The Effects of Regulating Hidden Add-on Costs[*]

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Abstract

We examine the welfare effects of price and disclosure regulation in a model where firms can shroud add-on costs, such as penalty fees for consumer financial products. Such regulation can increase or decrease welfare even when there are no direct costs. There are, however, strong complementarities between price controls and disclosure mandates: conditional on disclosure being mandated, price controls always (weakly) increase welfare, and conditional on prices being sufficiently constrained, disclosure mandates always (weakly) increase welfare.

Keywords: **Disclosure, Shrouding, Regulation, Add-on Pricing, Household Finance**

JEL Classification: D60, G28

1 Introduction

A common feature of many consumer financial products is the combination of low-cost initial terms with high-cost subsequent terms, which are often obfuscated by lenders. For example, credit cards often feature low introductory teaser rates combined with much higher subsequent rates and fees. The term "stealth pricing" was coined to refer to these pricing practices developed by Providian Financial in the 1990's. Negative-amortization and interest-only mortgages, which grew in prevalence prior to the crisis, also feature low introductory teaser rates which increase after a pre-set period. Even standard fixed-rate mortgages have often featured substantial prepayment penalties, which were generally obscured from consumers at the end of long mortgage documents.[1] A number of studies find that a large proportion of consumers, in fact, do not understand key lending terms and underestimate future costs.[2]

Such obscured costs can cause certain consumers to unknowingly enter into transactions that are ultimately welfare-reducing. For example, a first-year college student may open a credit card account with zero upfront costs to finance spending. He may then later regret having spent so much money once he learns the associated long-term costs when those costs are eventually imposed. In addition, markets with hidden add-on costs can allow for implicit transfers between consumers who use the product differently. For example, consumers who pay off their credit card balances in full each month often enjoy short-term lending with no fees and even associated rewards and incentives. This use is subsidized by other consumers who pay interest and fees on their credit card balances.

The aggregate amount of these fees paid by consumers is substantial. US households paid $15 billion per year in credit card penalty fees according to a White House estimate, and $516 per year per household in bank and credit card fees according to Stango and Zinman (2009).[3] In the case of debit cards, the average account was assessed $70 in overdraft and non-sufficient fund fees in 2011, and conditional on an account being assessed a fee, the average was $225.[4] Motivated in part by mounting household debt leading up to the financial crisis of 2008, both price and disclosure regulations have been proposed and instituted to remedy the problem of hidden fees. For example, the Credit CARD Act banned inactivity fees and capped late fees at $25, a form of price regulation. The Federal Reserve adopted a rule, effective since 2010, that financial institutions cannot charge overdraft fees for debit card transactions unless the consumer has affirmatively opted in—a form of disclosure regulation. In the mortgage domain, the Dodd-Frank Act has placed certain explicit limits on the size of prepayment penalties for standard mortgages and banned them outright for non-standard types. The principal regulations governing disclosures for consumer lending are contained

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[1]While prepayment penalties are generally seen as exploitative, this view is not unanimous; for example, Mayer, Piskorski, and Tchistyi (2011) show that it can be socially optimal for firms to issue prepayment penalties.

[2]In the mortgage domain, a large number of consumers do not understand key mortgage terms, underestimate their current interest rate as well as future interest rate increases in adjustable-rate mortgages and prepayment penalties. See, e.g., Cruickshank (2000), Campbell (2006), Bucks and Pence (2008), and Gerardi, Goette, and Meier (2010), respectively. In addition, Stango and Zinman (2009) find that most of the fees incurred by credit card borrowers are avoidable.

[3]Source: http://www.whitehouse.gov/the_press_office/Fact-Sheet-Reforms-to-Protect-American-Credit-Card-Holders.

[4]Source: http://files.consumerfinance.gov/f/201306_cfpb_whitepaper_overdraft-practices.pdf

in the Truth in Lending Act of 1968 (TILA) and its subsequent amendments. This act calls for "clear" disclosure of a loan's APR, the loan amount, and all costs. The Dodd-Frank Act enhances these requirements for mortgages by requiring the disclosure of specific costs at origination and on a monthly basis.

We analyze the effects of regulation in markets for goods where add-on costs may be shrouded by producers. To be specific, add-on costs are any optional costs that may be incurred at some point after the product has been acquired. Examples of such costs include not only penalty fees and rates for credit cards but also redemption fees for mutual funds and a variety of other consumer costs. We develop a model based on that of Gabaix and Laibson (2006), in which there are myopic consumers, who fail to anticipate add-on costs, and sophisticated consumers, who rationally anticipate them. Add-on costs may be shrouded and excessive in equilibrium since both types of consumers' demands can be insensitive to this cost.

There are two primary motivations for regulation: to improve the welfare of all consumers (regardless of their need for protection), and to protect the least sophisticated consumers who are most in need of protection. In this paper, we analyze the effects of regulation on two welfare functions that capture regulators' desired goals. The first is *total surplus*, which measures the average monetized net benefit of consumers from the product. The second is *myopic welfare*, which measures this net benefit to consumers who do not realize that add-on costs/fees exist unless the costs are disclosed.

It is well-known that disclosure mandates can harm welfare if they are costly to implement, and price controls can harm welfare if they lead to underprovision of the good. We abstract away from these concerns; disclosure has no direct costs, and price caps are always greater than production costs. Following Gabaix and Laibson (2006), however, we assume disclosure is imperfect: if a firm discloses the price of the add-on, some, but not all, myopic consumers will understand the disclosure and take the price into account. We show that disclosure mandates can decrease welfare. Specifically, disclosure increases the number of consumers who understand the costs of the add-on, and consumption of the add-on can decrease as a result. Since consumers' valuation for the add-on is assumed to exceed its production cost, such avoidance is inefficient, and total surplus can decrease. In addition to harming total surplus, disclosure mandates can actually harm myopic consumers. As mentioned before, disclosure mandates can reduce consumption of the add-on. Since firms earn less from selling the add-on, they must compensate for these lost profits by increasing the price of the base good. In some markets, the harm caused by the increase in the price of the base good can dominate the benefits myopic consumers receive from the disclosure.

Like disclosure mandates, price controls can harm welfare. If disclosure is not mandated, there exists a parameter region in which two equilibria can exist. In one of the equilibria, firms voluntarily disclose the add-on price, whereas in the other, they shroud it. Total surplus and myopic welfare are higher in the equilibrium with disclosure. If price controls cause the market to move from the equilibrium with disclosure to the one with shrouding, total surplus and myopic welfare would decline. In practice, this would correspond to firms responding to externally imposed

price regulations by relaxing their self-regulated disclosure.[5]

Though either form of regulation can harm consumers when employed in isolation, we show that when applied jointly, the unintended consequences described above can be averted. Conditional on disclosure being mandated, price controls always (weakly) increase both total surplus and myopic welfare. Conditional on prices being sufficiently constrained, disclosure mandates always (weakly) increase both total surplus and myopic welfare. To our knowledge, we are the first to document such complementarities between disclosure mandates and price controls.

We finally examine a variation of the model in which consumers have heterogeneous valuations for the product, which can represent a social harm to some in the sense that its cost exceeds some consumers' monetized utility from consuming the good. For example, it has been argued that several classes of consumer financial products are harmful to consumers such as payday loans, actively managed mutual funds, and retail structured products. Moreover, credit and debit cards are harmful to consumers who would not have obtained them had they properly anticipated the fees they incur. In this variation of the model, both price and disclosure regulations can provide additional benefits to consumers. In most cases, the regulations reduce the amount that firms earn from selling the add-on. Firms respond by increasing the price of the base good so that it is closer to the production cost. As a result, there is less consumption of the good by consumers whose valuation is less than the production cost. Our main takeaways from the baseline model continue to apply in this more general model: both forms of regulation can harm welfare when employed in isolation, but when applied jointly, the negative consequences can be avoided.

2 Related Literature

Our model of shrouded add-on prices is motivated by Gabaix and Laibson (2006). They show that if a subset of the population is myopic, allocational inefficiencies and shrouded add-on prices can persist in equilibrium, even if markets are competitive and advertising is costless. Our paper innovates their analysis in a few ways. First, we study the effect of regulations, characterizing all tractable equilibria that exist with both voluntary and mandatory disclosure across a broad range of price controls.[6] In addition, we extend the model to an economy where regulations are particularly pertinent, i.e., where consumers are heterogeneous and the product can impose harm on some. Ellison (2005) develops a similar model in which firms utilize add-on pricing in order to price discriminate among rational consumers. In his model, high add-on prices are not sustainable if advertising and search are costless. We analyze the effects of pricing and disclosure regulations in a Gabaix and Laibson (2006) type setting. Armstrong and Vickers (2012) examine the effects of regulations (in isolation)

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[5]Throughout this paper, we remain agnostic about which equilibrium arises if more than one equilibrium can be sustained. Essentially, price controls only harm consumers if the market moves from a "good" equilibrium to a "bad" equilibrium when both the good and bad equilibria can be supported before and after the regulation. In contrast, disclosure mandates can harm consumers even when there is a unique equilibrium before the regulation and after the regulation.

[6]In contrast, Gabaix and Laibson (2006) only characterize equilibria that exist under voluntary disclosure with sufficiently lax price controls as we discuss later.

in a Gabaix and Laibson (2006) setting, in which firms cannot voluntarily reveal the add-on cost. Our findings differ since firms in our model can voluntarily disclose this cost, which leads to a multiplicity of equilibria. In addition, our regulatory analysis is more comprehensive, examining the joint effect of price and disclosure regulations among other innovations.

These models belong to a more general class in which firms can make prices difficult for consumers to understand. Kosfeld and Schüwer (2011) also study regulation within a model based on Gabaix and Laibson (2006). They focus on consumer education and find that education can harm welfare because it increases the number of sophisticates who inefficiently avoid purchasing the add-on. They do not, however, conduct a comprehensive analysis of price controls.[7] de Meza and Reyniers (2012) study consmer welfare in a model with Cournot production of a good with surcharges.[8] They find that unshrouding such surcharges can harm consumers as shrouding can increase supply and decrease upfront fees. However, their analysis is limited to markets in which supply must be determined in advance of consumer purchase. Heidhues, Köszegi, and Murooka (2011) also examine a market in which firms can impose hidden surcharges. In their model, regulators can improve welfare by restricting the amount firms can charge through these surcharges. They also examine a version of their model in which the good is socially wasteful as we do. Piccione and Spiegler (2011) develop a model where firms choose how to frame information to consumers; for example, the unit of measurement (e.g., ounces or grams) to make it easy or hard for consumers to compare the firm's products to competitors' products. They find that firms have incentives to make their goods difficult to compare. Carlin and Manso (2010) develop a model in which firms can alter the composition of sophisticated consumers (who are relatively unprofitable to the firm) and myopic consumers (who are relatively profitable to the firm) by obfuscating prices. They analyze the optimal timing of obfuscation given that obfuscation is costly and that consumers learn over time.

Our paper is also related to the literature on disclosure. Generally, if consumers are rational and there are no externalities associated with disclosure, it is difficult to justify government-mandated disclosure; firms will voluntarily disclose if the benefits from disclosure outweigh the costs, and Bayesian consumers will rationally update their beliefs about the firm and its products based on the firm's decision of whether or not to disclose. Possible externalities include the revelation of useful information about consumer trends, technological shocks, and optimal operating practices (Leuz and Wysocki (2008)). Fishman and Hagerty (2003) model a monopolist selling a product to heterogeneous consumers, some of whom can understand the information content of the disclosure, others of whom can only observe whether or not the firm discloses information. They show that

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[7]For example, they assume that regulators have perfect information and can set prices at their first-best value. Price controls in our model are more realistic in that they may be different than the first-best value. In practice, regulators may have imperfect information about production costs or consumer valuations. Alternatively, they may have imperfect ability to enforce this price. In addition, these authors do not consider the effect of price controls and disclosure mandates jointly.

