CREDIT CARD PRICING: THE CARD ACT AND BEYOND

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We take a fresh look at the concerns about credit card pricing and empirically investigate whether the Credit CARD Act of 2009 (the CARD Act) has been successful in addressing those concerns. The rational choice theory of credit card pricing, which posits that issuers use back-end fees to adjust the price of credit to reflect new information about borrowers' credit risk, predicts that issuers will respond to the CARD Act by using alternative ways to price risk. In contrast, the behavioral economics theory, which posits that issuers use back-end fees because they are not salient to consumers, predicts that issuers will respond by increasing unregulated nonsalient prices. If the market is competitive, we argue that the CARD Act should also result in increases in some salient, up-front prices. But we show that if issuers have market power, reductions in nonsalient fees may not result in concomitant increases in salient charges. We test these predictions using two datasets on credit card contract terms before and after the CARD Act rules went into effect. We find that the rules have substantially reduced the back-end fees directly regulated by the CARD Act, including late fees and over-the-limit fees. However, unregulated contract terms, such as annual fees and purchase interest rates, have changed little. Post–CARD Act, consumers continue to face high long-term prices and low short-term prices, and imperfectly rational consumers still have difficulty understanding the cost of credit card borrowing. We thus consider potential improvements to the regulatory framework. We argue that improved disclosures that provide consumers with the aggregate cost of credit under the contract, based on information about the borrower's likely use of credit, would improve consumer outcomes. Furthermore, we suggest that regulators should not focus only on prices that are "too high" but should also consider limiting the ability of issuers to charge introductory teaser interest rates that are, in a sense, "too low."

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INTRODUCTION

Credit card contracts have come under increased public and political scrutiny. This scrutiny culminated in the passage, by an overwhelming bipartisan majority, of the Credit Card Accountability, Responsibility, and Disclosure Act of 2009 (the CARD Act)[1] and in the creation, as part of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (the Dodd-Frank Act),[2] of the Consumer Financial Protection Bureau (CFPB).[3] One of the main concerns motivating this landmark legal reform was the pricing structure used by many credit card issuers. Specifically, credit card contracts commonly lure consumers with low short-term prices (e.g., no annual fees and zero-percent introductory or teaser rates) and then impose high long-term prices (e.g., default interest rates and penalty fees).

The CARD Act specifically targets this pricing structure or, more accurately, one part of this pricing structure: it imposes limits on high long-term prices but does not meaningfully restrict issuers' ability to set low short-term prices. It significantly curtails interest rate increases: teaser rates must be in place for at least six months before the card account reverts to the higher "go-to" rate. Excluding the expiration of teaser rates and a few other narrow exceptions, issuers cannot increase interest rates in the first year after opening the credit card account. Rate increases, after the first year, apply only to new charges, not to existing balances. Long-term penalty fees have also been substantially restricted: late fees are restricted in magnitude and issuers may not charge over-the-limit fees unless the consumer explicitly requests that the issuer allow transactions that take the consumer over the credit limit. Finally, inactivity fees are banned.[4]

In this Article, we take a fresh look at the concerns about credit card pricing and empirically explore whether the CARD Act has been successful in addressing these concerns. Based on our findings, we offer tentative proposals for improving credit card regulation.

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1 Pub. L. No. 111-24, 123 Stat. 1734 (2009) (codified in scattered sections of 5, 11, 15, 20, and 31 U.S.C. (Supp. IV 2010)).

2 Pub. L. No. 111-203, 124 Stat. 1376 (2010) (codified in scattered sections of 7, 12, 15, 18, 22, 31, and 41 U.S.C. (Supp. IV 2010)).

3 Consumer Financial Protection Act, 12 U.S.C. § 5301 (Supp. IV 2010).

4 *See What You Need to Know: New Credit Card Rules Effective Aug. 22*, BOARD GOVERNORS FED. RES. SYS., http://www.federalreserve.gov/consumerinfo/wyntk_creditcardrules2.htm (last updated June 15, 2010); *What You Need to Know: New Credit Card Rules Effective Feb. 22*, BOARD GOVERNORS FED. RES. SYS., http://www.federalreserve.gov/consumerinfo/wyntk_creditcardrules.htm (last updated Mar. 11, 2010). For a summary of the CARD Act rules, see *infra* Table 1. Restrictions on permissible payment allocation methods and balance calculation methods further reduce the amount that consumers pay in long-term interest and fees.

We begin, in Part I, by surveying existing explanations for the low short-term prices and high long-term prices common in credit card contracts and considering their implications for the effects of the CARD Act. There are two main theories for why issuers charge the high back-end fees regulated by the CARD Act—the rational choice theory and the behavioral economics theory. Each provides a framework for analyzing the consequences of the CARD Act.[5]

We first consider the rational-choice, efficiency theory. Under this theory, issuers use the fees and rates regulated by the CARD Act to price risk.[6] Issuers set basic purchase annual percentage rates (APRs) for each consumer based on the issuer's initial assessment of the borrower's risk. Consumers who are subsequently revealed to be higher risk through their borrowing and repayment behavior under the contract are then charged increased rates and additional fees, such as default interest rates and late fees. The result of this *ex post* repricing is that borrowers with a higher risk of defaulting pay more for credit, resulting in a more efficient credit market.

The CARD Act restricts some of the back-end contractual instruments available to issuers to price risk.[7] The rational choice theory thus predicts that the CARD Act will result in issuers using alternative ways to price risk. Issuers can be expected to find different means of *ex post* risk-based repricing like the cash-advance fee. They can also be expected to engage in more *ex ante* risk-based pricing. For example, in the pre–CARD Act world, some issuers, relying on their ability to match price to risk through back-end rates and fees, engaged in only limited risk-based pricing on the front-end—offering the same basic APR on all approved applications regardless of credit score or other risk characteristics. The rational choice theory predicts that more issuers will offer risk-based pricing

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5 In a recent article, Adam Levitin explores rational-choice, risk-based accounts of rate-jacking—one important instance of high long-term prices, in our terminology. Levitin contrasts the risk-based pricing account with an "opportunistic pricing" account that has a behavioral economics flavor. *See* Adam J. Levitin, *Rate-Jacking: Risk-Based & Opportunistic Pricing in Credit Cards*, 2011 UTAH L. REV. 339, 342.

6 While focusing on the risk-based pricing theory of credit card pricing, we note another rational choice theory. According to this theory, the credit card product includes certain optional services such as obtaining a cash advance or using the card outside the United States. It is efficient to price these optional services separately through back-end fees (e.g., a cash-advance fee and a currency-conversion fee). Otherwise, issuers would be forced to cover the cost of these services by increasing the annual fee or the basic interest rate, and cardholders who do not utilize the optional services will cross-subsidize cardholders who do utilize these services. The cross-subsidy would also result in excessive use of the optional services and in inadequately low use of credit cards by cardholders who do not utilize the optional services. *See* OREN BAR-GILL, SEDUCTION BY CONTRACT: LAW, ECONOMICS AND PSYCHOLOGY IN CONSUMER MARKETS (forthcoming 2012) (manuscript at 18–20) (on file with authors).

