Working Paper Series

The Effects of Regulating Hidden Add-on Costs

K. Jeremy Ko
Jared Williams

DERA Working Paper 2013-03

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K. Jeremy Ko† Jared Williams‡

December 19, 2013

Abstract

We examine the welfare effects of regulation in a model where firms can shroud add-on costs, such as penalty fees for consumer financial products. In isolation, imposing price controls or disclosure mandates on such costs can increase or decrease welfare, even when these regulations have 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

*The Securities and Exchange Commission, as a matter of policy, disclaims responsibility for any private publication or statement by any of its employees. The views expressed herein are those of the author and do not necessarily reflect the views of the Commission or of the author's colleagues upon the staff of the Commission. We thank Kenneth Brevoort, Brian Bucks, Mike Fishman, Dave Haushalter, Peter Iliev, Yuji Masujima, Tomek Piskorski, Paul Rothstein, Hong Kee Sul, Joel Vanden, Raisa Velthuis and seminar participants at the Consumer Financial Protection Bureau, the Federal Reserve Board, the FDIC Consumer Research Symposium, Penn State, the Securities and Exchange Commission, the 2013 Western Finance Association annual meeting (Lake Tahoe), and the 2012 Financial Management Association annual meeting (Atlanta) for their helpful comments and suggestions. All errors are our own.

†The Division of Risk, Strategy, and Financial Innovation at the Securities and Exchange Commission, 100 F St. NE, Washington, DC 20549, kok@sec.gov, Phone: 202-551-7895

‡Department of Finance, Smeal College of Business, Penn State University. 344 Business Building, University Park, PA. E-mail: jmw52@psu.edu

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

[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. In particular, when disclosure is not mandated, there can exist two equilibria in some markets. In one equilibrium, 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. When price controls are implemented, it is possible for the market to move from the equilibrium with disclosure to the one with shrouding. When such a transition occurs, total surplus and myopic welfare can decline. In practice, this corresponds to firms responding to externally imposed price regulations by relaxing their self-regulated disclosure.

Though both forms 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.

Our paper is outlined as follows. We discuss the related literature in Section 2. Section 3 then discusses the general assumptions of the model. Section 4 analyzes the baseline model, in which the product is socially beneficial. In Section 5, we analyze the model in the case that the product represents a social harm to some consumers. We conclude in Section 6.

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.[5] 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)

[5] 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 for similar reasons as in our model. They do not, however, conduct a comprehensive analysis of price controls.[6] Heidhues, Köszegi, and Murooka (2011) examine a market in which firms can impose hidden surcharges.[7] In their model, regulators can improve welfare by restricting the amount firms can charge through hidden 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 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.

[6]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.

[7]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.

3 Model Setup

We adopt the model of Gabaix and Laibson (2006) with some minor changes. Firms sell a product, offering an up-front observable price of p_1 for the base good. They also offer an add-on to this product with a price of p_2 that is potentially unobserved. 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. 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 prices for the base-good, p_1, and the add-on, p_2. 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 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.[8] 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 decide whether to acquire zero or one units of the add-on. 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 in the model of Gabaix and Laibson (2006).

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 e 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 $t_i < \alpha(1 - \lambda)$.

Each consumer derives monetized utility e 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 briefly discuss the implications of heterogeneous add-on valuations in Appendix B. We also assume that $\bar{u} + e > 0$ and $e > 0$. 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.[9] 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) as in Gabaix and Laibson (2006). In this case, e represents the opportunity of cost of not consuming the add-on, i.e., the lesser of its monetized utility and the cost of the substitute.

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 $e \geq Ep_2$, where Ep_2 is the

[8] 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.

[9] 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 $\bar{u} + e < 0$.

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 ($\overline{p}$), 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 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. 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, e. 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.[10] If $p_2^* \notin \{\overline{p}, e\}$ 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 $p_2^* < e$) or be unaffected (if $p_2^* \geq e$). It follows that if $p_2^* \notin \{\overline{p}, e\}$, 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 $p_2^* \in \{\overline{p}, e\}$.

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 Mandatory Add-on Price Disclosure

We first consider the equilibrium prices when regulators require firms to disclose add-on prices. In contrast, Gabaix and Laibson (2006) only analyze equilibria in which disclosure is voluntary, which we address in the next section. 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 1. *When disclosure is mandatory, there exists a threshold, $\tilde{\overline{p}}_{MDU} = \frac{e}{\alpha(1-\lambda)}$, such that:*

- *If $\overline{p} \geq \tilde{\overline{p}}_{MDU}$, 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 $\overline{p} \leq \tilde{\overline{p}}_{MDU}$, there exists an equilibrium in which firms charge $p_1^* = -\min\{\overline{p}, e\}$ for the base good and $p_2^* = \min\{\overline{p}, e\}$ 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.

[10] 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.

The intuition for this proposition is straightforward. First, the threshold value of $\tilde{\overline{p}}_{\text{MDU}} = \frac{e}{\alpha(1-\lambda)}$ is increasing in consumers' reservation value for the add-on, e. Consider the case where $\overline{p} > e$. From Lemma 1, firms weigh two alternatives for the add-on price. They can (i) charge e, 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 who fail to understand the price disclosure and comprise $\alpha(1-\lambda)$ of the population. The first strategy is optimal when $e > \alpha(1-\lambda)\overline{p}$; otherwise, charging $\overline{p}$ is optimal.