[8]Surcharges differ from add-on prices in that with surcharges, there is only one good but two components to the price: an upfront fee and an additional fee that must be paid by everyone who purchases the good. With add-on pricing, there are two distinct goods: a base good and an add-on good or feature that may be purchased for an additional fee.

disclosure mandates can be beneficial to the consumers who are able to process the information, neutral for those who are unable to process the information, and harmful for the seller. Grubb (2011) finds that price disclosure mandates can be socially harmful when some consumers are inattentive because disclosure can restrict firms' ability to price discriminate.

3   Model Setup

We adopt the model of Gabaix and Laibson (2006) with some minor changes. Firms sell a product, offering a base good for an up-front observable price, p_1. They also offer an add-on to this product at a price of p_2 that is potentially unobservable. Firms' production functions for the base good and the add-on are both linear (with no fixed costs). Without loss of generality, we assume the unit production cost to be 0. Hence, prices are net of production costs, and they represent per-unit profits.

The price of the add-on is bounded by $\overline{p}$ so that no firm can charge $p_2 > \overline{p}$. This maximum price comes from either explicit or implicit price controls imposed by regulatory bodies, the legal system, etc. Obviously, price controls can harm welfare when they lead to underprovision of the good. We abstract away from this concern by assuming $\overline{p} \geq 0$.

There is a fraction, α, of *myopic consumers*. Specifically, if no firm discloses its price for the add-on, these consumers assume the add-on price to be zero, the production cost. This assumption is motivated by the evidence cited in footnote 2, which indicates that consumers systematically *underestimate* the cost of consumer financial products. The remainder of consumers are *sophisticated* and rationally anticipate the price of the add-on, whether it is disclosed or not. Firms are unable to observe consumers' types ex ante, so they are unable to price discriminate based on consumers' types.

- **Period 0:**

  Each firm determines its price for the base-good, p_1, and the add-on, p_2.[9] Each firm also decides whether to disclose or shroud the add-on price. There are no direct costs to disclosure, although our results hold when there are direct costs to disclosure.

- **Period 1:**

  If any firm discloses the price of its add-on, all sophisticates and a fraction $\lambda \in (0, 1]$ of myopic consumers observe add-on prices. The remainder of myopic consumers assume the add-on price is zero. For example, they may not read the (often lengthy) disclosures or properly process them as a result of cognitive costs or limitations. In the case of debit cards, the Fed prohibits banks from charging overdraft fees unless consumers opt-in, a form of disclosure regulation. However, many banks label their overdraft services as "overdraft protection" and market it as a protective measure, potentially fooling myopic consumers. We refer to any such consumers who improperly anticipate the add-on price as *uninformed myopic*. Informed myopic consumers

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[9]Firms are not allowed to change their pricing decisions in a later period.

who understand the add-on price disclosure behave identically to sophisticates, and we refer to them as such.

As in Gabaix and Laibson (2006), our model of disclosure is stylized in that either no myopic consumers or a fixed fraction is informed. This setting is attractive analytically because it admits symmetric pure strategy equilibria. Our paper represents an initial exploration of regulation in a minimal model of pricing and disclosure. One could consider a more nuanced model of disclosure with a continuous choice of disclosure quality and the tradeoff between simplicity and detail, for example.[10] We reserve this analysis for future research.

Consumers choose a firm, from which they buy either zero or one units of the base good. Consumers randomly select among all firms that provide them with the highest expected utility.

- **Period 2:**

  Consumers who purchase the base good acquire zero or one units of the add-on from the firm that sold them the base good. Consumers cannot purchase the add-on from firms that did not sell them the base good. If firms are able to sell the add-on to consumers who did not purchase the base good from them, the results of the Gabaix and Laibson (2006) model break down. In particular, separate competition in the add-on market would drive add-on prices down to cost. Therefore, this model may not be appropriate for markets such as printers (base good) and printer cartridges (add-on) if the firm does not have a patent on the printer cartridge and other firms are allowed to compete in the cartridge market.[11] However, the model is applicable to many penalty fees for consumer financial products. If a consumer engages in a penalized activity with firm X, it is often difficult or unfeasible for firm Y to intervene and divert the penalized activity to itself.[12]

  If firms do not disclose the add-on price, consumers do not observe this price until after their decision. For example, consumers may not learn the magnitude of penalty fees on a credit card until well after a late or delinquent payment. Our analysis can easily accommodate the case where consumers observe the add-on price before their decision as we discuss later in this section.

Each consumer i derives monetized utility $u_i \in [\underline{u}, \overline{u}]$ from consuming the base good. More formally, the population can be thought of as the rectangular region $[\underline{u}, \overline{u}] \times [0, 1]$. A consumer $(u_i, t_i) \in [\underline{u}, \overline{u}] \times [0, 1]$ has valuation u_i for the base good, and valuation ϵ for the add-on. If no firm discloses the price of its add-on, the agent is an uninformed myope if and only if $t_i < \alpha$. If at least one firm discloses the price of its add-on, the agent is an uninformed myope if and only if $t_i < \alpha(1 - \lambda)$.

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[10]Consumers may also be more attentive to disclosures that feature higher costs, i.e., λ may be a function of $\overline{p}$. We again reserve these variations of the model for future research in the interest of concision.

[11]We thank a referee for bringing this to our attention.

[12]For example, in the case of late payment fees, credit card lenders would likely incur exorbitant costs soliciting rollovers to the extent that they would effectively eliminate late payments for all consumers.

Each consumer derives monetized utility ϵ from consumption of the add-on good. Throughout this paper, we assume consumers are homogeneous in their valuations for the add-on for analytic simplicity. We discuss the implications of heterogeneous add-on valuations in an appendix to a previous draft of the paper, which is available upon request. We also assume that $\bar{u} + \epsilon > 0$ and $\epsilon > 0$. In other words, all consumers' valuation for the add-on is greater than its production costs, and there are some consumers whose valuation for the base good and add-on is more than the combined production cost.[13] Our model can accomodate the case in which there are substitutes for the add-on with non-negative cost (e.g., setting up an automatic credit card payment to avoid late fees). In Gabaix and Laibson (2006), consumers observe the price of the add-on before purchasing it but can substitute away from it if they incur a cost of e in advance. The welfare analysis is identical whether using the oppportunity cost of not purchasing the add-on from the firm, e, in the Gabaix and Laibson (2006) model or the utility of consuming the add-on, ϵ, in ours.[14] We choose our formulation of the model because of its applicability to our focal area of consumer financial products and to simplify actions and variables.

We assume there are no direct costs to disclosure. Our objective is to study social losses (and gains) that can result from regulations even in the absence of these costs. In addition, they strengthen our argument that disclosure requirements can decrease welfare as we elucidate later in the paper.

There is more than one firm that sets prices in Bertrand competition for consumer demand. Each consumer makes his purchase decision for the base good and add-on to maximize his total projected utility. Specifically, sophisticates purchase the add-on if $\epsilon \geq Ep_2$, where Ep_2 is the rational expectation for the add-on price offered by a firm. When computing Ep_2, sophisticated consumers take all relevant information into account: namely, the maximum amount firms are allowed to charge for the add-on ($\bar{p}$), and whether firms choose to disclose or shroud the price of the add-on. Uninformed myopes always buy the add-on if they have purchased the base good since they project its price to be zero.

3.1 Learning

In our model, the interaction between consumers and firms is a one-time game—firms set their prices and choose whether or not to shroud based only on the effects that period. In practice, firms and consumers are engaged in a repeated game, and myopic consumers can learn about penalty fees by incurring them. A natural question is whether our model applies to repeated interactions between firms and consumers.

Although we motivated our model by assuming that consumers are unaware of penalty fees, our analysis applies to situations where consumers know about the fees but underestimate the likelihood

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[13]Arguably, some consumer financial products such as actively-managed mutual funds and payday loans impose harms on a preponderance of consumers. In unreported analysis, we find that our results are largely similar when $\bar{u} + \epsilon < 0$.

[14]Specifically, the net monetized gain from purchasing the add-on in our model is $\epsilon - p_2$. In Gabaix and Laibson (2006), the monetized gain from purchasing the add-on from the firm is $\epsilon - p_2$ while the gain from subtitution is $\epsilon - e$. Therefore, the net monetized gain from purchasing the add-on from the firm (relative to opportunity cost) is $\epsilon - p_2$.

that they will incur the fees. For example, consumers may overestimate their ability to monitor their accounts and avoid fees. As a result, they would underestimate the expected cost of the add-on as in our model. Cognitive biases can suppress learning about these kinds of personal attributes as in Gervais and Odean (2001). In this framework, disclosure mandates might consist of mandating banks to provide consumers with information to de-bias them. For example, when consumers open an account, firms could disclose the average penalty fee paid by consumers and the percentage of consumers who incurred fees the previous year. After each year the consumer has had an account with a firm, the firm could provide annual penalty fee statements showing each consumer the total penalty fees he incurred that year. Such disclosures might cause consumers to pay more attention to their behavior and learn the true expected cost of add-ons more quickly over time.

Gabaix and Laibson (2006) provide other reasons why a static model such as ours can be applicable in more realistic scenarios. First, new consumers constantly enter markets, so there will always be myopic consumers who have never learned about penalty fees. Moreover, firms can create new types of penalties and charge fees for them.

3.2 Properties of Equilibria

As in Gabaix and Laibson (2006), we restrict our attention to symmetric pure-strategy equilibria, i.e., ones in which all firms charge the same prices for the base good and the add-on. In all such equilibria, firms earn zero profit. This result follows from the usual argument for competitive markets, except that in this market, firms compete on the price of the base good rather than the add-on. Specifically, if firms earned positive profits in equilibrium, a firm could earn a higher positive profit by lowering the base good price slightly and capturing all demand.[15] Another feature of the symmetric equilibria is that the price of the add-on is either the maximum amount firms are allowed to charge, $\overline{p}$, or the amount consumers value the add-on, ϵ. The logic behind this result is straightforward. In any equilibrium, firms earn non-negative profits from uninformed myopes and non-positive profits from sophisticated consumers.[16] If $p_2^* \notin \{\overline{p}, \epsilon\}$ and a firm raises the price of its add-on, uninformed myopes' demand would be unaffected, while the demand of sophisticated consumers would either fall to zero (if $p_2^* < \epsilon$) or be unaffected (if $p_2^* \geq \epsilon$). It follows that if $p_2^* \notin \{\overline{p}, \epsilon\}$, a firm could earn positive profits by raising the price of the add-on.

These results are stated formally in the following lemma.

Lemma 1. *In any symmetric pure-strategy equilibrium,*

(i) firms earn zero profit, and

(ii) p_2^*, the equilibrium price of the add-on good, satisfies $p_2^* \in \{\overline{p}, \epsilon\}$.

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[15]We should note that this result holds only if $\bar{u} + \epsilon \geq 0$ so that the good is not socially harmful to all consumers in the economy. In a similar model, Heidhues, Kőszegi, and Murooka (2011) derive equilibria in which firms earn positive profits. These equilibria exist because the good in their model is socially harmful to all consumers.

[16]This follows from the fact that uninformed myopes always consume the add-on, whereas sophisticated consumers only consume the add-on if its price is no greater than their valuation for it.

4 Baseline Model

In our baseline model, consumers have homogeneous valuations for the base good such that: $u_i \equiv \overline{u} = \underline{u} = u$ for all i. In Section 5, we analyze the effects of regulation when consumers have heterogeneous preferences for the base good.

4.1 Equilibria with Voluntary Add-on Price Disclosure

We first consider the equilibrium prices when the decision to disclose or shroud add-on prices is voluntary. This framework can apply to markets in which disclosure regulations do not exist or are lax in that information can be effectively obscured within pages of legal text. For example, a study by the Pew Charitable Trusts found that the median length of account agreements and fee schedule disclosures is 43 pages long.[17] We assume that firms prefer shrouding to disclosure if both result in identical profits (as they would if there were an infinitesimal cost to disclosure).

The following proposition summarizes the equilibria that exist for prices and disclosure. For $\overline{p} > \epsilon$, this setting is identical to that of Gabaix and Laibson (2006) under perfect competition.

