but instead we find that broader income falls roughly one-and-a-half times as much as we would expect. This anomaly is caused by the timing of one-time charge-offs from financial risk taking owing to decisions made significantly before debit card reform.

A review of the changes in the components (M.6.a-M.6.k) of other noninterest income (5.l) reveals several key findings.[52] For the Consistent Panel, a majority (64 percent) of other noninterest income is not in the formal subcategories (M.6.a-M.6.g).[53] This nonformal other noninterest income consists of two parts: 1) three free text fields (M.6.i-M.6.k), amounting to 24 percent of other noninterest income and 2) a little-documented residual component that equals other noninterest income - sum(M.6.a-M.6.g,M.6.i-M.6.k), amounting to 40 percent of other noninterest income.

Examination of the three free text fields, especially for treated firms, reveals that there were large decreases in the values contemporaneous with the implementation of Reg II. Further, these large changes (losses) are associated with changes in the values of hedges, negative revaluations of FDIC loss share agreements, and other sources that appear to be realizations of pre-Durbin decisions and nonrecurring in nature. It is likely that the residual component is also made of similar extraordinary items. As a result of these, we use the core income measures for our primary analysis.

B.3 Instructions for Other Noninterest Income and Expense

The form instructions for other noninterest income state that banks are to

> Include as other noninterest income:. . . (6) Charges to merchants for the bank's handling of credit card or charge sales when the holding company does not carry the related loan accounts on its books. Holding companies may report this income net of the expenses (except salaries) related to the handling of these credit card sales.[54]

Similar language appears for other noninterest expense:

[52] These components are listed in table 12 in appendix B.
[53] Category M.6.h is excluded because this line item is only available beginning 2009:Q4.
[54] Y-9C instructions are available at `www.federalreserve.gov/apps/reportforms/default.aspx`.

> (24) Expenses (except salaries) related to handling credit card or charge sales received from merchants when the holding company or its consolidated subsidiaries do not carry the related loan accounts on its books. Holding companies are also permitted to net these expenses against their charges to merchants for the holding company's handling of these sales reported in item 5(l) above.

These instructions allow banks to either report interchange income gross or net of related expenses.

B.4 Instructions for Deposit Fees

The deposit fee line item in regulatory financial statements includes a wide variety of fees. The language below comes from the reporting form instructions.

Current Y-9C Instructions for Deposit Fees
Line Item 5(b) Service charges on deposit accounts in domestic offices. Report in this item amounts charged depositors in domestic offices:
(1) For the maintenance of their deposit accounts with the bank holding company or its consolidated subsidiaries, so-called "maintenance charges."
(2) For their failure to maintain specified minimum deposit balances.
(3) Based on the number of checks drawn on and deposits made in their deposit accounts.
(4) For checks drawn on so-called "no minimum balance" deposit accounts.
(5) For withdrawals from nontransaction deposit accounts.
(6) For the closing of savings accounts before a specified minimum period of time has elapsed.
(7) For accounts which have remained inactive for extended periods of time or which have become dormant.
(8) For deposits to or withdrawals from deposit accounts through the use of automated teller machines or remote service units.
(9) For the processing of checks drawn against insufficient funds, so-called "NSF check charges," that the subsidiary banks of the bank holding company assess regardless of whether it decides to pay, return, or hold the check. Exclude subsequent charges levied against overdrawn accounts based on the length of time the account has been overdrawn, the magnitude of the overdrawn balance, or which are otherwise equivalent to interest (report in the appropriate subitem of item 1(a)(1), "Interest and fee income on loans in domestic offices").
(10) For issuing stop payment orders.

(11) For certifying checks.
(12) For the accumulation or disbursement of funds deposited to Individual Retirement Accounts (IRAs) or Keogh Plan accounts when not handled by the trust departments of subsidiary banks of the reporting bank holding company. Report such commissions and fees received for accounts handled by the trust departments of the holding company's banking subsidiaries or by other consolidated subsidiaries in item 5(a), "Income from fiduciary activities." Exclude penalties paid by depositors for the early withdrawal of time deposits (report in item 5(l), "Other noninterest income," or deduct from the interest expense of the related category of time deposits, as appropriate).

C Further Robustness Checks

C.1 Interchange Income Regressions for Firms Above the Threshold

As discussed in section 4.1, only firms with $25,000 of interchange income that exceeds 3 percent of other noninterest income are required to report interchange income. However, several firms not meeting this threshold still report interchange income. In order to avoid any biases, table 16 shows the regression results excluding these voluntary reporters. The results still hold. Interchange income declines in the range of 31 to 33 percent.

Table 16: Interchange Income Regressions—Only Firms Above the Threshold

Variables	Consistent 1	Interchange Inc. 2	Consistent 3	Interchange Inc. 4
Durbin×Treat	-0.394***	-0.378***	-0.394***	-0.381***
	(0.0483)	(0.0479)	(0.0485)	(0.0480)
Constant	0.118***	0.118***	0.131***	0.131***
	(0.0234)	(0.0233)	(0.0235)	(0.0234)
Fixed Effects?	No	No	Yes	Yes
Observations	9,682	9,829	9,682	9,829
Firms	652	662	652	662
R-squared	0.029	0.028	0.189	0.190
Adj. R-squared	0.028	0.027	0.129	0.129

Robust standard errors in parentheses are clustered at the firm level.
Year-quarter dummies are suppressed.
*** p<0.01, ** p<0.05, * p<0.10