The MD Unfair equilibrium is "unfair" in the sense that 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. In the MD Fair equilibrium, sophisticates and uninformed myopes have the same realized utility. Specifically, even if uninformed myopes were sophisticated, they would still consume the add-on. Our analysis shares the feature of Gabaix and Laibson (2006) and others that add-ons are priced above costs while base goods are priced below.[11] In our model, firms maximize add-on prices for a fixed level of sophisticate demand since uninformed myopic demand is insensitive to add-on costs. 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.

4.2 Equilibria with Voluntary Add-on Price Disclosure

We now consider the case when the decision to disclose or shroud add-on prices is voluntary. This framework can apply in 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.[12] 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. When $\overline{p} > e$, this setting is identical to that of Gabaix and Laibson (2006) under perfect competition.

Proposition 2. *When disclosure is voluntary, there exist thresholds, $\tilde{\overline{p}}_{MDU} = \frac{e}{\alpha(1-\lambda)}$ and $\tilde{\overline{p}}_{SU} = \frac{e}{\alpha}$, such that:*

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

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

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

equilibrium as **Voluntarily Unshrouded***.*

- *If* $\overline{p} \leq e$*, 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 when disclosure is voluntary.

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." Since they assume $\overline{p} > e$ and disclosure is never mandated, these are the *only* two symmetric equilibria that can arise. In contrast, we allow $\overline{p} < e$ and for regulators to mandate disclosure. As a result, there are five different symmetric equilibria that can arise in our setting, and prices can be shrouded "fairly" in equilibrium when $\overline{p} < e$, and prices can be unshrouded either voluntarily or because they are mandated. Because of these differences, we use different terminology to refer to the equilibria. 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. As they document, if $\overline{p} \in \left[\frac{e}{\alpha}, \frac{e}{\alpha(1-\lambda)}\right]$, the market can support either of these equilibria.[13]

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 price controls are relatively lax in that $\overline{p} > e$. In this case, shrouding equilibria can only exist if firms earn more from selling the add-on to uninformed myopes at $\overline{p}$ than from selling the add-on to all consumers at e. Since uninformed myopes comprise α of the population when firms shroud, a shrouding equilibrium can only be sustained if $\alpha\overline{p} \geq e$. We refer to this equilibrium as *Shrouded Unfair* because firms overcharge for the add-on, which is only purchased by uninformed myopes. Disclosure equilibria can only exist if firms earn more from selling the add-on to all consumers at e 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 $\alpha(1-\lambda)\overline{p} \leq e$. We refer to this equilibrium as *Voluntarily Unshrouded* because firms voluntarily choose to disclose the price of the add-on. It follows that if $\overline{p} \in \left[\frac{e}{\alpha}, \frac{e}{\alpha(1-\lambda)}\right]$, the market can support either the Shrouded Unfair or Voluntarily Unshrouded equilibrium, as noted by Gabaix and Laibson (2006).

Finally, consider the case where price controls are stringent in that $\overline{p} \leq e$. Since firms are prohibited from charging more than consumers' valuation for the add-on, all consumers will purchase

[13] 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).

the add-on, regardless of the 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* because all consumers purchase the add-on, which is not overpriced. In contrast, Gabaix and Laibson (2006) do not consider this equilibrium, implicitly assuming that price controls are sufficiently lax, i.e., $\overline{p} > e$.

In all these equilibria, base goods are priced below cost while the add-on is priced above cost. 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.

4.3 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 $u+e$. 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, e, 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.[14]

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

$$\Lambda_{\text{FB}} \quad = \quad u + e. \tag{1}$$

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

Recalling our assumption that $u+e > 0$, it follows from Propositions 1 and 2 that all consumers

[14] 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.

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 ($e \geq p_2^*$). It trivially follows that their realized net utility is $u - p_1^* + \max\{e - p_2^*, 0\}$. Uninformed myopic consumers, on the other hand, consume the add-on regardless of its price. Their realized net utility is therefore $u + e - p_1^* - p_2^*$. We let U_s and U_{um} denote the monetized net utility derived by sophisticated and uninformed myopic consumers, respectively:

$$
\begin{aligned}
U_s &= u - p_1^* + \max\{e - p_2^*, 0\} && (2) \\
U_{um} &= u + e - p_1^* - p_2^* && (3)
\end{aligned}
$$

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 the population of ex ante myopic consumers, i.e., those who act myopically if add-on costs are shrouded.[15] 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 ($\alpha^* = \alpha(1 - \lambda)$).

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

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

[15] 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.

Λ_s and Λ_m can then be expressed,

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

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

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, e, then sophisticated consumers will refrain from consuming it. This is socially inefficient because consumers' valuation for the add-on, e, exceeds its production cost, 0. It follows that Λ_s equals 0 if $p_2^* \leq e$, and Λ_s equals $-(1-\alpha^*)e$ if $p_2^* > e$. Recalling Propositions 1 and 2, and using obvious abbreviations (e.g., "MDF" to refer to the MD Fair equilibrium), Λ_s in the five equilibria are given by

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

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

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

In the MD Fair, Voluntarily Unshrouded, and Shrouded Fair equilibria, $p_2^* \leq e$, and all consumers—sophisticated and myopic—consume the base good and add-on. (See Propositions 1 and 2.) Moreover, $p_1^* + p_2^* = 0$, so it trivially follows that each consumer's net monetized utility (whether he is sophisticated or not) is $u + e$, 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 $p_2^* > e$. 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 $|(1-\lambda^*)(p_2^* - e)|$. It follows that Λ_m in the MD Unfair and Shrouded Unfair equilibria is given by

$$\Lambda^*_m = u - p_1^* - (1-\lambda^*)(p_2^* - e) - \Lambda_{\text{FB}}. \tag{12}$$