7 *See supra* note 4 and accompanying text.

up front since they no longer can rely on back-end prices, such as default interest rates and late fees to effectively price risk. This means that the variance of the basic APR can be expected to increase.

With fewer ways to price risk, the optimal contract under the CARD Act will be less effective at pricing risk. Consequently, we expect the average initial basic APR charged to rise, spreading the cost of risk across all cardholders. This may also result in a reduction in the prevalence of teaser rates. Under the rational choice theory, the main effect of the CARD Act should be to raise the price for actually using credit, specifically the basic APR.

Importantly, if the rational choice theory fully explains issuers' use of high back-end fees, then the CARD Act may very well reduce social welfare. Since the cost of unpriced risk will be spread across all cardholders, low-risk cardholders ultimately cross-subsidize higher-risk cardholders. This implies that high-risk consumers will end up using credit cards excessively while low-risk consumers will not use enough. Also, because increased risk is not priced (or not fully priced), cardholders will undertake excessive risk-increasing actions. And, again, to the extent that issuers cannot anticipate these risk-increasing actions and price them *ex ante*, they will spread the cost of the unpriced risk across all cardholders.

The behavioral economics theory provides a very different explanation of the high back-end fees regulated by the CARD Act: issuers use these fees because they are not salient to consumers. According to the behavioral theory, imperfectly rational consumers place excessive weight on short-term, salient prices and insufficient weight on long-term, nonsalient prices. Faced with such biased demand, issuers offer low short-term prices and high long-term prices to minimize the perceived total price of their product. Losses on the low, below-cost, short-term prices are recouped through high, above-cost, long-term prices. Additionally, front-end benefits to borrowers are funded by back-end costs.[8]

Under the behavioral theory, with the CARD Act in place, issuers still have the same incentive to use nonsalient fees but may only do so in a restricted manner.[9] The theory thus predicts that issuers will respond by increasing the remaining unregulated nonsalient prices on the contract, such as cash-advance fees and rates.

Furthermore, if the restrictions on nonsalient fees are sufficiently strong and the market remains sufficiently competitive, we also expect an increase in salient fees, such as annual fees and purchase APRs, and a reduction in the use of teaser rates. The

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8 *See* BAR-GILL, *supra* note 6.

9 *See supra* note 4 and accompanying text.

intuition becomes clear under the assumption of perfect competition. In a perfectly competitive market, issuers merely break even prior to the CARD Act rules. When the rules restricting the use of nonsalient fees are applied, issuers have to raise other prices on the contract, including potentially salient prices, to compensate for the loss in revenue from the regulated contract terms. If issuers have market power, however, they may prefer to keep unregulated, salient prices low to maintain high consumer demand.

While the rational choice theory has trouble justifying many of the CARD Act rules, the rules make perfect sense under the behavioral economics theory. According to this theory, pre–CARD Act prices were distorted: long-term, nonsalient prices were too high and short-term, salient prices were too low. Further, though efficient incentives require cost-based pricing, we instead had salience-based pricing. Indeed, the CARD Act helps to correct this distortion.[10]

Importantly, we do not think of the rational choice theory and the behavioral economics theory as necessarily mutually exclusive. Issuers could use certain contract terms both to price risk and because they are nonsalient to consumers.

In Part II, we empirically evaluate the effects of the CARD Act on long-term and short-term prices and describe the current state of credit card pricing using the Federal Reserve's *Report of Terms of Credit Card Plans* and a hand-coded dataset of credit card agreements. We show that the CARD Act had its intended effect on over-the-limit fees and late payment fees, two items that the CARD Act directly regulates. However, credit card terms not directly regulated by the CARD Act exhibited little change. The basic pricing structure used in the market prior to the CARD Act, consisting of low up-front prices and high back-end rates and fees, still remains in place. Introductory APRs have not decreased in popularity since the CARD Act's passage. Consumers face the same prevalence of default APRs should they fail to keep up with their payments. The fact that contract terms not regulated by the CARD Act did not adjust sufficiently to compensate for the loss in revenue from the regulated terms provides evidence that issuers have some degree of market power, perhaps stemming from consumers' switching costs (psychological or otherwise).

Given the persistence of this pricing structure under current rules, we conclude in Part III by exploring alternative regulatory approaches. First, we consider the possibility of designing a total-cost

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10 *See* BAR-GILL, *supra* note 6. When consumers behave in imperfectly rational ways, even prices that reflect the social cost of credit will not generally provide optimal incentives. *See id.* at 20. Consumer misperception distorts incentives, even when issuers do not deliberately distort prices. Skewed pricing exacerbates the incentive problem. *See id.* at 12. The CARD Act improves incentives by restricting skewed, salience-based pricing.

disclosure system that would aggregate both short-term and long-term price dimensions and thus help consumers choose optimally between competing credit card offers. Such disclosure, if effective, would also reduce issuers' incentives to decrease short-term prices and increase long-term prices. Second, we consider the possibility of directly regulating teaser rates. The CARD Act's prohibitions currently focus on back-end fees that are arguably *too high*. However, certain potential efficiency explanations do exist for these fees, described above, creating a real concern that there may be unintended consequences. In contrast, the CARD Act leaves untouched up-front prices that are *too low*, such as teaser interest rates. What's more, there is no convincing efficiency explanation for low (or zero) teaser interest rates. Therefore, we should be less concerned about the risk of unintended consequences posed by regulating teaser interest rates.

Since the CARD Act restrictions do not seem to substantially affect the use of teaser rates, we consider regulating them by increasing the minimum period that any teaser rate must remain in effect from the current six-month requirement under the CARD Act to eighteen months (or even longer). We expect such a change will increase offered teaser rates and lower their general prevalence. We also consider restricting the magnitude of the permitted increase from any teaser rate to the long-term, go-to rate. Such a restriction can be expected to increase teaser rates, decrease long-term, go-to rates, or both.

I
CREDIT CARD PRICING AND THE EFFECTS OF THE CARD ACT: THEORY

In this Part, we recount the rational choice, risk-based pricing theory for the structure of credit card pricing and the behavioral economics, salience-based pricing theory. We use these theories to explain common pricing patterns in the credit card market, specifically low short-term prices and high long-term prices, and to predict the effects of the CARD Act on these common pricing patterns. We then test these predictions empirically in Part II.

A. A Rational Choice Theory: Risk-Based Pricing

1. *Revealed Risk and Adjustable Prices*

Providing credit inevitably involves risk—the risk that the cardholder-borrower will default on repayment obligations. An optimal credit card contract prices risk and, moreover, adjusts prices to reflect new information about risk. When an issuer decides to supply a credit card to a specific consumer, the issuer has certain

information about this consumer—information provided in the credit card application, credit bureau information, etc. Based on this information, the issuer estimates the probability that the consumer will not repay the loan and sets the basic APR accordingly.