Proposition 1. *When disclosure is voluntary, there exist thresholds, $\tilde{\overline{p}}_{MDU} = \frac{\epsilon}{\alpha(1-\lambda)}$ and $\tilde{\overline{p}}_{SU} = \frac{\epsilon}{\alpha}$, such that:*

- *If $\overline{p} \geq \tilde{\overline{p}}_{SU}$, there exists an equilibrium in which firms shroud and charge $p_1^* = -\alpha\overline{p}$ for the base good and $p_2^* = \overline{p}$ for the add-on. Only uninformed myopes purchase the add-on. We refer to this equilibrium as* **Shrouded Unfair**.

- *If $\tilde{\overline{p}}_{MDU} \geq \overline{p} \geq \epsilon$, there exists an equilibrium in which firms disclose and charge $p_1^* = -\epsilon$ for the base good and $p_2^* = \epsilon$ for the add-on. All consumers purchase the add-on. We refer to this equilibrium as* **Voluntarily Unshrouded**.

- *If $\overline{p} \leq \epsilon$, there exists an equilibrium in which firms shroud and charge $p_1^* = -\overline{p}$ for the base good and $p_2^* = \overline{p}$ for the add-on. All consumers purchase the add-on. We refer to this equilibrium as* **Shrouded Fair**.

No other symmetric equilibria exist.

Gabaix and Laibson (2006) document the existence of the Shrouded Unfair and Voluntarily Unshrouded equilibria, although they refer to them as the "Shrouded Prices Equilibrium" and the "Unshrouded Prices Equilibrium."[18] As they document, if $\overline{p} \in \left[\frac{\epsilon}{\alpha}, \frac{\epsilon}{\alpha(1-\lambda)}\right]$, the market can support

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[17]Source: http://www.pewstates.org/uploadedFiles/PCS_Assets/2013/Bank_Fees_Rating_Report.pdf

[18]There are more equilibria that can arise in our setting than in Gabaix and Laibson (2006) because we allow for a wider range of parameters as well as a mandatory disclosure regime, which we analyze in the next section. Because we have more equilibria, we use more descriptive terminology than Gabaix and Laibson (2006). However, the reader should note that Shrouded Unfair and Voluntarily Unshrouded equilibria are the same as the equilibria that Gabaix and Laibson (2006) document under perfect competition.

either of these equilibria.[19]

To understand the intuition behind these results, suppose that firms shroud the price of the add-on. Since the price is shrouded, consumers' decisions to purchase the add-on cannot depend on the add-on price. That is, they are price-insensitive. Hence, if firms shroud, it is a dominant strategy for firms to charge the maximum allowed price, $\overline{p}$. It trivially follows that if firms charge less than $\overline{p}$ for the add-on, they will disclose the add-on price. Sophisticated consumers recognize this, so they rationally infer that the price of the add-on is $\overline{p}$ whenever firms shroud.

Consider the case where $\overline{p} > \epsilon$. From Lemma 1, firms weigh two alternatives for the add-on price. They can (i) charge ϵ, the maximum amount sophisticated consumers are willing to pay to consume the add-on, and sell the add-on to all consumers (both sophisticated and uninformed myopes), or they can (ii) charge the maximum allowed price, $\overline{p}$, and only sell it to the uninformed myopic consumers. In this case, shrouding equilibria can only exist if firms earn more from selling the add-on at $\overline{p}$ than from selling the add-on at ϵ. Since uninformed myopes comprise α of the population when firms shroud, a shrouding equilibrium can only be sustained if $\alpha \overline{p} \geq \epsilon$. We refer to this equilibrium as *Shrouded Unfair* because the add-on is overpriced relative to consumers' reservation value. As a result, uninformed myopes overpay for the add-on and their utility is lower than that of sophisticated consumers who do not buy the overpriced add-on. Disclosure equilibria can only exist if firms earn more from selling the add-on to all consumers at ϵ than from selling the add-on only to uninformed myopes at $\overline{p}$. Since uninformed myopes comprise $\alpha(1 - \lambda)$ of the population when firms disclose, disclosure equilibria can only be sustained when $\alpha(1 - \lambda)\overline{p} \leq \epsilon$. We refer to this equilibrium as *Voluntarily Unshrouded* because firms voluntarily choose to disclose the price of the add-on. It follows that if $\overline{p} \in \left[\frac{\epsilon}{\alpha}, \frac{\epsilon}{\alpha(1-\lambda)} \right]$, the market can support either the Shrouded Unfair or Voluntarily Unshrouded equilibrium, as noted by Gabaix and Laibson (2006). For $\overline{p} > \frac{\epsilon}{\alpha(1-\lambda)}$, there do not exist pure-strategy symmetric equilibria with voluntary disclosure as in Gabaix and Laibson (2006). In this region, firms will necessarily shroud in such equilibria, creating a potential role for disclosure regulation.[20]

In the case where $\overline{p} \leq \epsilon$, prices for the add-on are less than consumers' valuation, and all consumers purchase the add-on, regardless of its price. Hence, firms charge $\overline{p}$ for the add-on, and since they prefer shrouding to disclosure when they yield equal profits (by assumption), firms shroud the add-on price. We refer to this equilibrium as *Shrouded Fair*.[21] We refer to this equilibrium as "fair" because sophisticates and uninformed myopes have the same realized utility. Specifically, even if uninformed myopes were sophisticated, they would still consume the add-on. Again, there do not

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[19]Standard equilibrium refinements cannot eliminate either of the equilibria in this region. As a result, both equilibria are featured as stable outcomes of the game in the shrouding literature, e.g., Gabaix and Laibson (2006). Throughout this paper, we remain agnostic about which equilibrium will arise when multiple equilibria can be supported.

[20]Heidhues, Kőszegi, and Murooka (2011) study a similar model in which transparent equilibria always exist. They assume that disclosure informs *all* consumers so that a firm has no incentive to shroud if other firms disclose. Disclosure in our model does not necessarily inform all consumers as in Gabaix and Laibson (2006). Therefore, a firm may have an incentive to shroud even if other firms disclose. Specifically, this firm may still choose to exploit remaining myopic consumers if the maximum add-on price is sufficiently high.

[21]In contrast, Gabaix and Laibson (2006) do not consider this equilibrium, implicitly assuming that price controls are sufficiently lax, i.e., $\overline{p} > \epsilon$.

exist pure-strategy symmetric equilibria with voluntary disclosure for $\bar{p} < \epsilon$.

Our equilibria share the feature of Gabaix and Laibson (2006) and others that add-ons are priced above cost while base goods are priced below.[22] In the context of credit cards, this outcome captures the idea that cards are generally offered with low upfront fees and rates (and even rewards and incentives) while featuring high rates and fees that arise later.

As in Gabaix and Laibson (2006), firms can shroud add-on prices in equilibrium even though the market is competitive and there are no costs to disclosure. Such an equilibrium can be sustained because no firm has an incentive to inform myopes and compete on add-on prices. Specifically, any firm which decreases and discloses its add-on price must increase their base good price to break even. Consumers who learn this information may simply purchase the base good at a cheaper price from a competitor while avoiding its high cost add-ons. This "curse of debiasing" prevents competition from moderating exorbitant add-on costs.

4.2 Equilibria with Mandatory Add-on Price Disclosure

We now consider the case when when regulators require firms to disclose add-on prices. In contrast, Gabaix and Laibson (2006) only analyze equilibria in which disclosure is voluntary. In practice, examples of disclosure mandates include statutes such as TILA and the Federal Reserve Board's rules on monthly credit card disclosures imposed in early 2010.

Proposition 2. *When disclosure is mandatory, there exists a threshold, $\tilde{\bar{p}}_{MDU} = \frac{\epsilon}{\alpha(1-\lambda)}$, such that:*

- *If $\bar{p} \geq \tilde{\bar{p}}_{MDU}$, there exists an equilibrium in which firms charge $p_1^* = -\alpha(1-\lambda)\bar{p}$ for the base good and $p_2^* = \bar{p}$ for the add-on. Only uninformed myopes purchase the add-on. We refer to this equilibrium as* **MD Unfair***.*

- *If $\bar{p} \leq \tilde{\bar{p}}_{MDU}$, there exists an equilibrium in which firms charge $p_1^* = -\min\{\bar{p}, \epsilon\}$ for the base good and $p_2^* = \min\{\bar{p}, \epsilon\}$ for the add-on. All consumers purchase the add-on. We refer to this equilibrium as* **MD Fair***.*

No other symmetric pure-strategy equilibria exist when disclosure is mandatory.

The intuition for this proposition is straightforward. The unfair equilibrium can only exist if firms earn less from selling the add-on to all consumers at ϵ than from selling the add-on only to uninformed myopes at $\bar{p}$. Since uninformed myopes comprise $\alpha(1 - \lambda)$ of the population with mandatory disclosure, the unfair equilibrium can only be sustained when $\alpha(1 - \lambda)\bar{p} \geq \epsilon$. The fair equilibrium can only exist if firms earn more from selling the add-on to all consumers at ϵ than from selling the add-on only to uninformed myopes at $\bar{p}$. Therefore, the fair equilibrium can only be sustained when $\alpha(1 - \lambda)\bar{p} \leq \epsilon$. In these equilibria, base goods are again priced below cost while the add-on is priced above cost.

---

[22]See Ellison (2005) and the references contained therein.

4.3   Welfare

Since all consumers' valuation for the base good and add-on exceeds the production costs, in the first best outcome all consumers consume the base good and add-on. Since production costs are normalized to 0, consumers' net monetized utility in the first best is $u + \epsilon$. In the credit card example, this seems to suggest that in the first best outcome, everyone pays his bills late, exceeds his credit limit, etc., which is an extreme and somewhat nonsensical interpretation of our model. A more reasonable interpretation is to acknowledge that the likelihood of engaging in a penalized activity is continuous rather than discrete. Consider the optimal probability at which sophisticated consumers incur penalties: presumably, even consumers who understand penalties would occasionally incur them (due to a temporary need for extra liquidity, a simple mistake because they do not allocate all their time monitoring when their bills are due, etc.). In the first best scenario, the marginal utility that consumers derive from increasing the probability of engaging in penalized activity by ε equals the marginal costs incurred by banks for processing the increase in the penalty probability by ε. The parameter, ϵ, represents the difference between consumers' monetized utility from engaging in penalized activities at the first best probability (versus never engaging in penalized activities), netted against the cost banks incur from processing penalties at the first best probability.[23]

We let Λ_{FB} denote the per capita consumer surplus in the first best outcome:

$$\Lambda_{\mathrm{FB}} \;\; = \;\; u + \epsilon. \tag{1}$$

The first best outcome is achieved in some, but not all, of the equilibria.

Recalling our assumption that $u + \epsilon > 0$, it follows from Propositions 1 and 2 that all consumers will purchase the base good in every equilibrium. Sophisticated consumers always behave rationally. They only consume the add-on if its price is no greater than their valuation ($\epsilon \geq p_2^*$). It trivially follows that their realized net utility is $u - p_1^* + \max\{\epsilon - p_2^*, 0\}$. Uninformed myopic consumers, on the other hand, consume the add-on regardless of its price. Their realized net utility is therefore $u + \epsilon - p_1^* - p_2^*$. We let U_s and U_{um} denote the monetized net utility derived by sophisticated and uninformed myopic consumers, respectively:

$$U_s \;\; = \;\; u - p_1^* + \max\{\epsilon - p_2^*, 0\} \tag{2}$$

$$U_{um} \;\; = \;\; u + \epsilon - p_1^* - p_2^* \tag{3}$$

We introduce functions to capture consumer welfare in the market. *Total surplus* (Λ_s) is the per capita net monetized utility among the entire population of consumers. It is a weighted average of U_s and U_{um}, where the weights are determined by the proportion of consumers who are sophisticated in equilibrium. *Myopic welfare* (Λ_m) is the per capita consumer surplus among

---

[23]Arguably, some real-world penalty fees for credit cards have exceeded their production costs, and if those fees were reduced to their production costs, sophisticated consumers would have altered their behavior and incurred more penalties. If so, consumers have spent more effort monitoring their activity than they would have in the first best scenario, indicating a loss in total surplus relative to first best.

the population of ex ante myopic consumers, i.e., those who act myopically if add-on costs are shrouded.[24] It is a weighted average of U_s and U_{um}, where the weights are determined by the proportion of these consumers who become sophisticated in equilibrium. For both functions, we subtract the per capita consumer surplus in the first best outcome (Λ_{FB}). It trivially follows that Λ_s is never positive. Moreover, since sophisticated consumers always behave optimally, their realized net monetized utility is always as large as myopic consumers'. Hence, $\Lambda_s \geq \Lambda_m$, and Λ_m is also non-positive in every equilibrium.