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

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

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

Another way to justify (13) and (14) is to separately compare myopic consumers' consumption utility and their payment disutility relative to the first best. In the first best outcome, each consumer gets consumption utility $u + e$ and payment disutility 0 (the production cost). In the Shrouded Unfair equilibrium, all myopic consumers remain uninformed in equilibrium, so they consume the add-on even though its price exceeds their valuation. Their consumption utility is therefore $u + e$, which is the same as in the first best. However, unlike the first best, the total price of the base good and add-on is not 0; in the Shrouded Unfair equilibrium, $p_1^* + p_2^* = (1 - \alpha)\overline{p}$. Hence, relative to the first best outcome, myopic consumers' monetized utility is $(1 - \alpha)\overline{p}$ lower in the Shrouded Unfair equilibrium. This term reflects myopic consumers' overpayment for the add-on.

In the MD Unfair equilibrium, each myopic consumer has probability λ of becoming sophisticated, in which case he avoids the overpriced add-on. Since consumers derive monetized utility e from consuming the add-on, their expected consumption utility is λe lower in the MD Unfair equilibrium than in the first best (where they all consume the base good and the add-on). Regarding their expected payments to firms, all myopic consumers consume the base good, which costs p_1^*, and those that are uninformed in equilibrium (proportion $1 - \lambda$ of myopic consumers) pay p_2^* for the add-on. Hence, each myopic consumer's expected cash flow to firms is $p_1^* + (1 - \lambda)p_2^*$ higher in the MD Unfair equilibrium, which corresponds to the $-(1 - \lambda)(1 - \alpha)\overline{p}$ term in (14). Again, this term reflects uninformed myopic consumers' overpayment for the add-on.

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, $\overline{p}$, 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 regulatory agency or exogenously imposed by a separate governmental body. The following proposition summarizes the effect of mandating disclosure on consumer welfare.

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 $\overline{p} < \frac{e}{1-\alpha}$; 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.

We first discuss the effect of mandating disclosure on total surplus, which can be deduced from Figure 1. Consider the region where $\bar{p} > \tilde{\tilde{p}}_{\mathrm{MDU}}$. Mandating disclosure shifts the equilibrium from Shrouded Unfair to MD Unfair. In both equilibria, firms price the add-on unfairly (i.e., $p_2^* = \bar{p} > e$). Mandating disclosure decreases surplus because it increases the number of sophisticates who inefficiently avoid the add-on.

In the $\tilde{\tilde{p}}_{\mathrm{SU}} \leq \bar{p} < \tilde{\tilde{p}}_{\mathrm{MDU}}$ region, mandating disclosure increases total surplus by shifting the equilibrium from Shrouded Unfair to MD Fair. In this case, disclosure regulation will eliminate inefficient avoidance of the add-on by decreasing its price. Such regulations have no effect on total surplus if the market is in the Voluntarily Unshrouded or Shrouded Fair equilibrium. When disclosure mandates are imposed in either of these equilibria, the market moves to the MD Fair equilibria, and the first best outcome is achieved in all three of these equilibria.

The effects on myopic welfare can be deduced from Figure 2. In the region where $\overline{p} \leq \tilde{\tilde{p}}_{\mathrm{MDU}}$, mandating disclosure has the same effects on myopic welfare as it does on total surplus. First, it strictly increases myopic welfare if the equilibrium shifts from Shrouded Unfair to MD Fair. In the Shrouded Unfair equilibrium, myopic consumers overpay for the add-on whereas they do not in the MD Fair equilibrium. Second, mandating disclosure has no effect on myopic welfare when imposed in the Voluntarily Unshrouded or Shrouded Fair The market simply moves to the MD Fair equilibrium, which is also first best.

Finally, consider the effects on myopic welfare when disclosure mandates move the market from the Shrouded Unfair to the MD Unfair equilibrium ($\bar{p} > \tilde{\tilde{p}}_{\mathrm{MDU}}$). In this case, disclosure regulation decreases the pool of uninformed myopes who overpay for the add-on. As a result, firms earn less from selling the add-on. Firms respond by increasing the price of the base good from $p_1^* = -\alpha\overline{p}$ to $p_1^* = -\alpha(1-\lambda)\overline{p}$, an increase of $\alpha\lambda\overline{p}$. Myopic welfare increases only if the harm from the increase in the base good price, $\alpha\lambda\overline{p}$, is less than the expected benefits they receive from understanding the disclosure and avoiding the add-on. Since myopic consumers save $\overline{p} - e$ when they understand disclosure (which occurs with probability λ), these expected benefits are equal to $\lambda(\overline{p} - e)$. Hence, myopic welfare improves when the market moves from the Shrouded Unfair to the MD Unfair if $\overline{p} > \frac{e}{1-\alpha}$.