Over the course of the issuer–cardholder relationship, the issuer collects an increasing amount of information regarding the probability that the cardholder will not repay the loan. For example, when the cardholder makes a late payment or exceeds the credit limit, such events may indicate financial distress. A rational issuer would incorporate this new information into any risk assessments performed and adjust the price of credit to reflect the increased risk of nonpayment. Thus, late fees, over-the-limit fees, and default interest rates represent means for adjusting prices to reflect new risk information.

2. *The CARD Act*

The CARD Act restricts issuers' ability to raise interest rates and impose penalty fees.[11] In other words, it restricts issuers' ability to adjust the price of credit to new information about the risk of nonpayment. How would these restrictions affect the equilibrium pricing scheme? First, and obviously, to the extent that the CARD Act is effectively enforced, modes of repricing that the CARD Act bans will disappear: penalty fees exceeding limits set by the CARD Act or its implementing regulations will no longer be observed.[12] And the same goes for sharp increases in prescribed interest rates.

Second, given that such common repricing will effectively disappear, issuers can be expected to search for alternative modes of repricing.[13] According to the rational choice theory, issuers employed late fees and over-the-limit fees because paying late and exceeding the credit limit are indications of an increased probability of nonpayment. Unable to use, or fully use, these indicators, issuers will likely turn to less informative indicators. For example, if using the card's cash-advance feature is indicative of financial distress, issuers may respond by increasing cash-advance fees. Because the CARD Act restricts the use of more informative indicators—such as paying late and exceeding the credit limit—we expect issuers to rely more heavily on less informative indicators like cardholders taking out cash advances.

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11 *See supra* note 4 and accompanying text.

12 *See* Levitin, *supra* note 5, at 340 ("The CARD Act severely curtailed card issuers' ability to rate-jack consumer credit cards.").

13 *See* Robin Sidel, *Credit-Card Fees: The New Traps*, WALL ST. J., Feb. 20, 2010, http://online.wsj.com/article/SB10001424052748704804204575069374130248754.html (describing new types of credit card fees after the passage of the CARD Act).

Third, issuers can be expected to invest more in pricing risk *ex ante*.[14] Usually, issuers price risk most efficiently when using *ex post* price adjustments. When repricing based on *ex post* information is restricted, issuers turn to investing more in repayment risk information at the application stage and to incorporating this risk in their *ex ante* pricing. Specifically, we can expect greater variance in the initial basic APR. Before the CARD Act, issuers could expend less effort in fine-tuning the basic APR to cardholder risk because they could count on *ex post* repricing. Now that the CARD Act has restricted *ex post* repricing, however, issuers must resort to expending more effort in fine-tuning the basic APR.

Finally, on a related note, issuers can be expected to increase the basic APR. The CARD Act restricts issuers' ability to reprice risk *ex post* using penalty fees and interest rate increases.[15] As explained above, issuers will search for alternative means to price risk—alternative *ex post* repricing and more careful *ex ante* risk-based pricing. But these alternatives are second-best; it appears inevitable that the CARD Act will inhibit issuers' ability to price risk. Faced with a reduced ability to price risk—i.e., to make risky borrowers bear the cost of the higher risk they impose—we expect issuers to spread the cost of the unpriced risk across all cardholders. As a result, the average basic APR can be expected to increase.

B. A Behavioral Economics Theory: Salience-Based Pricing

Behavioral economics provides an alternative theory for credit card pricing that focuses on the salience of different dimensions of card contracts to consumers.

1. *Low Short-Term Prices and High Long-Term Prices*

Credit card issuers commonly set low short-term prices and high long-term prices.[16] From the cardholder's perspective, this pricing structure defers the costs of the credit card product into the future. The behavioral economics explanation for deferred-cost contracts is

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14 *See* Connie Prater, *Card Issuers Ready to Check Cardholder Income, Assets*, CREDITCARDS.COM (Jan. 22, 2010), http://www.creditcards.com/credit-card-news/credit-card-application-income-check-1282.php (describing the methods by which credit card issuers "will be peering more deeply into card applicants' financial affairs" after the CARD Act goes into effect).

15 *See supra* note 4 and accompanying text.

16 *See* Paul Heidhues & Botond Kőszegi, *Exploiting Naïvete About Self-Control in the Credit Market*, 100 AM. ECON. REV. 2279, 2279 (2010) ("[F]or most types of nonsophisticated borrowers the baseline repayment terms are cheap, but they are also inefficiently front loaded and delays require paying large penalties. Although credit is for future consumption, nonsophisticated consumers overborrow, pay the penalties, and back load repayment, suffering large welfare losses.").

based on evidence that future costs are often underestimated.[17] When cardholders underestimate future costs, contracts with deferred-cost features become more attractive to cardholders and thus to issuers. Put differently, cardholders who suffer from the underestimation bias find long-term prices nonsalient. Issuers, then, increase these nonsalient price dimensions because they have limited effect on demand for the credit card product.[18]

Two underlying biases jointly contribute to the underestimation of many future costs: myopia and optimism. A myopic cardholder focuses on short-term benefits and excessively discounts long-term costs. An optimistic cardholder underestimates any self-control problems and the likelihood of contingencies bearing economic hardship, resulting in the underestimation of future borrowing. Since many long-term price dimensions in the credit card contract depend on borrowing levels, the underestimation of future borrowing leads to an underestimation of future costs.[19]

When cardholders underestimate future costs, issuers will offer deferred-cost credit card contracts. Consider a simplified credit card contract with two price dimensions: a short-term price, P_{ST} (e.g., an introductory interest rate), and a long-term price, P_{LT} (e.g., a long-term interest rate). Assume that the optimal credit card contract sets $P_{ST} = 0.1$ and $P_{LT} = 0.1$, as these prices provide optimal incentives and minimize total costs. Specifically, assume that these interest rates reflect the issuer's risk-adjusted cost of funds such that the rates induce borrowing only if the value of borrowing to the cardholder exceeds the cost of lending to the issuer. In this simplified example, if cardholders are rational, issuers will offer this optimal contract.

Now assume that cardholders underestimate future costs. For example, assume that cardholders underestimate the likelihood of borrowing on their credit card beyond the introductory period: while they will actually borrow an amount of $100 both during and after the introductory period, they think they will borrow $100 during the introductory period but only $50 after the introductory period ends.

As a result of such misperception, issuers will no longer offer the optimal contract. To see this result, compare the optimal contract,

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17 *See* Oren Bar-Gill, *The Law, Economics and Psychology of Subprime Mortgage Contracts*, 94 CORNELL L. REV. 1073, 1119 (2009) (discussing this underestimation phenomenon in a different context).

18 For a more detailed discussion, see BAR-GILL, *supra* note 6, at 3–10, 16–18; Oren Bar-Gill, *Seduction by Plastic*, 98 NW. U. L. REV. 1373, 1395–1400 (2004).