To mathematically express these functions, we introduce additional notation. Let α^* denote the proportion of consumers who are uninformed myopes in equilibrium, and let λ^* denote the proportion of myopic consumers who learn about add-on prices in equilibrium. If no firm discloses its add-on price, then none of the myopic consumers learn about add-on prices ($\lambda^* = 0$), and there will be α myopic consumers in the market ($\alpha^* = \alpha$). If any firm discloses its add-on price, then the proportion of myopic consumers who learn about the add-on price is λ (i.e., $\lambda^* = \lambda$), so there will be $\alpha(1 - \lambda)$ consumers who remain uninformed ($\alpha^* = \alpha(1 - \lambda)$).

$$
\alpha^* = \begin{cases} \alpha & \text{if no firm discloses its add-on price} \\ \alpha(1 - \lambda) & \text{if any firm discloses its add-on price} \end{cases} \tag{4}
$$

$$
\lambda^* = \begin{cases} 0 & \text{if no firm discloses its add-on price} \\ \lambda & \text{if any firm discloses its add-on price} \end{cases} \tag{5}
$$

Λ_s and Λ_m can then be expressed,

$$
\Lambda_s = \alpha^* U_{um} + (1 - \alpha^*) U_s - \Lambda_{FB} \tag{6}
$$

$$
\Lambda_m = \lambda^* U_s + (1 - \lambda^*) U_{um} - \Lambda_{FB} \tag{7}
$$

Firms earn zero profits in every equilibrium (Lemma 1). Thus, firms are unaffected by any inefficiencies in the market: all inefficiencies in the market accrue to consumers. With regard to total surplus, there is only one possible source of inefficiency in this market: if the equilibrium price of the add-on, p_2^*, exceeds consumers' valuation for it, ϵ, then sophisticated consumers will refrain from consuming it. This is socially inefficient because consumers' valuation for the add-on, ϵ, exceeds its production cost, 0. It follows that Λ_s equals 0 if $p_2^* \leq \epsilon$, and Λ_s equals $-(1 - \alpha^*)\epsilon$ if $p_2^* > \epsilon$. Recalling Propositions 2 and 1, and using obvious abbreviations (e.g., "MDF" to refer to

---

[24]Λ_m can be viewed two different ways. First, it represents an expected utility assuming that myopic consumers are homogeneous, i.e., if firms disclose, each myopic consumer has probability of λ of understanding the disclosure and probability of $1 - \lambda$ of not understanding it. Second, suppose that in practice there are three types of consumers: (i) fully rational consumers, (ii) semi-rational consumers who myopically assume $p_2^* = 0$ if prices are shrouded, but can understand disclosure when it is presented to them, and (iii) irrational consumers who myopically assume $p_2^* = 0$ whether prices are disclosed or not. Myopic welfare is the average utility of semi-rational and irrational consumers, weighted by the relative proportion of each in the population.

the MD Fair equilibrium), Λ_s in the five equilibria are given by

$$\Lambda^*_{s,\text{MDF}} = \Lambda^*_{s,\text{VU}} = \Lambda^*_{s,\text{SF}} = 0 \tag{8}$$

$$\Lambda^*_{s,\text{SU}} = -(1-\alpha)\epsilon \tag{9}$$

$$\Lambda^*_{s,\text{MDU}} = -[1-\alpha(1-\lambda)]\epsilon \tag{10}$$

In the MD Fair, Voluntarily Unshrouded, and Shrouded Fair equilibria, $p^*_2 \leq \epsilon$, and all consumers—sophisticated and myopic—consume the base good and add-on. (See Propositions 2 and 1.) Moreover, $p^*_1 + p^*_2 = 0$, so it trivially follows that each consumer's net monetized utility (whether he is sophisticated or not) is $u + \epsilon$, the first best outcome. Hence,

$$\Lambda^*_{m,\text{MDF}} = \Lambda^*_{m,\text{VU}} = \Lambda^*_{m,\text{SF}} = 0. \tag{11}$$

In the MD Unfair and Shrouded Unfair equilibria, $p^*_1 < u$ and $p^*_2 > \epsilon$. Myopic consumers (like sophisticated ones) consume the base good, so their net monetized utility from the base good is $u - p^*_1$. However, unlike sophisticated consumers, myopic consumers will consume the add-on if they remain myopic in equilibrium, which occurs with probability $1 - \lambda^*$ (see (5)). Hence, myopic consumers' per capita losses from the add-on are given by $|(1-\lambda^*)(p^*_2 - \epsilon)|$. It follows that Λ_m in the MD Unfair and Shrouded Unfair equilibria is given by

$$\Lambda^*_m = u - p^*_1 - (1-\lambda^*)(p^*_2 - \epsilon) - \Lambda_{\text{FB}}. \tag{12}$$

Plugging in the prices from Propositions 2 and 1, and recalling the definition of λ^* (from (5)), myopic welfare in the unfair equilibria can be expressed,

$$\Lambda^*_{m,\text{SU}} = -(1-\alpha)\bar{p} \tag{13}$$

$$\Lambda^*_{m,\text{MDU}} = -\lambda\epsilon - (1-\lambda)(1-\alpha)\bar{p}. \tag{14}$$

4.4 Effects of Regulation

To analyze the effects of these regulations on consumer welfare, it is useful to graphically depict Λ_s and Λ_m as a function of the maximum add-on price, $\bar{p}$, for each of the five equilibria. Figures 1 and 2 simply summarize equations (8)-(11) and (13)-(14).

[INSERT FIGURES 1 AND 2]

4.4.1 Disclosure Mandates

Here, we consider disclosure regulation in isolation, assuming that the maximum feasible add-on price, $\bar{p}$, is exogenous. For example, price controls may not be within the scope of a given regula-

tory agency or exogenously imposed by a separate governmental body. The following proposition highlights a rather striking result: disclosure requirements can strictly decrease welfare even when the associated costs are zero.

Proposition 3. *If the market is in the Shrouded Unfair equilibrium, mandating disclosure:*

- *increases (decreases) total surplus if it results in the MD Fair (MD Unfair) equilibrium.*

- *decreases myopic welfare if it results in the MD Unfair equilibrium and $\overline{p} < \frac{\epsilon}{1-\alpha}$; otherwise, mandating disclosure increases myopic welfare.*

If the market is in the Voluntarily Unshrouded or Shrouded Fair equilibria, mandating disclosure has no effect on either welfare function.

Mandating disclosure can improve total surplus and myopic welfare when $\tilde{\overline{p}}_{\text{SU}} \leq \overline{p} < \tilde{\overline{p}}_{\text{MDU}}$ and the market is in the Shrouded Unfair equilibrium; the market will necessarily shift to the MD Fair equilibrium, and the price of the add-on falls to a fair price. This is presumably the intended consequence when regulators mandate disclosure.

However, unintended consequences can arise when regulators mandate disclosure and the market is in the Shrouded Unfair equilibrium. Consider the region where $\overline{p} > \tilde{\overline{p}}_{\text{MDU}}$. Mandating disclosure shifts the equilibrium from Shrouded Unfair to MD Unfair. In both equilibria, firms price the add-on unfairly (i.e., $p_2^* = \overline{p} > \epsilon$). Mandating disclosure decreases surplus because it increases the number of sophisticates who inefficiently avoid the add-on. In addition, if $\frac{\epsilon}{\alpha(1-\lambda)} < \overline{p} < \frac{\epsilon}{1-\alpha}$, consumers—even the myopic ones that regulators are trying to protect—are strictly *worse* off. The benefit of mandatory disclosure to each myope is that he will understand the disclosure with positive probability, and if he understands the disclosure, he will avoid overpaying for the add-on. However, since there will be less consumption of the overpriced add-on, firms will increase the price of the base good to compensate for the lost profits from sales of the add-on. This increase in the price of the base good dominates the benefits that myopes receive from the disclosure. This reduction in myopic welfare is graphically depicted in the $\overline{p} \in (\frac{\epsilon}{\alpha(1-\lambda)}, \frac{\epsilon}{1-\alpha})$ region of Figure 2.

It is worth noting that disclosure mandates can only harm myopic welfare if $\alpha \geq \frac{1}{2-\lambda}$. Consequently, more than half of consumers must be myopic. Such a high incidence of naïvete among consumers is consistent with empirical evidence for at least some financial products. For example, Stango and Zinman (2009) find that 60% of fees incurred in the median credit and debit card account are avoidable.[25] In addition, disclosure regulations are harmful only if the effectiveness of disclosures is weak as measured by the parameter, λ. Weak disclosure methods such as the obscuring of information in lengthy disclosure documents can, in fact, impose harms on consumers. Our analysis,

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[25]In addition, Bucks and Pence (2008) find that 57% of adjustable-rate mortgage borrowers indicate that their interest rate cannot move by more than 5% over the life of the loan whereas only 6% of lenders indicate such limits in comparable data. These figures indicate that at least half of borrowers do not understand the terms of their adjustable rate mortgage.

therefore, provides additional arguments for strengthening and simplifying cost disclosures at the point of sale. Other papers such as Kosfeld and Schüwer (2011) and de Meza and Reyniers (2012) also document welfare losses from increasing consumer sophistication in similar settings. However, these do not papers provide a comprehensive analysis of price controls in isolation and in conjunction with information-oriented regulations as we do in the next sections.

4.4.2 Price Controls

We now examine the case when the maximum add-on price is endogenous. We refer to regulators decreasing the maximum add-on price ($\bar{p}$) as imposing additional price controls. If regulators could perfectly observe production costs and consumers' valuations for the add-on, they could achieve a first best outcome by setting price caps so that $0 \leq \bar{p} \leq \epsilon$. We believe it is more realistic to assume regulators cannot perfectly observe production costs or consumers' valuations.[26]

Although price controls generally benefit myopic consumers, there can be unintended consequences.

Proposition 4. *If the market is in the Shrouded Fair or the MD Fair equilibrium, imposing additional price controls has no effect on total surplus or myopic welfare.*

If the market is in the Voluntarily Unshrouded equilibrium, imposing additional price controls decreases both total surplus and myopic welfare if it results in the Shrouded Unfair equilibrium; otherwise, it has no effect on either welfare function.

If the market is in the Shrouded Unfair equilibrium, imposing additional price controls:

- *increases total surplus if it results in the Voluntarily Unshrouded or Shrouded Fair equilibria; otherwise, it has no effect on total surplus.*

- *increases myopic welfare.*

If the market is in the MD Unfair equilibrium, imposing additional price controls:

- *increases total surplus if it results in the MD Fair equilibrium; otherwise, it has no effect on total surplus.*

- *increases myopic welfare.*

If price controls are imposed when the market is in an unfair equilibrium (MD Unfair or Shrouded Unfair) and the market remains in an unfair equilibrium, then firms earn less from selling the add-on, the price of the base good rises, total surplus is unaffected, and myopic welfare improves.

---

[26]Indeed, it is difficult to ascertain whether price caps such as the $25 limit on late payment fees from the Card Act are above or below consumers' monetized utility from making a late payment on their credit cards.

In this scenario, the effect of the regulation is simply a transfer from sophisticated consumers to myopic consumers.

Price controls improve total surplus and myopic welfare when they are imposed in an unfair equilibrium and the resulting fee cap is sufficiently low that the market can no longer support the unfair equilibrium.