We should point out that disclosure mandates can only harm myopic welfare if $\bar{p} \geq \tilde{\tilde{p}}_{\mathrm{MDU}} = \frac{e}{\alpha(1-\lambda)}$ (so that the MD Unfair equilibrium exists) and $\overline{p} \leq \frac{e}{1-\alpha}$. Therefore, myopic consumers can only be harmed if $\frac{e}{\alpha(1-\lambda)} \leq \frac{e}{1-\alpha}$, which implies that $\alpha \geq \frac{1}{2-\lambda}$. 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.[16]

[16]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

This proposition highlights a rather striking result: disclosure requirements can strictly decrease welfare even when the associated costs are zero. When price controls are lax in that $\overline{p} \geq \tilde{\tilde{p}}_{\text{MDU}} = \frac{e}{\alpha(1-\lambda)}$, disclosure mandates can decrease total surplus and myopic welfare. Disclosure mandates cannot cause harm if price controls are sufficiently strict in that $\overline{p} < \tilde{\tilde{p}}_{\text{MDU}} = \frac{e}{\alpha(1-\lambda)}$. Therefore, price controls and disclosure mandates can function as *complements* in that sufficient price controls eliminate harms associated with disclosure mandates.[17]

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, therefore, provides additional arguments for strengthening and simplifying cost disclosures at the point of sale.

Finally, Proposition 3 suggests that disclosure mandates generally have better effects on myopic welfare than on total surplus—the parameter region where disclosure mandates improve total surplus is a strict subset of the region where myopic welfare is improved. Hence, there is greater rationale for disclosure regulation based on protecting myopic consumers than based on maximizing total surplus.

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 ($\overline{p}$) 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 $0 \leq \overline{p} \leq e$. We believe it is more realistic to assume regulators cannot perfectly observe production costs or consumers' valuations.[18]

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.*

rate mortgage.

[17]We should note that disclosure mandates and price controls are not complements *uniformly* for all parameters in our model. For example, mandating disclosure does not enhance myopic welfare when price controls are imposed such that $\overline{p}$ shifts from greater than $\frac{e}{1-\alpha}$ to the interval $\left(\frac{e}{(1-\lambda)\alpha}, \frac{e}{1-\alpha}\right)$. Our finding is that these two types of regulation serve as complements when prices are sufficiently constrained, but they can act as substitutes when prices are not sufficiently constrained. Our paper is the first to articulate this finding to our knowledge.

[18]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.

- *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.*

Suppose first that the market is in the Shrouded Fair equilibrium (where disclosure is voluntary and $\overline{p} \leq e$). In this case, welfare is first-best since firms price the add-on fairly. From Figures 1 and 2, it is clear that decreasing the maximum add-on price cannot shift the equilibrium and has no effect on welfare. The same reasoning applies if price controls are imposed in the MD Fair equilibrium (when $\overline{p} \leq \tilde{\tilde{p}}_{\text{MDU}}$ and disclosure is mandatory).

Now consider the intermediate region of $\tilde{\tilde{p}}_{\text{SU}} \leq \overline{p} \leq \tilde{\tilde{p}}_{\text{MDU}}$ where both the Voluntarily Unshrouded and Shrouded Unfair equilibria can be sustained when disclosure is voluntary. In this region, a decrease in $\overline{p}$ can potentially shift the equilibrium from Voluntarily Unshrouded to Shrouded Unfair. In this case, price controls decrease welfare. 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 rulemaking 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.[19]

Price controls have no effect, however, if the market remains in the Voluntarily Unshrouded equilibrium.

Finally, suppose price controls are imposed in one of the unfair equilibria (MD Unfair or Shrouded Unfair). It is clear from Figure 1 that total surplus is unaffected unless the market moves to a different equilibrium, in which case surplus improves.[20] From Figure 2, it is clear that price controls always improve myopic welfare when they are imposed in an unfair equilibrium.[21] Either the market moves to a fair equilibrium, which is first best, or it stays in the unfair equilibrium, in which case price controls reduce the amount that uninformed myopic consumers overpay for the add-on.

[19]Alternatively, the equilibrium in this region may 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.

[20]Note that price controls cannot move the market from MD Unfair to Shrouded Unfair or vice versa; only a change in disclosure mandates can cause a movement between these equilibria.

[21]Again, recall that price controls cannot move the market from MD Unfair to Shrouded Unfair or vice versa; only a change in disclosure mandates can cause a movement between these equilibria.

In Section 4.4.1, we showed that disclosure mandates can harm welfare, but only if add-on prices are not sufficiently constrained. Here, we document another complementarity between price and disclosure regulations. Namely, when disclosure is voluntary, price controls can reduce welfare; however, when disclosure is mandated, price controls always (weakly) improve welfare. Price controls only harm welfare when they push the market from a fair equilibrium to an unfair equilibrium. With voluntary disclosure, this is possible because the Voluntarily Unshrouded equilibrium and the Shrouded Unfair equilibrium can both exist whenever $\overline{p}$ is in the interval $\left[\frac{e}{\alpha}, \frac{e}{\alpha(1-\lambda)}\right]$ (Proposition 2). With mandatory disclosure, on the other hand, there is a threshold, $\tilde{\overline{p}}_{\text{MDU}}$, for the maximum add-on price such that fair equilibria only exist if $\overline{p} \leq \tilde{\overline{p}}_{\text{MDU}}$, and unfair equilibria only exist if $\overline{p} \geq \tilde{\overline{p}}_{\text{MDU}}$ (Proposition 1). Hence, reducing $\overline{p}$ can never shift the market from a fair equilibrium to an unfair one. These complementarities are noteworthy since price controls and 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 Model

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 (e). 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.[22] 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

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

mutual funds are harmful to consumers because cheaper alternatives are often available.[23] 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.[24]

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.