19 *See* Lawrence M. Ausubel, *Credit Card Defaults, Credit Card Profits, and Bankruptcy*, 71 AM. BANKR. L.J. 249, 263 (1997) ("[A] substantial portion of credit card borrowing still occurs at postintroductory interest rates . . . .").

the (0.1,0.1) contract, with an inefficient, deferred-cost contract setting $P_{ST} = 0.05$ and $P_{ST} = 0.16$, denominated as the (0.05,0.16) contract. Assume that under both contracts, the issuer, who operates in a competitive market, just covers the total cost of offering the credit card product. Under the optimal (0.1,0.1) contract, total interest payments are: $P(0.1,0.1) = 0.1 \cdot 100 + 0.1 \cdot 100 = 20$ (assuming, for clarity of exposition, that the introductory period and the postintroductory period are one year long each and that interest is assessed at the end of the period; time discounting is also ignored for simplicity). Under the inefficient (0.05,0.16) contract, total interest payments are: $P(0.05,0.16) = 0.05 \cdot 100 + 0.16 \cdot 100 = 21$. Total cost, and thus total interest payments, are higher under the inefficient, deferred-cost contract.

Now consider the cost of the credit card as perceived by the imperfectly rational cardholder. Perceived total interest payments under the optimal (0.1,0.1) contract are: $\hat{P}(0.1,0.1) = 0.1 \cdot 100 + 0.1 \cdot 50 = 15$. Perceived total interest payments under the inefficient (0.05,0.16) contract are: $\hat{P}(0.05,0.16) = 0.05 \cdot 100 + 0.16 \cdot 50 = 13$. Cardholders would prefer, and thus lenders will offer, the inefficient, deferred-cost contract.

Our results suggest that a similar outcome—low short-term prices and high long-term prices—also obtains in a monopoly setting. In the absence of consumer misperception, the monopolist faces the following dilemma: it wants to raise prices to increase its per-unit revenue and thus total profit, but higher prices decrease the number of units sold (i.e., decrease demand for the product, thus reducing total profit). Misperception solves the monopolist's dilemma, at least to a certain extent. When misperception causes consumers to underestimate one price dimension, the monopolist will increase the underestimated price and decrease the accurately perceived price. In doing so, the monopolist maximizes per-unit revenues while minimizing the accompanying reduction in demand.

2. *The CARD Act*

The CARD Act imposes restrictions on long-term rates and fees that are nonsalient to cardholders.[20] By doing so, the CARD Act restricts issuers' ability to defer costs. Thus, an effective CARD Act should successfully change credit card pricing. Three specific sets of changes can be expected. First, long-term rates and fees that fall under CARD Act restrictions, such as late fees and over-the-limit fees, should decrease.

Second, long-term rates and fees not restricted by the CARD Act

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[20] *See supra* note 4 and accompanying text.

can be expected to increase. Faced with imperfectly rational cardholders who underestimate long-term, nonsalient prices, issuers have a strong incentive to defer costs. If the CARD Act restricts certain types of cost deferral, issuers will search for alternative types of cost deferral not targeted by the CARD Act. For example, cash-advance fees and rates and foreign-transaction fees, which are not restricted by the CARD Act, can be expected to increase.

Third, if the market is sufficiently competitive, we can expect short-term, salient prices to increase. In the absence of legal restrictions, issuers set high long-term prices and use revenues from these back-end prices to fund front-end perks and thus compensate for lower revenues, and even losses, incurred from low short-term prices. When back-end revenues dry up due to CARD Act restrictions, issuers may have to increase front-end, salient prices to continue covering their costs. As noted above, issuers will try to minimize this negative impact on back-end revenues by shifting to back-end prices not regulated by the CARD Act. But it is unlikely that they will entirely avoid a reduction in back-end revenues. As a result, short-term, salient prices can be expected to increase.[21] Specifically, we can expect an increase in annual fees, introductory interest rates, and the basic APR, which, though a long-term price, has become increasingly salient to cardholders.

However, if credit card issuers have market power, they may not increase their front-end, salient prices in response to the CARD Act.[22] With market power, the issuer may decide to maintain low salient prices to keep demand high. We analyze below the implications of the CARD Act for credit card pricing under the behavioral economics theory, focusing on the effects of market structure, using a simple model.

3. *A Simple Model*

We develop a simple model designed to demonstrate that, while legal restrictions on long-term, nonsalient prices necessarily result in concomitant increases in short-term, salient prices under perfect

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[21] Consider a profit-maximizing issuer choosing between two nonsalient back-end fees: F1 and F2. If the issuer chose to focus on F1, that means that F1 represents the more efficient means of extracting back-end revenues. If the CARD Act restricts the use of F1, the issuer will switch to F2. But F2 is less effective in extracting back-end revenues. Accordingly, the issuer will reduce the front-end perks, and front-end prices will increase. The issuer retains another option in the form of investing in designing a new nonsalient term, F3, which is as effective as F1 in extracting back-end revenues. It is unlikely, however, that the issuer will find a perfect substitute for F1. But, again, the cost K would need to be financed somehow—financing that will likely come from increased short-term prices.

[22] *See infra* Part I.B.3.

competition, the same does not hold true when sellers have market power. In this latter scenario, legal restrictions on long-term, nonsalient prices will generally have a smaller effect, and in some cases no effect, on short-term, salient prices.

Assume a simple two-dimensional pricing scheme with a short-term, salient price p_1, and a long-term, nonsalient price p_2. The consumer accurately perceives p_1. Namely, the perceived price, $\hat{p}_1$, equals the actual price, p_1. The consumer underestimates the long-term, nonsalient price. Specifically, the perceived price is $\hat{p}_2 = \delta \cdot p_2$, where $0 < \delta < 1$. We further assume that prices are nonnegative (i.e., $p_1 \geq 0$ and $p_2 \geq 0$).[23]

Every consumer who chooses to purchase the product will pay a total price of $p_1 + p_2$ (for simplicity, assume no discounting). In other words, every consumer who purchases the product will pay p_1 exactly once and p_2 exactly once. The underlying, simplifying assumption is either: (1) that prices are applied regardless of how the consumer uses the credit card product; or (2) that every consumer who purchases the credit card product uses the product the same way, triggering the same prices, and that the prices themselves do not affect the usage intensity.

However, consumers *perceive* the total price *ex ante* to be only $p_1 + \hat{p}_2 = p_1 + \delta \cdot p_2$. Demand for the credit card product is a function of the total perceived price. The demand function can thus be written as follows: $q = q(p_1 + \hat{p}_2)$. For simplicity, we focus on the special case where demand is linear in the perceived total price: $q = q(p_1 + \hat{p}_2) = \bar{q} - a \cdot (p_1 + \hat{p}_2)$.

On the supply side, we assume that issuers face a constant marginal cost of c. Issuer profits are given by: $\pi(p_1, p_2) = q(p_1 + \hat{p}_2) \cdot (p_1 + p_2 - c) = [\bar{q} - a \cdot (p_1 + \delta \cdot p_2)] \cdot (p_1 \cdot p_2 - c)$.

We begin by assuming a perfectly competitive market and consider the effects of a cap on the long-term price. In particular, suppose that issuers may not charge a long-term price p_2 greater than some $\bar{p}_2$. The effects of such a cap in a competitive market are described in the following proposition. (The full analysis of the model and all proofs are relegated to Appendix 1.)