It is possible for price controls to harm welfare if they are imposed when the market is in the Voluntarily Unshrouded equilibrium and the market can support the Voluntarily Unshrouded and the Shrouded Unfair equilibrium. If the reduction in price cap is modest and the market remains in a region where both equilibria can be supported, and the market shifts to the Shrouded Unfair equilibrium, then total surplus and myopic welfare decline.[27] It is worth noting that there is less reason to be concerned about this particular unintended consequence than the one associated with disclosure regulations. In particular, disclosure regulations *necessarily* reduce total surplus and myopic welfare in certain parameter regions, whereas there are no parameter regions in which price controls necessarily reduce total surplus and myopic welfare.

4.4.3 Complementarities

We have demonstrated that disclosure and price regulation can each harm total surplus and myopic welfare. In this section, we document that there are complementarities between the two forms of regulation.

Proposition 5. *If $\overline{p} \leq \frac{\epsilon}{(1-\lambda)\alpha}$, disclosure mandates never reduce total surplus or myopic welfare. If disclosure is mandated, add-on price regulations never reduce total surplus or myopic welfare.*

Disclosure mandates can only reduce total surplus and myopic welfare if the market moves from the Shrouded Unfair equilibrium to the MD Unfair equilibrium. It can be seen from Figures 1 and 2 that if add-on prices ($\overline{p}$) are sufficiently constrained to the point that $\overline{p} \leq \frac{\epsilon}{(1-\lambda)\alpha}$, disclosure mandates cannot cause this particular equilibrium transition. Hence, price regulation serves as a complement to disclosure regulation. Moreover, price regulations can only harm welfare when the Voluntarily Unshrouded and Shrouded Unfair equilibria can be supported before and after the regulation. Since this is only possible when disclosure is voluntary, disclosure mandates serve as a complement to price regulation. These complementarities are noteworthy since price controls and

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[27]There are reasons to believe externally imposed price controls could affect firms' self-regulated disclosure. An example of such self-regulation occurs when industry trade groups promulgate best practices with the goal of pre-empting external regulation or enhancing public image. For instance, the Investment Company Institute pre-emptively proposed disclosure principles for target-date funds in June 2009 in anticipation of pending rule-making to regulate these funds. The imposition of regulation through price controls could, in principle, decrease firms' incentive to self-regulate and congregate around the best practice of disclosing add-on costs.

Alternatively, the equilibrium in this region could shift from Shrouded Unfair to Voluntarily Unshrouded as a result of additional price controls. There is clear rationale for such a shift in a non-competitive model where firms can earn rents from sale of the add-on. Namely, firms have increased incentive to self-regulate and disclose add-on prices if they earn less from selling the add-on when shrouding.

disclosure mandates are often viewed as *substitutes*, in that greater disclosure obviates the need for price controls. To our knowledge, our paper is the first to document complementarities between disclosure mandates and price controls.

5 Heterogeneous Valuations

The markets we analyze are perfectly competitive in the sense that firms earn zero profits in equilibrium. In competitive markets, prices usually equal production costs. However, in Section 3 we showed that in the presence of myopic consumers and shroudable add-on prices, prices for the goods do not equal production costs in any equilibrium. These pricing distortions only affect economic efficiency in two of the equilibria in Section 4: the MD Unfair and Shrouded Unfair equilibria. In these equilibria, all consumers' valuations for the add-on exceed the production cost of the add-on, but sophisticated consumers refrain from consuming the add-on because its price $(\overline{p})$ exceeds their valuation (ϵ). In the other three equilibria, on the other hand, all consumers consume the base good and the add-on. Even though prices for the base good are below production costs, there is no inefficient consumption of the base good because all consumers' valuations for the base good exceed the production cost.

In practice, it is reasonable to believe that consumers have heterogeneous valuations not only in markets for consumption goods, where there is heterogeneity in which consumers purchase different types of goods, but also in credit markets. For example, consumers differ in their preferences for borrowing on credit cards versus using cash instruments.[28] In the previous section, we examined the polar case where all consumers had the same valuation for the good. We now examine the opposite case where consumers' valuations vary over a wide interval. In addition, we assume that the good is socially harmful to some consumers in the sense that their valuation is below production costs. This model is appropriate when some consumers regret use of a good once they learn its long-term costs. It has also been argued that certain credit and investment products such as actively managed mutual funds are harmful to consumers because cheaper alternatives are often available.[29] In our heterogeneous model, some consumers participate in the market by purchasing the base good, while others abstain from the market entirely because equilibrium prices exceed their valuations.[30]

We assume consumers' valuations for the base good are uniformly distributed over the interval $[\underline{u}, \overline{u}]$:

$$u \sim U\left(\underline{u}, \overline{u}\right).$$

---

[28]Sprenger and Stavins (2012), for example, study heterogeneity in the use of payment instruments including credit and debit cards.

[29]There are numerous add-on fees associated with investment vehicles such as mutual funds including early redemption fees. The arguments against actively managed mutual funds extend back to the seminal paper of Jensen (1968).

[30]Our paper is not the first to examine socially harmful products in this setting. For example, Heidhues, Kőszegi, and Murooka (2011) study product innovation in a similar model where goods with shrouded costs can be socially harmful.

To avoid normalization, we assume that the measure of consumers in the economy is equal to $\bar{u} - \underline{u}$. To simplify our analysis, we also assume that valuations are sufficiently disperse so that in each equilibrium, some sophisticated consumers purchase the base good and others do not: $\underline{u} + \epsilon \leq -\bar{p}$. We continue to assume that the add-on represents a net benefit to consumers, i.e., $\epsilon \geq 0$. For example, credit card use may induce overspending and impose associated harms on consumers; however, the option to pay bills late or exceed one's credit limit may still be valuable to a consumer net of the cost to the producer. In this section, we also continue to assume that consumers have homogeneous valuations for the add-on.[31]

As in the baseline model, there can exist five different symmetric pure strategy equilibria, which we label as MD Fair, MD Unfair, Shrouded Unfair, Voluntarily Unshrouded, and Shrouded Fair. We provide the details of these equilibria in Lemma 2 in the appendix.

The effects of regulation are more nuanced in this setting. Regulation can be more desirable when valuations are heterogeneous. As in the homogeneous case, equilibrium prices for the base good are always less than the production cost. Unlike the homogeneous case, this mispricing induces some consumers to consume the good even though their valuations are less than the production costs. Specifically, some myopic consumers fail to account for the expense of the add-on, which is priced above cost, when deciding to purchase the base good. Also, in the unfair equilibria, some sophisticated consumers consume the base good (and avoid the add-on) even though the base good's production cost exceeds their valuation for it. Regulation can reduce this socially harmful consumption. Price controls and disclosure regulation (in tandem or in isolation) can raise total surplus by inducing firms to raise the price of the base good to a level closer to the production cost, which causes fewer consumers to participate in the market. For example, disclosure mandates and price controls can increase base good prices when applied in the Shrouded Fair equilibrium, resulting in a Pareto-improvement which increases both total surplus and myopic welfare. In the baseline model, such regulations have no effect on welfare when applied in this equilibrium as there is no socially harmful consumption of the base good. In addition, in the baseline model, regulation was never Pareto-improving.

However, with heterogeneous base good valuations, there are cases in which price controls can decrease welfare when they did not in the baseline model. Specifically, price controls can decrease welfare when they shift the equilibrium from Voluntarily Unshrouded to Shrouded Fair since the loss of disclosure can increase the pool of myopes inefficiently buying the base good. In contrast, in the baseline model welfare is first-best in both equilibria.

The following proposition describes the welfare effects of regulation when there are heterogeneous valuations for the base good.

---

[31] Allowing for heterogeneity in add-on valuations complicates the analysis significantly. For example, in some parameter regions, no symmetric pure strategy equilibrium exists. Because of this intractability, welfare conclusions are difficult to discern. However, if we continue assuming that symmetric, pure strategy equilibria arise whenever they exist, we can still conclude that sufficiently stringent price controls remove harms from disclosure regulations. This analysis is available upon request.

Proposition 6. *When base good valuations are heterogeneous,* **disclosure mandates** *can either increase or decrease total surplus and myopic welfare. If the market is in the Shrouded Unfair equilibrium, mandating disclosure:*

- *strictly decreases total surplus if and only if it results in the MD Unfair equilibrium and:*

$$\alpha\lambda(2\overline{u}\epsilon + \epsilon^2) > p_{1,SU}^{*2} - p_{1,MDU}^{*2} \tag{15}$$

- *strictly decreases myopic welfare if and only if it results in the MD Unfair equilibrium and:*

$$(2-\alpha)(p_{1,SU}^{*2} - p_{1,MDU}^{*2}) + 2(1-\alpha)\overline{u}(p_{1,MDU}^* - p_{1,SU}^*) - \alpha\lambda(2\overline{u}\epsilon + \epsilon^2) \quad < \quad 0, \tag{16}$$

where $p_{1,SU}^*$ and $p_{1,MDU}^*$ are the prices of the base good in the Shrouded Unfair and MD Unfair equilibria as defined in Lemma 2 in the appendix.

When base good valuations are heterogeneous, **price regulations** *can either increase or decrease total surplus and myopic welfare. If the market is in the Voluntarily Transparent equilibrium, imposing additional price controls strictly decreases both total surplus and myopic welfare if and only if it results in the Shrouded Unfair equilibrium or it results in the Shrouded Fair equilibrium and the new maximum add-on price is more than $\epsilon\sqrt{1-\lambda}$.*

Tables 1 and 2 compare the effects of regulation in the baseline and heterogeneous models.

As in the baseline model, either form of regulation can harm consumers (even the myopic ones), and there are complementarities between the two forms of regulation as the overall structure of the equilibria remain similar. Namely, if disclosure is mandated, price regulations do not reduce total surplus or myopic welfare, and if add-on prices are sufficiently constrained, disclosure mandates do not reduce total surplus or myopic welfare.

6   Conclusion

We have analyzed the welfare effects of price and disclosure regulation in markets where add-on costs can be shrouded from consumers, e.g., penalty fees for consumer financial products. We derived a number of novel results. First, mandating disclosure can decrease welfare, whether measured by the total surplus that accrues to all consumers or the welfare of myopic consumers. Such disclosure mandates can increase the pool of sophisticated consumers who inefficiently avoid the add-on. This results in higher prices for the base good, harming the myopic consumers who are left behind by the disclosure.

Second, price controls can also increase or decrease welfare. Third, there are complementarities between price and disclosure regulations. Namely, disclosure requirements can never impose harms if prices are sufficiently constrained, and price controls can never impose harms if disclosure is

mandated. Finally, both price and disclosure regulations can serve to screen out consumers who are harmed by the product.

Our work suggests a number of paths for future research. First, one could test the model's empirical implications. According to both versions of the model (baseline and heterogeneous), when the market moves from the Shrouded Unfair to the MD Unfair equilibrium, the base good price increases while the add-on price remains the same. Hence, one could examine whether disclosure regulations (such as TILA and its amendments) increase up-front consumer lending fees while not decreasing subsequent penalty fees. One should expect to observe such an outcome in environments with little or no price controls, i.e., in markets where the unfair equilibria can exist.[32] Agarwal, Chomsisengphet, Mahoney, and Stroebel (2014) come closest to testing these predictions by empirically examining the effects of the CARD Act, which imposed price and disclosure regulations on penalties for consumer financial products. They present evidence that the law reduced borrowing costs for consumers, and they find no evidence that it lead to unintended consequences such as an increase in interest rates or a decrease in credit volume. If one views interest rates as a base good price, their findings challenge our model's predictions that price and disclosure regulations of the add-on (penalty fees) cause a rise in the price of the base good. However, in our view, usage fees net of rewards (such as cash back bonuses) is the best measure of the base good price. Due to the nature of their data, they are unable to test whether the law lead to a reduction in rewards.[33] Therefore, the authors are unable to test whether the regulations cause the base good price to rise. In addition, the authors are only able to analyze the short term effects following the regulations; it is possible that banks chose to wait until regulatory and public scrutiny subsides before increasing interest rates or reducing credit provision.