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

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

To avoid normalization, we assume that the measure of consumers in the economy is equal to $\overline{u} - \underline{u}$. 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: $\underline{u} + e \leq -\overline{p}$. We continue to assume that the add-on represents a net benefit to consumers, i.e., $e \geq 0$. 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.[25]

Finally, we address consumers' participation constraints. In the baseline model, all consumers purchase the base good in every equilibrium, so the participation constraint is irrelevant. In this section, some consumers will avoid the base good in every equilibrium. Sophisticated consumers always behave rationally. Conditional on consuming the base good, they consume the add-on if its price is no greater than their valuation ($e \geq p_2^*$). It trivially follows that a sophisticated consumer

[23]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).

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

[25]Allowing for heterogeneity in add-on valuations complicates the analysis significantly. For example, in some parameter regions, no symmetric pure strategy equilibria exist. 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. See Propositions 11 and 12 in Appendix B.

with base good valuation u_i purchases the base good if $u_i - p_1^* + \max\{e - p_2^*, 0\} \geq 0$. Uninformed myopic consumers, on the other hand, believe they receive the benefits of the add-on without having to pay more than production costs. In the case of credit card penalty fees, such consumers may not diligently monitor themselves, believing that their fine will be negligible if they miss a payment or exceed their limit.[26] Therefore, an uninformed myopic consumer with base good valuation u_i purchases the base good if $u_i + e \geq p_1^*$.

5.1 Equilibria

Since Lemma 1 applies whether valuations are homogeneous or heterogeneous, the equilibria are similar in the baseline and heterogeneous models. The add-on price is either e or $\overline{p}$, and the base good price is set so that firms earn zero profits. As in the homogeneous model, there are five possible equilibria: three when disclosure is voluntary (Shrouded Unfair, Shrouded Fair, and Voluntarily Unshrouded) and two when it is mandatory (MD Fair and MD Unfair). In the three equilibria in which the add-on price is "fair" (Voluntarily Unshrouded, Shrouded Fair, and MD Fair), prices for the goods are the same as they are in the homogeneous model.

In the "unfair" equilibria (Shrouded Unfair and MD Unfair), the add-on price is still the maximum value, $\overline{p}$, though the base good prices are no longer $-\alpha\overline{p}$ and $-\alpha(1-\lambda)\overline{p}$. In these equilibria, the equilibrium base good price depends on the proportion of each firm's customers (i.e., consumers who purchase the base good) that are uninformed myopes in equilibrium. In the baseline model, this proportion is always either α (in the shrouding equilibria) or $\alpha(1-\lambda)$ (in the disclosure equilibria). Since sophisticated consumers and uninformed myopes have different participation constraints, this is no longer true.

Consider the Shrouded Unfair equilibrium. To compute the proportion of each firm's customers who are uninformed myopes in the Shrouded Unfair equilibrium, first note that a sophisticate participates in the market if and only if $u_i \in [p_1^*, \overline{u}]$ (i.e., if $u_i - p_1^* + \max\{e - p_2^*, 0\} \geq 0$), whereas an uninformed myope participates if and only if $u_i \in [p_1^* - e, \overline{u}]$ (i.e., if $u_i + e \geq p_1^*$).[27] Hence, the measure of uninformed myopes participating in the market is $\alpha(\overline{u} - p_1^* + e)$, while the measure of sophisticates participating in the market is $(1-\alpha)(\overline{u} - p_1^*)$. Therefore, the measure of all customers in the market is the sum of the two or $\overline{u} - p_1^* + \alpha e$. It follows that in the Shrouded Unfair equilibrium, the proportion of each firm's customers that are uninformed myopes, α_{su}, satisfies:

$$\alpha_{\text{su}} = \frac{\alpha(\overline{u} - p_{1,\text{SU}}^* + e)}{\overline{u} - p_{1,\text{SU}}^* + \alpha e}. \tag{15}$$

where $p_{1,\text{SU}}^*$ is the base good price in the Shrouded Unfair equilibrium. Only uninformed myopes purchase the add-on in the Shrouded Unfair equilibrium, so firms earn $\alpha_{\text{su}}\overline{p}$ for the add-on per customer. Therefore, the zero profit condition (Lemma 1) again implies that the price of the base

[26] As mentioned previously, an equivalent assumption would be that uninformed myopic consumers underestimate their likelihood of paying the add-on fee for a fixed amount of effort to avoid it. Therefore, they would project their net cost from the add-on to be less than the true expected value (as in our model).

[27] Recall that in the Shrouded Unfair equilibria, $\overline{p} > e$.

good satisfies:

$$p^*_{1,\mathrm{SU}} \quad = \quad -\alpha_{\mathrm{su}}\overline{p}. \tag{16}$$

Combining (15) and (16) and solving for $p^*_{1,\mathrm{SU}}$ and α_{su}, it can be shown that the proportion of each firm's customers that are uninformed myopes in the Shrouded Unfair equilibrium is given by the following equation:

$$\alpha_{\mathrm{su}} = \frac{-\overline{u} + \alpha(\overline{p} - e) + \sqrt{(\overline{u} - \alpha(\overline{p} - e))^2 + 4\alpha\overline{p}(\overline{u} + e)}}{2\overline{p}} \tag{17}$$

The analysis for the MD Unfair equilibrium is analogous. Since firms are compelled to disclose, the proportion of uninformed myopes in the population of α is simply replaced by $\alpha(1-\lambda)$ in the equation above. It follows that the proportion of each firm's customers that are uninformed myopes in the MD Unfair equilibrium is given by the equation:

$$\alpha_{\mathrm{mdu}} = \frac{-\overline{u} + \alpha(1-\lambda)(\overline{p} - e) + \sqrt{(\overline{u} - \alpha(1-\lambda)(\overline{p} - e))^2 + 4\alpha(1-\lambda)\overline{p}(\overline{u} + e)}}{2\overline{p}} \tag{18}$$