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[23] In this simple framework, in the absence of the nonnegativity constraints, sellers will set p_1 at minus infinity and p_2 at positive infinity. A more general framework would replace the nonnegativity constraints with an assumption that setting a negative price entails a cost for the seller (beyond the cost of paying money to the consumer)—the cost from opportunistic behavior by consumers. In this more general framework, we could have negative (albeit not too negative) prices, as is sometimes observed in the market (e.g., loyalty programs can be viewed as creating a negative price for transacting). To view further justifications for these types of price-floor assumptions, see generally Paul Heidhues et al., The Market for Deceptive Products (Jan. 2012) (unpublished manuscript) (on file with author).

Proposition 1: *Effect of a cap on the long-term price in a competitive market.*

In a perfectly competitive market, when the law imposes a constraint $\bar{p}_2$ on the long-term price, the effects of the legal constraint, as compared to the outcome with no constraint, depend on the strictness of the constraint. In particular, there exists a set of thresholds for the constraint, $k_1 < k_2$, with $k_2 = c$, such that:

(a) *Nonstrict Constraint.* If $\bar{p}_2 \geq k_2$, then the legal constraint has no effect and firms choose $p_1 = 0$ and $p_2 = c$.

(b) *Strict Constraint.* If $k_1 \leq \bar{p}_2 \leq k_2$, then:

i. Sellers will reduce the regulated long-term price p_2 to the lowest level permitted by law.

ii. Sellers will increase the short-term price p_1 to compensate for the reduction in the long-term price p_2.

iii. Demand will decrease.

(c) *Very Strict Constraint.* If $\bar{p}_2 < k_1$, then the market will shut down.

The intuition for these results is straightforward. First, in the absence of any cap, firms prefer to make their money through the long-term price rather than through the short-term price because consumers are less sensitive to the long-term price.[24] However, once a binding cap constrains the long-term price, firms must raise the short-term price to cover their costs. In a perfectly competitive market, firms just barely break even, so a firm that fails to raise its short-term price in response to such a cap would go out of business. While the total price consumers pay does not change, the price *perceived* by consumers goes up (since more of it comes from the up-front price) and hence demand goes down.

If there is market power, however, a different cap effect emerges. To simplify, consider the polar case in which there is a single, monopolistic seller. The following proposition summarizes the effect of a cap on the long-term price on a monopolist.

Proposition 2: *Effect of a cap on the long-term price in a monopolistic market.*

In a monopolistic market, when the law imposes a constraint $\bar{p}_2$ on the long-term price, then, compared to the no-constraint benchmark:

(a) If the long-term price is capped below the price the

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24 *See supra* Part I.B.1.

monopolist would otherwise choose, the monopolist will reduce the long-term price p_2 to the lowest level permitted by law.

(b) The effect on the short-term price and on demand depends on how strict the legal constraint is. In particular, there exists a set of thresholds of the constraint $k_1 < k_2 < k_3$, with $k_2 = c$, such that:

i. *Mild constraint.* If $\bar{p}_2 \geq k_3$, then the law has no effect on the short-term price and demand will increase.

ii. *Intermediate constraint.* If $k_2 \leq \bar{p}_2 \leq k_3$, then the short-term price will increase but demand will still increase.

iii. *Strict constraint.* If $k_1 \leq \bar{p}_2 \leq k_2$, then the short-term price will increase and demand will decrease.

iv. *Very Strict Constraint.* If $\bar{p}_2 < k_1$, then the market will shut down.

In the monopolist case, the results are more complicated. In the absence of a legal constraint, the monopolist also prefers to make all of its revenue from the long-term price since consumer demand is less sensitive to the long-term price than to the short-term price.[25] However, unlike in the case of perfect competition, if the cap is binding, the monopolist may not raise the short-term price. The reason is that with a mild constraint, the increase in per-customer revenue that an increase in the short-term price would produce is less than the loss in revenue from the resulting reduction in demand. Thus, a mild legal constraint on the long-term price will *increase* demand for the monopolist's product. However, as the constraint becomes progressively stricter, the monopolist will ultimately begin to raise its short-term price.

Even over the range of legal constraints in which the monopolist responds by increasing the short-term price, the monopolist will adjust short-term price less than will firms in a perfectly competitive market. We formalize this point by comparing the effect of the legal constraint across the two market structures in the following proposition.

Proposition 3: When the legally imposed cap rests in the $k_1 \leq \bar{p}_2 \leq k_2$ range, the cap will cause firms in a perfectly competitive market to increase their short-term prices by more than a monopolist will.

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25 *See id.*

The intuition for this result is straightforward: In a competitive market, for every dollar decrease in p_2 caused by the legal constraint, sellers must raise p_1 by a dollar (to cover their costs). In a monopolistic market, such a large increase in p_1 is not necessary since the monopolist is making a positive profit. The legal constraint clearly reduces the monopolist's profit. When recalibrating its pricing strategy in response to the legal constraint, the monopolist trades off the benefits of an increase in p_1—a larger per-unit revenue (or a smaller decrease in per-unit revenue)—against the costs of such an increase in terms of reduced demand. Accordingly, the monopolist will increase p_1 by a smaller amount as compared to sellers in a competitive market.[26]

Perfect competition and monopoly represent only the two polar cases. Real-world markets, including the credit card market, fall somewhere in between. Despite housing a large number of competing firms, the credit card market has exhibited some degree of supracompetitive pricing, a point made in an influential paper by Laurence M. Ausubel in 1991.[27] According to Ausubel, one source of market power in the credit card market stems from the cost to consumers of searching for a better credit card and switching between cards.[28] As costs of switching away from an issuer (to a competing issuer) rise, so does the issuer's market power.

Whatever the source of market power in the credit card market, we conjecture that the results derived from the comparison of the two polar cases of monopoly and perfect competition apply more generally. Namely, the legal constraint on p_2 has a smaller effect on p_1 and on demand when the issuer has more market power.

From a welfare perspective, the fact that the increase in p_1 is smaller in magnitude than the reduction in p_2 implies that consumers enjoy part of the surplus that the monopolist (or issuer with lesser market power) lost. Moreover, as pricing shifts from misperceived price dimensions to accurately perceived price dimensions, the total

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26 Our assumption of linear demand plays a role in this result. Under perfect competition, the reduction in the nonsalient price always passes through dollar for dollar to the salient price, no matter what the shape of the demand function. With linear demand, a monopolist passes through less than 100% of the change in the nonsalient price. But if the demand function is sufficiently concave in the relevant region, a monopolist can possibly pass through more than 100% of the change in the nonsalient price. The argument is that market power represents one reason why incomplete, or even zero, pass through may occur.