There are also a number of natural extensions of the model. Consumers in our model properly anticipate their utility from use of the base good and add-on. However, models with time-inconsistent preferences are often applicable to consumer credit markets, in which consumers may not properly anticipate their future utility and use of the good. Such models can explain the excessive borrowing and spending observed in such markets. One could explore how imperfect anticipation of preferences would alter the model, and how educational programs which make consumers more self-aware would affect welfare and the private incentive to disclose information. Finally, one could explore consumer welfare in a setting with a more nuanced model of disclosure as mentioned previously. Such a model could attempt to capture various features of disclosure including disclosure quality and the tradeoff between simplicity and detail.

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[32]Empiricists have documented that consumers do not fully react to shrouded components of some goods' prices, e.g., shipping costs in eBay auctions. See, for example, Brown, Hossain, and Morgan (2010) and Chetty, Looney, and Kroft (2009).

[33]The authors conduct a difference-in-differences analysis of consumer credit cards, which were subject to the regulation, and small business credit cards, which were not. Since the authors can analyze interest rates and credit provision at the account level, they can identify the causal effect of the CARD Act on these variables. However, they can only observe rewards expenses at the firm level. Hence, they cannot use their diff-in-diffs methodology to identify the causal effect of the CARD Act on rewards.

A Proofs

Proof. (**Lemma 1, (i)**)

Let (p_1^*, p_2^*) be a symmetric equilibrium. We first prove that firms earn zero profit in any such equilibrium. The per-consumer equilibrium profit when firms offer prices of p_1^* for the base good and p_2^* for the add-on is given by the following expression:

$$
\Pi(p_1^*, p_2^*) = \frac{1-\alpha^*}{M} \frac{\max\{\overline{u} - \underline{u}_S^*, 0\}}{\overline{u} - \underline{u}} \left(p_1^* + p_2^* \cdot \mathbf{1}_{\{p_2^* \leq \epsilon\}} \right) \\
+ \frac{\alpha^*}{M} \frac{\max\{\overline{u} - \underline{u}_N^*, 0\}}{\overline{u} - \underline{u}} (p_1^* + p_2^*)
\tag{17}
$$

In the expression above, M represents the number of firms. In addition, $\underline{u}_S^*$ represents the minimum base good valuation for which a sophisticate will purchase the base good such that $\underline{u}_S^* = \max\{p_1^* + \min\{p_2^* - \epsilon, 0\}, \underline{u}\}$. Similarly, $\underline{u}_N^*$ represents the minimum base good valuation for which a myope will purchase the base good such that $\underline{u}_N^* = \max\{p_1^* - \epsilon, \underline{u}\}$. For the case when $\overline{u} = \underline{u}$, the equilibrium profit is given by:

$$
\Pi(p_1^*, p_2^*) = \frac{1-\alpha^*}{M} \mathbf{1}_{\{\overline{u} \geq p_1^* + \min\{p_2^* - \epsilon, 0\}\}} \left(p_1^* + p_2^* \cdot \mathbf{1}_{\{p_2^* \leq \epsilon\}} \right) \\
+ \frac{\alpha^*}{M} \mathbf{1}_{\{\overline{u} \geq p_1^* - \epsilon\}} (p_1^* + p_2^*)
\tag{18}
$$

We assume that this equilibrium profit is positive then prove by contradiction that it is profitable for firms to offer $p_1 = p_1^* - \varepsilon$ for the base good and $p_2 = p_2^*$ for the add-on if $\varepsilon > 0$ is sufficiently small. Any such firm will capture all consumer demand previously captured by other firms. Therefore, the off-equilibrium profit from this deviation is given as follows:

$$
\Pi(p_1, p_2) = (1 - \alpha^*) \frac{\max\{\overline{u} - \underline{u}_S, 0\}}{\overline{u} - \underline{u}} \left(p_1^* + p_2^* \cdot \mathbf{1}_{\{p_2^* \leq \epsilon\}} - \varepsilon \right) \\
+ \alpha^* \frac{\max\{\overline{u} - \underline{u}_N, 0\}}{\overline{u} - \underline{u}} (p_1^* + p_2^* - \varepsilon)
\tag{19}
$$

In the expression above, $\underline{u}_S$ and $\underline{u}_N$ now represent the minimum base good valuation for which sophisticates and myopes will purchase the base good at these off-equilibrium prices, respectively. Namely, $\underline{u}_S = \max\{p_1^* + \min\{p_2^* - \epsilon, 0\} - \varepsilon, \underline{u}\}$, and $\underline{u}_N = \max\{p_1^* - \epsilon - \varepsilon, \underline{u}\}$. For the case when $\overline{u} = \underline{u}$, this off-equilibrium profit is given by:

$$
\Pi(p_1, p_2) = (1 - \alpha^*) \mathbf{1}_{\{\overline{u} \geq p_1^* + \min\{p_2^* - \epsilon, 0\} - \varepsilon\}} \left(p_1^* + p_2^* \cdot \mathbf{1}_{\{p_2^* \leq \epsilon\}} - \varepsilon \right) \\
+ \alpha^* \mathbf{1}_{\{\overline{u} \geq p_1^* - \epsilon - \varepsilon\}} (p_1^* + p_2^* - \varepsilon)
\tag{20}
$$

Since $\Pi(p_1, p_2)$ is continuous in ε, it is clear that $\Pi(p_1, p_2) > \Pi(p_1^*, p_2^*) > 0$ for ε sufficiently small and $M \geq 2$.

$\square$

Proof. (**Lemma 1, (ii)**)

First, suppose $p_2^* < \min\{\epsilon, \overline{p}\}$. Consider the per-customer profits of a firm that charges $(p_1^*, \overline{p})$. Since $p_2^* < \epsilon$, no sophisticated consumer will choose to frequent the firm that charges $(p_1^*, \overline{p})$. Hence,

the firm's customers will consist only of myopes, so $\pi(p_1^*, \overline{p})$, the per-customer profits of a firm that charges $(p_1^*, \overline{p})$, satisfies

$$
\begin{aligned}
\pi(p_1^*, \overline{p}) & = & p_1^* + \overline{p} \\
& > & p_1^* + p_2^* \\
& = & \pi(p_1^*, p_2^*) \\
& = & 0,
\end{aligned}
\tag{21}
$$

contradicting the optimality of (p_1^*, p_2^*). Hence, for any symmetric equilibrium, $p_2^* \geq \min\{\epsilon, \overline{p}\}$.

Now, suppose $\epsilon < p_2^* < \overline{p}$. Then holding the price of the base good constant and increasing the price of the add-on does not affect consumers' demand (either myopic or sophisticated) for the firm's products, and it increases the profits the firm earns from the myopic consumers. Hence, $p_2^* \notin (\epsilon, \overline{p})$.

By the definition of $\overline{p}$, $p_2^* \leq \overline{p}$. This, and the results that $p_2^* \geq \min\{\epsilon, \overline{p}\}$ and $p_2^* \notin (\epsilon, \overline{p})$ imply that $p_2^* \in \{\epsilon, \overline{p}\}$, completing the proof. $\qquad\square$

Proof. (**Uniqueness, Proposition 1**)

Consider separately the shrouding equilibria and the non-shrouding equilibria. In particular, the uniqueness claim of Proposition 2 is equivalent to the following claim:

Possible shrouding equilibria:

- $\overline{p} \geq \frac{\epsilon}{\alpha} \implies (p_1^*, p_2^*) = (-\alpha\overline{p}, \overline{p})$

- $\overline{p} \in (\epsilon, \frac{\epsilon}{\alpha}) \implies$ No equilibrium

- $\overline{p} \leq \epsilon \implies (p_1^*, p_2^*) = (-\overline{p}, \overline{p})$

Possible disclosure (non-shrouding) equilibria:

- $\overline{p} \geq \frac{\epsilon}{\alpha(1-\lambda)} \implies$ No equilibrium

- $\overline{p} \in \left(\epsilon, \frac{\epsilon}{\alpha(1-\lambda)}\right) \implies (p_1^*, p_2^*) = (-\epsilon, \epsilon)$

- $\overline{p} \leq \epsilon \implies$ No equilibrium

It is straightforward to verify these claims by analyzing each of the cases separately.

$\qquad\square$

Proof. (**Existence, Proposition 1**) To prove the existence claim of Proposition 2, we must show that the following equilibria exist:

Shrouding equilibria:

- If $\overline{p} \geq \frac{\epsilon}{\alpha}$, then $(p_1^*, p_2^*) = (-\alpha\overline{p}, \overline{p})$ is a shrouding equilibrium

- If $\overline{p} \leq \epsilon$, then $(p_1^*, p_2^*) = (-\overline{p}, \overline{p})$ is a shrouding equilibrium

Disclosure (non-shrouding) equilibria:

- If $\bar{p} \in \left[\epsilon, \frac{\epsilon}{\alpha(1-\lambda)} \right]$, then $(p_1^*, p_2^*) = (-\epsilon, \epsilon)$ is a disclosure equilibrium

Gabaix and Laibson (2006) prove (see their Proposition 1) that if $\bar{p} \geq \frac{\epsilon}{\alpha}$, then $(p_1^*, p_2^*) = (-\alpha\bar{p}, \bar{p})$ is a shrouding equilibrium. The $\bar{p} \leq \epsilon$ case that they do not consider can be analyzed in an analogous manner.

$\square$

Proof. (**Uniqueness, Proposition 2**)

First note that since disclosure is mandatory, there exist measure $\alpha(1-\lambda)$ of myopes and measure $1 - \alpha(1-\lambda)$ of sophisticates.

Case 1: $\alpha(1-\lambda)\bar{p} > \epsilon$. Let (p_1^*, p_2^*) be a symmetric equilibrium.

Suppose $p_2^* \neq \bar{p}$. By Lemma 1, $p_2^* = \epsilon$, and the zero profit condition implies $p_1^* = -\epsilon$. Consider the per-customer profit of a firm charging $(p_1, p_2) = (-\epsilon, \bar{p})$:

$$
\begin{aligned}
\pi &= \alpha(1-\lambda)(\bar{p} - \epsilon) + [1 - \alpha(1-\lambda)](-\epsilon) \\
&= \alpha(1-\lambda)\bar{p} - \epsilon \\
&> 0,
\end{aligned}
$$

contradicting the optimality of (p_1^*, p_2^*). Hence, $p_2^* = \bar{p}$, and Lemma 1 implies $p_1^* = -\alpha(1-\lambda)\bar{p}$, so the equilibrium is unique for this case.

The $\alpha(1-\lambda)\bar{p} < \epsilon$ and $\alpha(1-\lambda)\bar{p} = \epsilon$ cases are similar.

$\square$

Proof. (**Existence, Proposition 2**)

Case 1: $\alpha(1-\lambda)\bar{p} \geq \epsilon$. We must show $(p_1^*, p_2^*) = (-\alpha(1-\lambda)\bar{p}, \bar{p})$ is an equilibrium.

Suppose all firms are charging $(p_1^*, p_2^*) = (-\alpha(1-\lambda)\bar{p}, \bar{p})$, and consider the profits of a firm that charges (p_1, p_2).

If $p_1 > p_1^*$, the firm will not attract any myopic consumers, and it will attract sophisticated consumers if and only if $p_2 \leq \epsilon$ and $p_2 \leq \epsilon - (p_1 - p_1^*)$. For such (p_1, p_2), the firm's per-customer profits are given by the equation

$$
\begin{aligned}
\pi(p_1, p_2) &= p_1 + p_2 \\
&\leq \epsilon + p_1^* \\
&= \epsilon - \alpha(1-\lambda)\bar{p} \\
&\leq 0.
\end{aligned}
$$

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Hence, no firm has an incentive to charge $p_1 > p_1^*$.