Proposition 5. *When disclosure is mandatory, there exists a threshold, $\overline{p}^\dagger_{MDU} = \frac{e}{\alpha_{mdu}}$, 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 $p^*_1 = -\min\{e, \overline{p}\}$ for the base good and $p^*_2 = \min\{e, \overline{p}\}$ for the add-on. We call this equilibrium* **MD Fair***.*

When disclosure is voluntary, there exists a threshold, $\overline{p}^\dagger_{SU} = \frac{e}{\alpha_{su}}$, such that $e < \overline{p}^\dagger_{SU} < \overline{p}^\dagger_{MDU}$ 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 $e \leq \overline{p} \leq \overline{p}^\dagger_{MDU}$, there exists an equilibrium in which firms disclose and charge $p^*_1 = -e$ for the base good and $p^*_2 = e$ for the add-on, and firms disclose the price of the add-on. We call this equilibrium* **Voluntarily Unshrouded***.*
- *If $\overline{p} \leq e$, 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.

5.2 Welfare

Recall that production costs for the base good and add-on are normalized to 0. Moreover, consumers' valuation for the add-on, e, is greater than the production cost, i.e., $e > 0$. Hence, a first best outcome is achieved if and only if each consumer, i: (i) consumes the base good and add-on if $u_i + e > 0$ and (ii) does not consume the base good or add-on if $u_i + e < 0$. Therefore, the first-best per capita net monetary benefit across consumers is given by the following expression:

$$\Lambda_{\text{FB}} = (\overline{u} - \underline{u})^{-1} \int_{-e}^{\overline{u}} (u + e)\ \mathrm{d}u = \frac{1}{2}(\overline{u} - \underline{u})^{-1}(\overline{u} + e)^2 \tag{19}$$

Welfare can be less than first-best in our model, however, since consumers do not necessarily buy the base good under these conditions. Sophisticates with base good valuation of u realize net monetized utility $u - p_1^* + \max\{e - p_2^*, 0\}$ if this quantity is positive. In addition, uninformed myopes realize net monetized utility $u - p_1^* + e - p_2^*$ if $u + e \geq p_1^*$. Therefore, total surplus is given by:

$$\begin{aligned} \Lambda_s &= (1 - \alpha^*)(\overline{u} - \underline{u})^{-1} \textstyle\int_{p_1^* - \max\{e - p_2^*, 0\}}^{\overline{u}} [u - p_1^* + \max\{e - p_2^*, 0\}]\ \mathrm{d}u \\ &+ \alpha^*(\overline{u} - \underline{u})^{-1} \textstyle\int_{p_1^* - e}^{\overline{u}} [u - p_1^* + e - p_2^*]\ \mathrm{d}u - \Lambda_{\text{FB}} \end{aligned} \tag{20}$$

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. We again measure welfare net of first-best by deducting Λ_{FB}.

Similarly, myopic welfare is given by the following expression, where λ^* again denotes the proportion of myopic consumers who become sophisticated (equal to λ if firms disclose and 0 if they shroud):

$$\begin{aligned} \Lambda_m &= \lambda^*(\overline{u} - \underline{u})^{-1} \textstyle\int_{p_1^* - \max\{e - p_2^*, 0\}}^{\overline{u}} [u - p_1^* + \max\{e - p_2^*, 0\}]\ \mathrm{d}u \\ &+ (1 - \lambda^*)(\overline{u} - \underline{u})^{-1} \textstyle\int_{p_1^* - e}^{\overline{u}} [u - p_1^* + e - p_2^*]\ \mathrm{d}u - \Lambda_{\text{FB}} \end{aligned} \tag{21}$$

We analyze these welfare functions by aggregating inefficiencies relative to first-best. In the five equilibria discussed in Section 5.1, there are three possible sources of inefficiencies:

(i) It is socially suboptimal for consumers to buy the product if their total valuation is below production cost, i.e., $u_i + e < 0$. Uninformed myopes, however, purchase the product when their base good valuation is such that $u_i \geq p_1^* - e$. Therefore, there is a social loss of $|u_i + e|$ from each uninformed myope in the interval $u_i \in [p_1^* - e, -e)$ consuming the product. This inefficiency exists in *all* of the equilibria since the base good price is less than cost (i.e., $p_1^* < 0$). Let ℓ_1 denote the per capita losses across uninformed myopes associated with this consumption:

$$\ell_1 = (\overline{u} - \underline{u})^{-1} \left| \int_{p_1^* - e}^{-e} (u + e)\ \mathrm{d}u \right| = \frac{p_1^{*2}}{2(\overline{u} - \underline{u})}. \tag{22}$$

(ii) In the MD Unfair and Shrouded Unfair equilibria, sophisticated consumers with base good valuations in the interval $u_i \in [p_1^*, -e)$ consume the base good. This inefficiency only exists in the "unfair" equilibria; in the "fair" equilibria, sophisticates consume both the base good and add-on only if $u_i + e \geq p_1^* + p_2^* = 0$. Let ℓ_2 denote the per capita losses across sophisticates associated with this consumption:

$$\ell_2 = (\overline{u} - \underline{u})^{-1} \int_{p_1^*}^{-e} u \; \mathrm{d}u = \frac{p_1^{*2} - e^2}{2(\overline{u} - \underline{u})}. \tag{23}$$