27 Laurence M. Ausubel, *The Failure of Competition in the Credit Card Market*, 81 AM. ECON. REV. 50, 75–76 (1991).

28 *See id.* at 68–70; *see also* Paul S. Calem & Loretta J. Mester, *Consumer Behavior and the Stickiness of Credit-Card Interest Rates*, 85 AM. ECON. REV. 1327, 1328–29 (1995) (discussing Ausabel's theory in greater detail); Victor Stango, *Pricing with Consumer Switching Costs: Evidence from the Credit Card Market*, [50] J. INDUS. ECON. 475, 475–92 (2002).

effect of consumer bias on consumer decision making is reduced—to the benefit of consumers.[29] This effect is present in both competitive and monopolistic markets.

II
CREDIT CARD PRICING AND THE EFFECTS OF THE CARD ACT: EVIDENCE

In this Part, we first seek to provide some suggestive evidence on the causal effect of the CARD Act, an ambitious goal given the other macroeconomic events that occurred during the period in which the CARD Act's rules took effect. In pursuing this goal, we mainly rely on a simple before–after comparison to provide evidence on the effect of the CARD Act. Households' borrowing behavior and financial institutions' lending behavior were of course affected by the financial crisis over this period, so the before–after comparisons must be interpreted with caution. Still, we think the data discussed below showing sharp changes upon the passage of the CARD Act provide convincing evidence that the Act had the intended effect on the contract terms directly regulated under it. Less clear, however, is whether the before–after comparisons on terms *not* directly regulated by the CARD Act, which reflect much smaller changes, are properly attributable to the CARD Act.

Our second goal is more straightforward: we seek simply to describe the current state of credit card pricing. The behavior of credit card issuers under current rules sheds light on the scope for further improvements to credit card regulation.

The new rules imposed on credit card issuers under the CARD Act were phased in at the beginning of 2009. Starting on the effective date of the CARD Act, August 22, 2009, issuers were required to give forty-five days' notice for certain rate and fee increases.[30] On February 22, 2010, a set of additional rules went into effect including restrictions on interest rate increases in the first year of new credit card accounts and an opt-in requirement for over-the-limit transactions and fees.[31] On August 22, 2010, another set of rules went into effect including restrictions on late payment fees and a ban on inactivity fees.[32] In Table 1 of Appendix 2, we provide the key provisions that went into effect on each date.

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29 The difference between the actual total price and the perceived total price is $(p_1 + p_2) - (p_1 + \delta \cdot p_2) = (1 - \delta) \cdot p_2$. This difference is decreasing in p_2.

30 *See* Prater, *supra* note 14.

31 *See What You Need to Know: New Credit Card Rules Effective Feb. 22*, *supra* note 4.

32 *See What You Need to Know: New Credit Card Rules Effective Aug. 22*, *supra* note 4.

APPENDIX 1

Appendix 1 contains the full analysis of the model outlined in Part I.B.3. We start with the perfect competition case, then proceed to the monopoly case, and finally compare the two cases.

a. Perfect Competition

A seller operating in a perfectly competitive market seeks to maximize demand by minimizing the perceived total price while satisfying its participation constraint.[106] Formally, the seller minimizes $p_1 + \hat{p}_2$, subject to $\pi(p_1, p_2) = [\bar{q} - a \cdot (p_1 + \delta \cdot p_2)] \cdot (p_1 + p_2 - c) \geq 0$. We further assume that prices are nonnegative, i.e., $p_1 \geq 0$ and $p_2 \geq 0$.[107] The seller's problem reduces to: $Min \langle p_1 + \delta \cdot p_2 \rangle$ s.t. $p_1 + p_2 \geq c$ and the nonnegativity constraints. Solving this problem, we find that the seller will set $p_1^{NLC} = 0$ and $p_2^{NLC} = c$ (the superscript "NLC" denotes the benchmark case, in which the monopolist faces "No Legal Constraint" in its pricing strategy). With these prices, demand for the product will be: $q^{NLC} = \bar{q} - a \cdot \delta \cdot c$.

Now assume that the law limits the permissible level of p_2 to $\bar{p}_2 < c$. Faced with such a legal constraint, the seller will set $p_1^{LC} = c - \bar{p}_2$ and $p_2^{LC} = \bar{p}_2$ (the superscript "LC" denotes the "Legal Constraint"). With these prices, demand for the product will be: $q^{LC} = \bar{q} - a \cdot \delta \cdot c - a \cdot (1 - \delta) \cdot (c - \bar{p}_2) < q^{NLC}$. Note that when $\bar{p}_2 < \frac{a \cdot c - \bar{q}}{a \cdot (1 - \delta)}$, demand is zero (or negative), and the market shuts down.

These results are summarized in the following proposition.

Proposition A1: In a perfectly competitive market—

(a) Without a legal constraint, sellers will set $p_1^{NLC} = 0$ and $p_2^{NLC} = c$, and demand will be $q^{NLC} = \bar{q} - a \cdot \delta \cdot c$.

(b) With a legal constraint $p_2 \leq \bar{p}_2$ (where $\bar{p}_2 < c$), sellers will set $p_1^{LC} = c - \bar{p}_2$ and $p_2^{LC} = \bar{p}_2 < c$, and demand will be $q^{LC} = \bar{q} - a \cdot \delta \cdot c - a \cdot (1 - \delta) \cdot (c - \bar{p}_2)$.

(c) With a very strict legal constraint, $\bar{p}_2 < \frac{a \cdot c - \bar{q}}{a \cdot (1 - \delta)}$, the market shuts down.

Corollary A1 summarizes the effects of the legal constraint on pricing and demand.

Corollary A1: In a perfectly competitive market, when the law imposes a legal constraint $p_2 \leq \bar{p}_2$ (where $\bar{p}_2 < c$)—

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106 *See* ROBERT S. PINDYCK & DANIEL L. RUBINFELD, MICROECONOMICS 271–72 (7th ed. 2009).

107 See *supra* note 23 for comments on an alternative to this simplified framework.

(a) The Regulated Price, p_2: sellers will reduce p_2, as compared to the no-constraint benchmark, to the maximum level permitted by law.
(b) The Unregulated Price, p_1: sellers will increase p_1, as compared to the no-constraint benchmark, to compensate for the reduction in p_2.
(c) Demand, q: demand will decrease, as compared to the no-constraint benchmark.

b. Monopoly

The monopolist seller maximizes $\pi(p_1, p_2) = [\bar{q} - a \cdot (p_1 + \delta \cdot p_2)] \cdot (p_1 + p_2 - c)$, subject to $p_1 \geq 0$ and $p_2 \geq 0$. The first order conditions (ignoring, for the moment, the nonnegativity constraints) are:

$$\frac{\partial \pi(p_1, p_2)}{\partial p_1} = -a \cdot (p_1 + p_2 - c) + [\bar{q} - a \cdot (p_1 + \delta \cdot p_2)]$$

$$\frac{\partial \pi(p_1, p_2)}{\partial p_2} = -a \cdot \delta \cdot (p_1 + p_2 - c) + [\bar{q} - a \cdot (p_1 + \delta \cdot p_2)]$$

The first thing to note is that for all p_1 and p_2,

$$\frac{\partial \pi(p_1, p_2)}{\partial p_2} > \frac{\partial \pi(p_1, p_2)}{\partial p_1}.$$