If $p_1 < p_1^*$, the firm will attract every consumer's demand, but it cannot earn positive profits:

$$
\begin{aligned}
\pi(p_1, p_2) &= p_1 + p_2 \mathbf{1}_{\{p_2 \leq \epsilon\}} + \alpha(1-\lambda)p_2 \mathbf{1}_{\{p_2 > \epsilon\}} \\
&\leq p_1 + \max\{\epsilon, \alpha(1-\lambda)\bar{p}\} \\
&< p_1^* + \alpha(1-\lambda)\bar{p} \\
&= \pi(p_1^*, p_2^*),
\end{aligned}
$$

Hence, no firm has incentive to charge $p_1 = p_1^*$ for the base good. Assume $p_1 = p_1^*$. Then the firm's optimal add-on price is clearly either ϵ or $\bar{p}$. Namely, if a firm charges $p_2 < \min\{\epsilon, \bar{p}\}$, it can earn more from both myopes and sophisticates if by increasing p_2 to $\min\{\epsilon, \bar{p}\}$. If $\epsilon < p_2 < \bar{p}$, the firm can earn more from myopes and the same from sophisticates by increasing p_2 to $\bar{p}$. The per-customer profits earned from $p_2 = \epsilon$ or $\bar{p}$ are given as follows:

$$
\begin{aligned}
\pi(p_1^*, \epsilon) &= p_1^* + \epsilon \\
&\leq p_1^* + \alpha(1-\lambda)\bar{p} \\
&= \pi(p_1^*, p_2^*).
\end{aligned}
$$

Hence, (p_1^*, p_2^*) is each firm's best response, so it is an equilibrium.

The other cases are similar.

□

Proof. (**Propositions 3-5**) These follow directly from Figures 1 and 2. □

Proof. (**Proposition 6**)

Consider consumers' participation constraints. (In the baseline model, all consumers purchase the base good in every equilibrium, so the participation constraint is irrelevant in that model.) It is easily seen that with heterogeneous valuations, a sophisticated consumer with base good valuation u_i purchases the base good if $u_i - p_1^* + \max\{\epsilon - p_2^*, 0\} \geq 0$, and an uninformed myopic consumer with base good valuation u_i purchases the base good if $u_i + \epsilon \geq p_1^*$.

Lemma 1 applies whether valuations are homogeneous or heterogeneous, so the equilibria are similar in the baseline and heterogeneous models, as the following lemma describes:

Lemma 2. *Let α_{su} and α_{mdu} be defined by*

$$
\alpha_{su} = \frac{-\bar{u} + \alpha(\bar{p} - \epsilon) + \sqrt{(\bar{u} - \alpha(\bar{p} - \epsilon))^2 + 4\alpha\bar{p}(\bar{u} + \epsilon)}}{2\bar{p}} \tag{22}
$$

$$\alpha_{mdu} = \frac{-\overline{u} + \alpha(1-\lambda)(\overline{p}-\epsilon) + \overline{\sqrt{(\overline{u}-\alpha(1-\lambda)(\overline{p}-\epsilon))^2 + 4\alpha(1-\lambda)\overline{p}(\overline{u}+\epsilon)}}}{2\overline{p}}. \tag{23}$$

When disclosure is mandatory, there exists a threshold, $\overline{p}^{\dagger}_{MDU} = \frac{\epsilon}{\alpha_{mdu}}$, such that:

- If $\overline{p} \geq \overline{p}^{\dagger}_{MDU}$, there exists an equilibrium in which firms charge $p_1^* = p_{1,MDU}^* = -\alpha_{mdu}\overline{p}$ for the base good and $p_2^* = \overline{p}$ for the add-on. We call this equilibrium **MD Unfair**.

- If $\overline{p} \leq \overline{p}^{\dagger}_{MDU}$, there exists an equilibrium in which firms charge $p_1^* = -\min\{\epsilon, \overline{p}\}$ for the base good and $p_2^* = \min\{\epsilon, \overline{p}\}$ for the add-on. We call this equilibrium **MD Fair**.

When disclosure is voluntary, there exists a threshold, $\overline{p}^{\dagger}_{SU} = \frac{\epsilon}{\alpha_{su}}$, such that $\epsilon < \overline{p}^{\dagger}_{SU} < \overline{p}^{\dagger}_{MDU}$ and:

- If $\overline{p} \geq \overline{p}^{\dagger}_{SU}$, there exists an equilibrium in which firms shroud and charge $p_1^* = p_{1,SU}^* = -\alpha_{su}\overline{p}$ for the base good and $p_2^* = \overline{p}$ for the add-on. We call this equilibrium **Shrouded Unfair**.

- If $\epsilon \leq \overline{p} \leq \overline{p}^{\dagger}_{MDU}$, there exists an equilibrium in which firms disclose and charge $p_1^* = -\epsilon$ for the base good and $p_2^* = \epsilon$ for the add-on, and firms disclose the price of the add-on. We call this equilibrium **Voluntarily Unshrouded**.

- If $\overline{p} \leq \epsilon$, there exists an equilibrium in which firms shroud and charge $p_1^* = -\overline{p}$ for the base good and $p_2^* = \overline{p}$ for the add-on. We call this equilibrium **Shrouded Fair**.

No other symmetric equilibria exist.

Welfare in the first best outcome is given by:

$$\Lambda_{\text{FB}} = (\overline{u} - \underline{u})^{-1} \int_{-\epsilon}^{\overline{u}} (u + \epsilon)\,\mathrm{d}u = \frac{1}{2}(\overline{u} - \underline{u})^{-1}(\overline{u} + \epsilon)^2, \tag{24}$$

while total surplus and myopic welfare are given by:

$$\begin{aligned}
\Lambda_s &= (1-\alpha^*)(\overline{u} - \underline{u})^{-1} \int_{p_1^* - \max\{\epsilon - p_2^*, 0\}}^{\overline{u}} [u - p_1^* + \max\{\epsilon - p_2^*, 0\}]\,\mathrm{d}u \\
&\quad + \alpha^*(\overline{u} - \underline{u})^{-1} \int_{p_1^* - \epsilon}^{\overline{u}} [u - p_1^* + \epsilon - p_2^*]\,\mathrm{d}u - \Lambda_{\text{FB}} \\
\Lambda_m &= \lambda^*(\overline{u} - \underline{u})^{-1} \int_{p_1^* - \max\{\epsilon - p_2^*, 0\}}^{\overline{u}} [u - p_1^* + \max\{\epsilon - p_2^*, 0\}]\,\mathrm{d}u \\
&\quad + (1-\lambda^*)(\overline{u} - \underline{u})^{-1} \int_{p_1^* - \epsilon}^{\overline{u}} [u - p_1^* + \epsilon - p_2^*]\,\mathrm{d}u - \Lambda_{\text{FB}},
\end{aligned} \tag{25, 26}$$

where as in Section 4.3, α^* denotes the proportion of uninformed myopes in the population in equilibrium (equal to α if firms shroud and $\alpha(1-\lambda)$ if firms disclose), and λ^* denotes the proportion of myopic consumers who become sophisticated (equal to λ if firms disclose and 0 if they shroud).

Consider the welfare losses relative to the first best outcome. Let ℓ_1-ℓ_3 be defined by:

$$\ell_1 = (\overline{u} - \underline{u})^{-1} \left| \int_{p_1^* - \epsilon}^{-\epsilon} (u + \epsilon) \, du \right| = \frac{p_1^{*2}}{2(\overline{u} - \underline{u})} \tag{27}$$

$$\ell_2 = (\overline{u} - \underline{u})^{-1} \left| \int_{p_1^*}^{-\epsilon} u \, du \right| = \frac{p_1^{*2} - \epsilon^2}{2(\overline{u} - \underline{u})} \tag{28}$$

$$\ell_3 = (\overline{u} - \underline{u})^{-1} \left| \int_{-\epsilon}^{\overline{u}} \epsilon \, du \right| = \frac{(\overline{u} + \epsilon)\epsilon}{\overline{u} - \underline{u}}. \tag{29}$$

ℓ_1 is the welfare loss associated with consumers purchasing the product when their total valuation is below the production cost (i.e., $u_i + \epsilon < 0$), ℓ_2 captures the welfare loss in the MD Unfair and Shrouded Unfair equilibria associated with sophisticated consumers participating in the market when their base good valuation is in the interval $[p_1^*, -\epsilon)$, and ℓ_3 represents the welfare loss associated with non-participation of sophisticated consumers whose base good valuation lies in the interval $[-\epsilon, \overline{u}]$ in the MD Unfair and Shrouded Unfair equilibria.

In the fair equilibria, welfare (relative to the first best) is $\Lambda_s = -\alpha^* \ell_1$ and $\Lambda_m = -(1 - \lambda^*)\ell_1$. In the unfair equilibria, welfare is given by $\Lambda_s = -\alpha^* \ell_1 - (1 - \alpha^*)(\ell_2 + \ell_3)$. It follows that total surplus and myopic welfare in the five equilibria are given by the equations:

$$\Lambda_{s,\text{MDF}}^* = -\frac{\alpha(1 - \lambda) \min\{\overline{p}^2, \epsilon^2\}}{2(\overline{u} - \underline{u})} \tag{30}$$

$$\Lambda_{s,\text{SF}}^* = -\frac{\alpha \overline{p}^2}{2(\overline{u} - \underline{u})} \tag{31}$$

$$\Lambda_{s,\text{VU}}^* = -\frac{\alpha(1 - \lambda)\epsilon^2}{2(\overline{u} - \underline{u})} \tag{32}$$

$$\Lambda_{m,\text{MDF}}^* = -\frac{(1 - \lambda) \min\{\overline{p}^2, \epsilon^2\}}{2(\overline{u} - \underline{u})} \tag{33}$$

$$\Lambda_{m,\text{SF}}^* = -\frac{\overline{p}^2}{2(\overline{u} - \underline{u})} \tag{34}$$

$$\Lambda_{m,\text{VU}}^* = -\frac{(1 - \lambda)\epsilon^2}{2(\overline{u} - \underline{u})} \tag{35}$$

$$\Lambda_{s,\text{MDU}}^* = -\frac{p_{1,\text{MDU}}^{*2} + [1 - \alpha(1 - \lambda)](2\overline{u}\epsilon + \epsilon^2)}{2(\overline{u} - \underline{u})} \tag{36}$$

$$\Lambda_{s,\text{SU}}^* = -\frac{p_{1,\text{SU}}^{*2} + (1 - \alpha)(2\overline{u}\epsilon + \epsilon^2)}{2(\overline{u} - \underline{u})}. \tag{37}$$

$$\Lambda_{u,\text{SU}}^* = \frac{-(2 - \alpha)p_{1,\text{SU}}^{*2} + 2(1 - \alpha)\overline{u}p_{1,\text{SU}}^*}{2\alpha(\overline{u} - \underline{u})} \tag{38}$$

$$\Lambda_{u,\text{MDU}}^* = \frac{-(2 - \alpha)p_{1,\text{MDU}}^{*2} + 2(1 - \alpha)\overline{u}p_{1,\text{MDU}}^* - \alpha\lambda(2\overline{u}\epsilon + \epsilon^2)}{2\alpha(\overline{u} - \underline{u})} \tag{39}$$

The claim trivially follows from these equations.

$\square$

Proof. (**Lemma 2**)

Once we establish that

- $p^*_{1,\text{SU}} = -\epsilon$ and $p^*_{1,\text{MDU}} = -\epsilon$ have unique solutions (when viewed as a function of $\bar{p}$), and

- $\epsilon < \bar{p}^\dagger_{\text{SU}} < \bar{p}^\dagger_{\text{MDU}}$,

the rest of the proof follows the same as it does in the homogeneous case.[34]

To verify the existence and uniqueness of the solution to $p^*_{1,\text{SU}}(\bar{p}) = -\epsilon$, note that $p^*_{1,\text{SU}}$ is continuous and unbounded in $\bar{p}$ and

$$
\begin{aligned}
\frac{\partial p^*_{1,\text{SU}}}{\partial \bar{p}} &= -\frac{\alpha}{2} - \frac{4\alpha(\bar{u}+\epsilon) - 2\alpha(\bar{u} - \alpha(\bar{p}-\epsilon))}{4} \frac{}{(\bar{u} - \alpha(\bar{p}-\epsilon))^2 + 4\alpha\bar{p}(\bar{u}+\epsilon)} \\
&< 0.
\end{aligned} \tag{40}
$$

$\bar{p}^\dagger_{SU}$ is simply the solution to the equation above. $\bar{p}^\dagger_{MDU}$ is the analogous solution when looking at $p^*_{1,\text{MDU}}$ (as opposed to $p^*_{1,\text{SU}}$).