(iii) Sophisticated consumers in the interval $u_i \in [-e, \overline{u}]$ forego consumption of the add-on.[28] This inefficiency only exists in the unfair equilibria (MD Unfair and Shrouded Unfair) where the add-on is overpriced relative to consumers' valuation (i.e., $p_2^* = \overline{p} > e$). Let ℓ_3 denote the per capita losses across sophisticates associated with this consumption:

$$\ell_3 = (\overline{u} - \underline{u})^{-1} \int_{-e}^{\overline{u}} e \; \mathrm{d}u = \frac{(\overline{u} + e)e}{\overline{u} - \underline{u}}. \tag{24}$$

5.3 Regulation

5.3.1 Disclosure Mandates

If add-on price disclosure is voluntary, the market will either be in the Shrouded Fair, Voluntarily Unshrouded, or Shrouded Unfair equilibria.

We begin by analyzing the effects of disclosure mandates when the market is in a fair equilibrium. If disclosure is mandated and the market is in the Voluntarily Unshrouded equilibrium, welfare is unaffected. The mandate simply moves the market to the MD Fair equilibrium as is clear from Proposition 5. In each equilibrium, prices are given by $(p_1^*, p_2^*) = (-e, e)$, and the proportion of uninformed myopes in the population is $\alpha(1 - \lambda)$ since firms disclose. Therefore, consumer welfare is the same in both equilibria.

Now consider the Shrouded Fair equilibrium. In this equilibrium, $p_1^* = -\overline{p}$ and $p_2^* = \overline{p} \leq e$, so every consumer who purchases the base good also consumes the add-on. In the homogeneous model, this equilibrium is first-best, and welfare is unaffected by disclosure mandates—such mandates simply push the market to the MD Fair equilibrium, which is also first-best. This is not the case when consumer valuations are heterogeneous. In this case, uninformed myopes make mistakes when their base good valuations lie in the interval: $u_i \in [p_1^* - e, -e) = [-\overline{p} - e, -e)$, as discussed in the previous subsection. Each such consumer participates in the market by consuming the base good and the add-on even though his combined valuation for the base good and add-on, $u_i + e$, is less than the price paid for these goods, $p_1^* + p_2^* = 0$. As with the baseline model, when disclosure is mandated, the market moves to the MD Fair equilibrium, where prices are the same: $(p_1^*, p_2^*) = (-\overline{p}, \overline{p})$. Mandating disclosure, however, decreases the number of uninformed myopes who make mistakes in their participation decision and, therefore, improves total surplus and myopic welfare.

[28] Sophisticated consumers in the interval $[p_1^*, -e)$ also consume the base good and forego consumption of the add-on in the unfair equilibria. However, since they do not consume the base good in the first-best outcome, their non-consumption of the add-on should not be considered when comparing the welfare to the first-best outcome.

The following proposition summarizes the effects of disclosure mandates when valuations are heterogeneous and the market is in a fair equilibrium with voluntary disclosure.

Proposition 6. *If the market is in the Shrouded Fair equilibrium, mandating disclosure strictly increases total surplus and myopic welfare.*

If the market is in the Voluntarily Unshrouded equilibrium, mandating disclosure has no effect on total surplus or myopic welfare.

The Shrouded Unfair equilibrium is the only unfair equilibrium that exists when disclosure is voluntary. If the market is in the Shrouded Unfair equilibrium and disclosure is mandated, the market can move to either the MD Fair or MD Unfair equilibrium (Proposition 5). It is easy to see that total surplus increases if it moves to the MD Fair equilibrium. The only inefficiency in the MD Fair equilibrium is that uninformed myopes consume the good when their base good valuations are in the interval $u_i \in [p_1^* - e, -e)$. The number of uninformed myopes inefficiently consuming the base good is greater in the Shrouded Unfair equilibrium since the proportion of such uninformed myopes is greater. Moreover, the base good price is lower in the Shrouded Unfair since firms earn more from the add-on. In addition, the Shrouded Unfair has inefficiencies from low-valuation sophisticates consuming the base good and high-valuation sophisticates avoiding the add-on. Therefore, total surplus is higher in the MD Fair equilibrium than in the Shrouded Unfair equilibrium. For these same reasons, myopic welfare also increases when disclosure is mandated in this case. In fact, the gains to myopic consumers exceeds the total surplus gains because sophisticated consumers' welfare falls (due to the rise in price of the base good).

If the market moves from the Shrouded Unfair equilibrium to the MD Unfair equilibrium, total surplus can either increase or decrease. Total surplus can decrease for the same reason as with the baseline model. Namely, the number of sophisticates inefficiently avoiding the add-on increases. Unlike the baseline model, mandating disclosure can increase total surplus in this case. Disclosure causes firms to earn less from the add-on, and firms respond by increasing the price of the base good. The increase in the price of the base good pushes it closer to its production cost, resulting in less consumption of the base good by low valuation consumers.

Myopic welfare can either increase or decrease if the market shifts from the Shrouded Unfair to the MD Unfair equilibrium. As with the baseline model, myopic consumers can benefit by understanding the disclosure and avoiding the overpriced add-on, but they can be harmed by the increase in the price of the base good. In the heterogeneous model, there is an additional benefit from mandating disclosure. Namely, the number of consumers inefficiently buying the base good decreases as a result of the base good price rising.