This means that the monopolist always prefers raising p_2 (if it can) to raising p_1. By increasing p_2, the monopolist gets the same per-unit increase in revenue as it would get from increasing p_1 with a smaller reduction in demand. Accordingly, without any legal constraint on the ability to raise p_2, the monopolist will set $p_1^{NLC} = 0$ and a p_2 that solves $\frac{\partial \pi(p_1 = 0, p_2)}{\partial p_2} = 0$, or:

$$-a \cdot \delta \cdot (p_2 - c) + [\bar{q} - a \cdot \delta \cdot p_2] = 0$$

Solving for p_2, we obtain $p_2^{NLC} = \frac{\bar{q} + a \cdot \delta \cdot c}{2 \cdot a \cdot \delta}$. (We assume that $\frac{\bar{q} + a \cdot \delta \cdot c}{2 \cdot a \cdot \delta} \geq c$, which reduces to $\bar{q} \geq a \cdot \delta \cdot c$; otherwise, there would be no market for the product.) With these prices, demand for the product will be $q^{NLC} = \bar{q} - a \cdot \delta \cdot \frac{\bar{q} + a \cdot \delta \cdot c}{2 \cdot a \cdot \delta}$.

Now assume that the law limits the permissible level of p_2 to $\bar{p}_2 < p_2^{NLC} = \frac{\bar{q} + a \cdot \delta \cdot c}{2 \cdot a \cdot \delta}$, adding another constraint, $p_2 \leq \bar{p}_2$, to the monopolist's maximization problem.

As explained above, the monopolist always prefers to raise p_2. Therefore, the legal constraint is binding, and the monopolist will set $p_2^{LC} = \bar{p}_2$. But now it is possible that the monopolist will also want to set a positive p_1. To explore this possibility, we calculate the derivate of profits with respect to p_1 at $p_1 = 0$, given $p_2 = \bar{p}_2$:

$$\left.\frac{\partial \pi(p_1, \bar{p}_2)}{\partial p_1}\right|_{p_1 = 0} = -a \cdot (\bar{p}_2 - c) + [\bar{q} - a \cdot \delta \cdot \bar{p}_2] = \bar{q} - a \cdot (1 + \delta) \cdot \bar{p}_2 + a \cdot c$$

This derivative is positive if and only if $\bar{p}_2 < \frac{\bar{q} + a \cdot c}{a \cdot (1 + \delta)}$. Note that $\frac{\bar{q} + a \cdot c}{a \cdot (1 + \delta)} \leq \frac{\bar{q} + a \cdot \delta \cdot c}{2 \cdot a \cdot \delta}$ (given our assumption that $\bar{q} \geq a \cdot \delta \cdot c$). We thus have

two cases:

(1) Mild Legal Constraint: $\frac{\bar{q}+a\cdot c}{a\cdot(1+\delta)} \leq \bar{p}_2 < \frac{\bar{q}+a\cdot\delta\cdot c}{2\cdot a\cdot\delta}$. When the legal constraint is mild,

$$\frac{\partial\pi(p_1,\bar{p}_2)}{\partial p_1}\Big|_{p_1=0} \leq 0,$$

and the monopolist will set: $p_1^{LC} = 0$ and $p_2^{LC} = \bar{p}_2$. With these prices, demand for the product will be $q^{LC} = \bar{q} - a\cdot\delta\cdot\bar{p}_2 > q^{NLC}$.

(2) Stricter Legal Constraint: $\bar{p}_2 < \frac{\bar{q}+a\cdot c}{a\cdot(1+\delta)}$. When the legal constraint is stricter,

$$\frac{\partial\pi(p_1,\bar{p}_2)}{\partial p_1}\Big|_{p_1=0} > 0,$$

the monopolist will set a positive p_1. Specifically, solving the first order condition:

$$\frac{\partial\pi(p_1,\bar{p}_2)}{\partial p_1} = -a\cdot(p_1+\bar{p}_2-c) + [\bar{q} - a\cdot(p_1+\delta\cdot\bar{p}_2)] = 0$$

we obtain:

$$p_1^{LC} = \frac{\bar{q} - a\cdot(1+\delta)\cdot\bar{p}_2 + a\cdot c}{2\cdot a} > 0$$

Case 2 needs to be further divided into the following subcases:

(2a) Intermediate Legal Constraint: $c < \bar{p}_2 < \frac{\bar{q}+a\cdot c}{a\cdot(1+\delta)}$. Note that $c \leq \frac{\bar{q}+a\cdot c}{a\cdot(1+\delta)}$ (given our assumption that $\bar{q} \geq a\cdot\delta\cdot c$). With an intermediate legal constraint, the monopolist will set $p_1^{LC} = \frac{\bar{q}-a\cdot(1+\delta)\cdot\bar{p}_2+a\cdot c}{2\cdot a} > 0$ and $p_2^{LC} = \bar{p}_2$. With these prices, demand for the product will be $q^{LC} = \bar{q} - a\cdot(p_1^{LC} + \delta\cdot\bar{p}_2) > q^{NLC}$.

(2b) Strict Legal Constraint: $\frac{a\cdot c-\bar{q}}{a\cdot(1-\delta)} \leq \bar{p}_2 \leq c$. Note that $\frac{a\cdot c-\bar{q}}{a\cdot(1-\delta)} \leq c$ (given our assumption that $\bar{q} \geq a\cdot\delta\cdot c$). With a strict legal constraint, the monopolist will set $p_1^{LC} = \frac{\bar{q}-a\cdot(1+\delta)\cdot\bar{p}_2+a\cdot c}{2\cdot a} > 0$ and $p_2^{LC} = \bar{p}_2$. With these prices, demand for the product will be $q^{LC} = \bar{q} - a\cdot(p_1^{LC} + \delta\cdot\bar{p}_2) \leq q^{NLC}$. The expressions for the two prices and for the demand (i.e., the quantity sold) are the same as with an intermediate legal constraint. The difference is that with a strict legal constraint, demand for the product decreases, as compared to the no-constraint benchmark.

(2c) Very Strict Legal Constraint: $\bar{p}_2 < \frac{a\cdot c-\bar{q}}{a\cdot(1-\delta)}$. The preceding analysis and the resulting prices,

$$p_1^{LC} = \frac{\bar{q}-a\cdot(1+\delta)\cdot\bar{p}_2+a\cdot c}{2\cdot a} > 0$$

and $p_2^{LC} = \bar{p}_2$, apply only as long as we don't hit the monopolist's participation constraint, $\pi(p_1,p_2) \geq 0$, which boils down to $p_1 + p_2 \geq c$. When $\bar{p}_2 < \frac{a\cdot c-\bar{q}}{a\cdot(1-\delta)}$, the participation constraint is binding, and the monopoly case converges with the perfect competition case. The monopolist will set

$$p_1^{LC} = c - \bar{p}_2 > \frac{\bar{q}-a\cdot(1+\delta)\cdot\bar{p}_2+a\cdot c}{2\cdot a}$$

and $p_2^{LC} = \bar{p}_2$, and demand will be $q^{LC} = \bar{q} - a\cdot\delta\cdot c - a\cdot(1-\delta)\cdot(c-\bar{p}_2) < q^{NLC}$. But, as in the perfect competition case, nonnegative demand cannot be sustained when $\bar{p}_2 < \frac{a\cdot c-\bar{q}}{a\cdot(1-\delta)}$, and the market shuts down.