All that's left to verify is that $\epsilon < \bar{p}^\dagger_{\text{SU}} < \bar{p}^\dagger_{\text{MDU}}$. To see this, note that

$$
\begin{aligned}
\frac{\partial p^*_{1,\text{SU}}}{\partial \alpha} &= \frac{-(\bar{p}-\epsilon)}{2} - \frac{4\bar{p}(\bar{u}+\epsilon) - 2(\bar{p}-\epsilon)(\bar{u} - \alpha(\bar{p}-\epsilon))}{4} \frac{}{(\bar{u} - \alpha(\bar{p}-\epsilon))^2 + 4\alpha\bar{p}(\bar{u}+\epsilon)} \\
&= \frac{-(\bar{p}-\epsilon)}{2} - \frac{4\bar{p}\bar{u} + 4\bar{p}\epsilon - 2(\bar{p}-\epsilon)\bar{u} + 2\alpha(\bar{p}-\epsilon)^2}{4} \frac{}{(\bar{u} - \alpha(\bar{p}-\epsilon))^2 + 4\alpha\bar{p}(\bar{u}+\epsilon)} \\
&< 0.
\end{aligned} \tag{41}
$$

From (40) and (41), it's clear that

- $p^*_{1,\text{MDU}}(\cdot) > p^*_{1,\text{SU}}(\cdot)$

- The $\bar{p}$ that solves $p^*_{1,\text{MDU}}(\bar{p}) = -\epsilon$ is larger than the $\bar{p}$ that solves $p^*_{1,\text{SU}}(\bar{p}) = -\epsilon$, i.e., $\bar{p}^\dagger_{\text{SU}} < \bar{p}^\dagger_{\text{MDU}}$.

That $\bar{p}^\dagger_{\text{SU}} > \epsilon$ is obvious, because the Shrouded Unfair equilibrium can only exist if firms earn as much by selling the add-on at $\bar{p}$ to myopes as they do from selling the add-on at ϵ to all of their consumers. □

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[34]One potential concern is that firms might have incentive to lower the price of its base good to change the mix of sophisticated/myopic consumers that it faces. However, by lowering p_1, it's easily verified that the proportion of myopic consumers that it faces *decreases*, and since the profits they earn from myopic consumers is always at least as large as the profits firms earn from sophisticates, such a change in the composition never benefits firms.

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Figure 1: Total Surplus (Baseline Model)
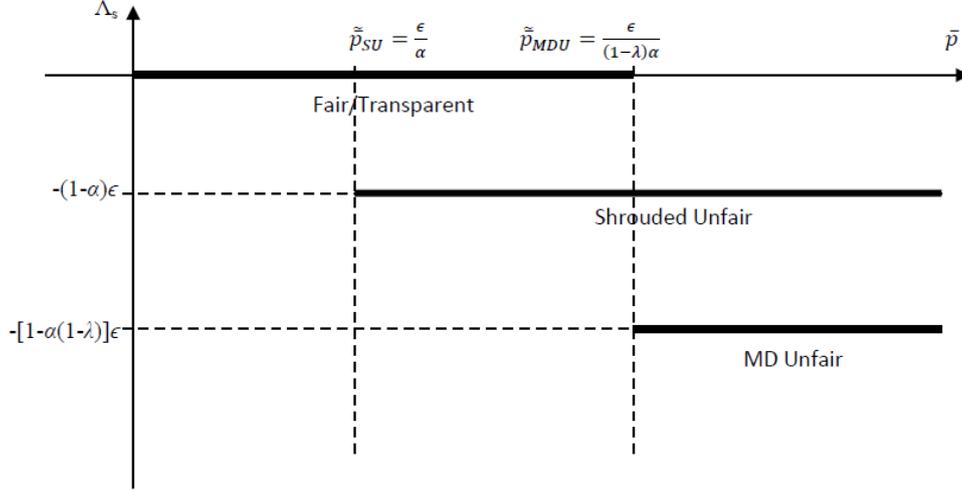
We plot total surplus, Λ_s, as a function of the maximum add-on price, $\bar{p}$, for the equilibria described in Propositions 1 and 2.

Figure 2: Myopic Welfare (Baseline Model)
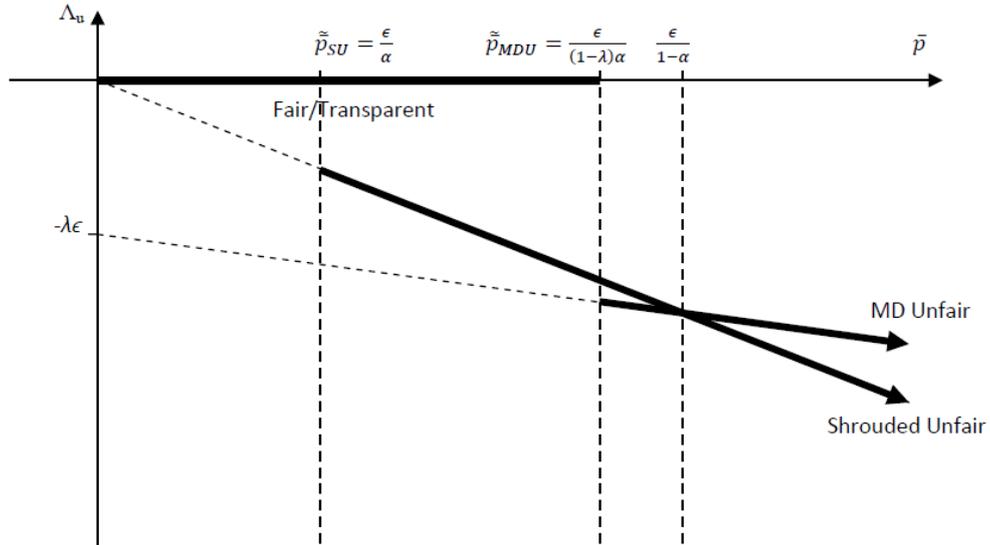
We plot myopic welfare, Λ_m, as a function of the maximum add-on price, $\bar{p}$, for the equilibria described in Propositions 1 and 2.

Table 1: Effect of Disclosure Mandates on Total Surplus

Pre-Regulation Equilibrium	Baseline Model	Heterogeneous Model
Shrouded Unfair	**Total Surplus Increases** if the market moves to the MD Fair equilibrium **Total Surplus Decreases** if the market moves to the MD Unfair equilibrium	**Total Surplus Increases** if the market moves to the MD Fair equilibrium or $\alpha\lambda(2\overline{u}\epsilon + \epsilon^2) < p^{*2}_{1,\mathrm{SU}} - p^{*2}_{1,\mathrm{MDU}}$ **Total Surplus Decreases** if the market moves to the MD Unfair equilibrium and $\alpha\lambda(2\overline{u}\epsilon + \epsilon^2) > p^{*2}_{1,\mathrm{SU}} - p^{*2}_{1,\mathrm{MDU}}$
Voluntarily Unshrouded	**Total Surplus Unaffected**	**Total Surplus Unaffected**
Shrouded Fair	**Total Surplus Unaffected**	**Total Surplus Increases**

We summarize the effects of disclosure mandates on total surplus, Λ_s. The left column lists the equilibrium the market is in when the disclosure mandates are imposed. The middle column describes the effect of the disclosure mandates on total surplus when consumers have homogeneous valuations for the base good. The right column describes the effect when consumers' valuations for the base good vary over a wide interval.

Table 2: Effect of Disclosure Mandates on Myopic Welfare

Pre-Regulation Equilibrium	Baseline Model	Heterogeneous Model
Shrouded Unfair	**Myopic Welfare Increases** if the market moves to the MD Fair equilibrium or $\bar{p} > \frac{\epsilon}{1-\alpha}$ **Myopic Welfare Decreases** if the market moves to the MD Unfair equilibrium and $\bar{p} < \frac{\epsilon}{1-\alpha}$	**Myopic Welfare Increases** if the market moves to the MD Fair equilibrium or $\Gamma > 0$ (see caption below) **Myopic Welfare Decreases** if the market moves to the MD Unfair equilibrium and $\Gamma < 0$
Voluntarily Unshrouded	**Myopic Welfare Unaffected**	**Myopic Welfare Unaffected**
Shrouded Fair	**Myopic Welfare Unaffected**	**Myopic Welfare Increases**

We summarize the effects of disclosure mandates on myopic welfare, Λ_m. The left column lists the equilibrium the market is in when the disclosure mandates are imposed. The middle column describes the effect of the disclosure mandates on myopic welfare when consumers have homogeneous valuations for the base good. The right column describes the effect when consumers' valuations for the base good vary over a wide interval. Γ is defined as follows:

$$\Gamma = (2-\alpha)(p_{1,\text{SU}}^{*2} - p_{1,\text{MDU}}^{*2}) + 2(1-\alpha)\bar{u}(p_{1,\text{MDU}}^{*} - p_{1,\text{SU}}^{*}) - \alpha\lambda(2\bar{u}\epsilon + \epsilon^2).$$

Table 3: Effect of Price Controls on Total Surplus

Pre-Regulation Equilibrium	Baseline Model	Heterogeneous Model
Shrouded Unfair	**Total Surplus Increases** if market moves to the Voluntarily Unshrouded or Shrouded Fair equilibria	**Total Surplus Increases**
Voluntarily Unshrouded	**Total Surplus Decreases** if the market moves to the Shrouded Unfair equilibrium	**Total Surplus Increases** if the market moves to the Shrouded Fair equilibrium with $\overline{p} < \epsilon\sqrt{1-\lambda}$ **Total Surplus Decreases** if (i) the market moves to the Shrouded Unfair equilibrium or (ii) the market moves to the Shrouded Fair equilibrium with $\overline{p} > \epsilon\sqrt{1-\lambda}$
Shrouded Fair	**Total Surplus Unaffected**	**Total Surplus Increases**
MD Unfair	**Total Surplus Increases** if the market moves to the MD Fair equilibrium	**Total Surplus Increases**
MD Fair	**Total Surplus Unaffected**	**Total Surplus Increases** if the new maximum add-on price, $\overline{p} < \epsilon$

We summarize the effects of price controls on total surplus, Λ_s. The left column lists the equilibrium the market is in when the price controls are imposed. The middle column describes the effect of the price controls on total surplus when consumers have homogeneous valuations for the base good. The right column describes the effect when consumers' valuations for the base good vary over a wide interval.

Table 4: Effect of Price Controls on Myopic Welfare

Pre-Regulation Equilibrium	Baseline Model	Heterogeneous Model
Shrouded Unfair	**Myopic Welfare Increases**	**Myopic Welfare Increases**
Voluntarily Unshrouded	**Myopic Welfare Decreases** if the market moves to the Shrouded Unfair equilibrium	**Myopic Welfare Increases** if the market moves to the Shrouded Fair equilibrium with $\overline{p} < \epsilon\sqrt{1-\lambda}$. **Myopic Welfare Decreases** if (i) the market moves to the Shrouded Unfair equilibrium or (ii) the market moves to the Shrouded Fair equilibrium with $\overline{p} > \epsilon\sqrt{1-\lambda}$
Shrouded Fair	**Myopic Welfare Unaffected**	**Myopic Welfare Increases**
MD Unfair	**Myopic Welfare Increases**	**Myopic Welfare Increases**
MD Fair	**Myopic Welfare Unaffected**	**Myopic Welfare Increases** if the new maximum add-on price, $\overline{p} < \epsilon$

We summarize the effects of price controls on myopic welfare, Λ_m. The left column lists the equilibrium the market is in when the price controls are imposed. The middle column describes the effect of the price controls on myopic welfare when consumers have homogeneous valuations for the base good. The right column describes the effect when consumers' valuations for the base good vary over a wide interval.