The results are summarized in the following proposition.

Proposition A2: In a monopolistic market—

(a) Without a legal constraint, the monopolist will set $p_1^{NLC} = 0$ and $p_2^{NLC} = \frac{\bar{q}+a\cdot\delta\cdot c}{2\cdot a\cdot\delta}$, and demand will be $q^{NLC} = \bar{q} - a\cdot\delta\cdot\frac{\bar{q}+a\cdot\delta\cdot c}{2\cdot a\cdot\delta}$.

(b) With a legal constraint, $p_2 \le \bar{p}_2$ (where $\bar{p}_2 < \frac{\bar{q}+a\cdot\delta\cdot c}{2\cdot a\cdot\delta}$)—

i. With a Mild Legal Constraint, $\frac{\bar{q}+a\cdot c}{a\cdot(1+\delta)} \le \bar{p}_2 < \frac{\bar{q}+a\cdot\delta\cdot c}{2\cdot a\cdot\delta}$, the monopolist will set $p_1^{LC} = 0$ and $p_2^{LC} = \bar{p}_2$, and demand will be $q^{LC} = \bar{q} - a\cdot\delta\cdot\bar{p}_2 > q^{NLC}$.

ii. With an Intermediate Legal Constraint, $c < \bar{p}_2 < \frac{\bar{q}+a\cdot c}{a\cdot(1+\delta)}$, the monopolist will set $p_1^{LC} = \frac{\bar{q}-a\cdot(1+\delta)\cdot\bar{p}_2+a\cdot c}{2\cdot a} > 0$ and $p_2^{LC} = \bar{p}_2$, and demand will be $q^{LC} = \bar{q} - a\cdot(p_1^{LC} + \delta\cdot\bar{p}_2) > q^{NLC}$.

iii. With a Strict Legal Constraint, $\frac{a\cdot c-\bar{q}}{a\cdot(1-\delta)} \le \bar{p}_2 \le c$, the monopolist will set

$$p_1^{LC} = \frac{\bar{q}-a\cdot(1+\delta)\cdot\bar{p}_2+a\cdot c}{2\cdot a} > 0$$

and $p_2^{LC} = \bar{p}_2$, and demand will be $q^{LC} = \bar{q} - a\cdot(p_1^{LC} + \delta\cdot\bar{p}_2) \le q^{NLC}$.

iv. With a Very Strict Legal Constraint, $\bar{p}_2 \le \frac{a\cdot c-\bar{q}}{a\cdot(1-\delta)}$, the market shuts down.

Corollary A2 summarizes the effects of the legal constraint on pricing and demand.

Corollary A2: In a monopolistic market, when the law imposes a legal constraint $p_2 \le \bar{p}_2$ (where $\bar{p}_2 < \frac{\bar{q}+a\cdot\delta\cdot c}{2\cdot a\cdot\delta}$)—

(a) The Regulated Price, p_2: sellers will reduce p_2, as compared to the no-constraint benchmark, to the maximum level permitted by law.

(b) The Unregulated Price, p_1:

i. When the legal constraint is mild, $\frac{\bar{q}+a\cdot c}{a\cdot(1+\delta)} \le \bar{p}_2 < \frac{\bar{q}+a\cdot\delta\cdot c}{2\cdot a\cdot\delta}$, the law will not affect p_1. The monopolist will set $p_1 = 0$ with and without the legal constraint.

ii. When the legal constraint is stricter (intermediate or strict), $\frac{a\cdot c-\bar{q}}{a\cdot(1-\delta)} \le \bar{p}_2 < \frac{\bar{q}+a\cdot c}{a\cdot(1+\delta)}$, the law will induce the monopolist to increase p_1, as compared to the no-constraint benchmark.

(c) Demand, q:

i. When the legal constraint is mild or intermediate, $c < \bar{p}_2 < \frac{\bar{q}+a\cdot\delta\cdot c}{2\cdot a\cdot\delta}$, demand will increase, as compared to the no-constraint benchmark.

ii. When the legal constraint is strict or very strict, $\bar{p}_2 \le c$, demand will decrease, as compared to the no-constraint benchmark.

c. Perfect Competition vs. Monopoly

The results derived above can be used to compare the perfect competition case and the monopoly case. The comparison is summarized in Corollary A3.

Corollary A3:

(a) When $c \le \bar{p}_2 < \frac{\bar{q}+a\cdot\delta\cdot c}{2\cdot a\cdot\delta}$,
   i. In the perfect competition case, the legal constraint has no effect (since sellers in a perfectly competitive market do not price above c).
   ii. In the monopoly case, the legal constraint will result in a lower p_2; p_1 will remain at zero if the legal constraint is mild, $\frac{\bar{q}+a\cdot c}{a\cdot(1+\delta)} \le \bar{p}_2 \le \frac{\bar{q}+a\cdot\delta\cdot c}{2\cdot a\cdot\delta}$, and will increase if the legal constraint is intermediate, $c \le \bar{p}_2 \frac{\bar{q}+a\cdot c}{a\cdot(1+\delta)} \le \frac{\bar{q}+a\cdot\delta\cdot c}{2\cdot a\cdot\delta}$; and demand will increase.

(b) When $\frac{a\cdot c-\bar{q}}{a\cdot(1-\delta)} < \bar{p}_2 < c$,
   i. In the perfect competition case, the legal constraint will result in a lower p_2, a higher p_1, and reduced demand.
   ii. In the monopoly case, the legal constraint will result in a lower p_2, a higher p_1, and reduced demand.
   iii. The increase in p_1 and the decrease in the demand will be larger in the perfect competition case.

(c) When $\bar{p}_2 \le \frac{a\cdot c-\bar{q}}{a\cdot(1-\delta)}$, the market shuts down in both the perfect competition and monopoly cases.

Most of the results summarized in Corollary A3 follow immediately from Corollary A1 and Corollary A2. The results in part (b)(iii) of the Corollary require further proof. Starting with the effect of the legal constraint on p_1: In the perfect competition case $p_1^{LC} = c - \bar{p}_2$, and

$$\frac{dp_1^{LC}}{d\bar{p}_2} = -1.$$

In the monopoly case,

$$p_1^{LC} = \frac{\bar{q}-a\cdot(1+\delta)\cdot\bar{p}_2+a\cdot c}{2\cdot a}$$

and

$$\frac{dp_1^{LC}}{d\bar{p}_2} = -\frac{1+\delta}{2}.$$

The effect is larger in the competition case since $\frac{1+\delta}{2} < 1$. The relative effect on demand follows from the relative effect on p_1 since p_2 is the same in both the perfect competition and monopoly cases.