The following proposition summarizes the effects of disclosure mandates on welfare when valuations are heterogeneous and the market is in the Shrouded Unfair equilibrium:

Proposition 7. *If the market is in the Shrouded Unfair equilibrium, mandating disclosure:*

- *strictly increases total surplus and myopic welfare if it results in the MD Fair equilibrium.*
- *strictly decreases total surplus if and only if it results in the MD Unfair equilibrium and:*

$$\alpha\lambda(2\overline{u}e + e^2) > p^{*2}_{1,SU} - p^{*2}_{1,MDU} \tag{25}$$

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

$$(2-\alpha)(p^{*2}_{1,SU} - p^{*2}_{1,MDU}) + 2(1-\alpha)\overline{u}(p^{*}_{1,MDU} - p^{*}_{1,SU}) - \alpha\lambda(2\overline{u}e + e^2) \quad < \quad 0. \tag{26}$$

Although the comparative statics of the inequalities in (25) and (26) are complex, we can make statements about the asymptotic properties of these expressions. First, consider the effect of disclosure mandates on total surplus when they shift the equilibrium from Shrouded Unfair to MD Unfair. Disclosure mandates are likely to improve total surplus if the add-on is not very valuable relative to production costs, i.e., if e is small. For small e, the welfare losses associated with sophisticates' foregone consumption of the add-on is insignificant. This inefficiency is dominated by the other source of inefficiency: consumption by consumers whose valuations are less than the goods' production costs. Since $p^{*}_{1,\text{SU}} < p^{*}_{1,\text{MDU}}$, this inefficiency is more severe in the Shrouded Unfair equilibrium than the MD Unfair equilibrium.

Disclosure mandates also tend to improve total surplus if the maximum add-on price ($\overline{p}$) is large.[29] As $\overline{p}$ increases, the difference between the price of the base goods in the MD Unfair and Shrouded Unfair equilibria ($p^{*}_{1,\text{MDU}} - p^{*}_{1,\text{SU}}$) increases without bound.[30] Hence, the surplus losses caused by consumption of the base good by consumers with low valuations is significantly higher in the Shrouded Unfair equilibrium than in the MD Unfair equilibrium. This difference dominates the other effects, and disclosure improves total surplus.

A comparison of disclosure regulation for the heterogeneous versus homogeneous models is provided in Tables 1 and 2. It is clear from our results that there is generally more rationale for disclosure regulation in the heterogeneous than the homogeneous model. Specifically, disclosure mandates now improve welfare in the Shrouded Fair equilibrium whereas they did not previously. In addition, such regulation is Pareto-improving in this case as it decreases the number of uninformed myopes inefficiently buying the base good while leaving the welfare of other consumers unchanged. In contrast, regulation in the baseline model is never Pareto-improving. In addition, unlike the baseline model, disclosure can also increase total surplus when it shifts the equilibrium from Shrouded Unfair to MD Unfair.

[29] Note that given our assumptions that $\underline{u} \leq -\overline{p} - e$, it is not possible for $\overline{p}$ to increase unboundedly without $\underline{u}$ decreasing unboundedly.

[30] To see this, notice that as $\overline{p} \to \infty$, $\alpha_{\text{mdu}} \to \alpha(1-\lambda)$, $\alpha_{\text{su}} \to \alpha$ so $p^{*}_{1,\text{MDU}} \to \alpha(1-\lambda)\overline{p}$ and $p^{*}_{1,\text{SU}} \to \alpha\overline{p}$, so $\frac{p^{*}_{1,\text{SU}}}{p^{*}_{1,\text{MDU}}} \to \frac{1}{1-\lambda}$. Since $p^{*}_{1,\text{SU}}, p^{*}_{1,\text{MDU}} \to -\infty$ as $\overline{p} \to \infty$, the result trivially follows.

5.3.2 Price Controls

In the baseline model, much of price controls' efficacy comes from its power to move the market from one equilibrium to another. For example, total surplus is entirely determined by which equilibrium the market is in. The only welfare improvements from price controls that are possible within an equilibrium involve myopic welfare in the unfair equilibria: if the market stays in one of the two unfair equilibria (MD Unfair or Shrouded Unfair), price controls improve myopic welfare by reducing wealth transfers from myopic to sophisticated consumers.

In the heterogeneous model, in contrast, there are additional circumstances in which price controls can improve total surplus and myopic welfare even within the same equilibrium. When the maximum price of the add-on ($\overline{p}$) is reduced, the equilibrium price of the base good (p_1^*) rises if firms earn less from the add-on. Consequently, total surplus can rise as consumers with low valuations for the base good are priced out of the market.

Consider first the effects of price controls on total surplus when the market is in the Shrouded Fair equilibrium. If price controls are employed in this equilibrium, they cannot push the market to a different equilibrium (Proposition 5). The only source of welfare losses in this case is participation in the market by uninformed myopic consumers with low valuations for the products. These losses decrease in the base good price, which decreases in $\overline{p}$. Hence, price controls always improve efficiency in the Shrouded Fair equilibrium. All of these gains accrue to myopic consumers; they harm themselves by consuming goods whose prices exceed their valuations for the goods. Price controls do not affect sophisticated consumers' welfare in this equilibrium. Neither their participation decision nor the total price they pay ($p_1^* + p_2^*$) is affected by $\overline{p}$. Hence, price controls are Pareto-improving when the market stays in this equilibrium. The same reasoning applies in the MD Fair equilibrium if $\overline{p} < e$. Therefore, price controls improve efficiency in the MD Fair equilibrium if the maximum add-on price, $\overline{p}$, is less than consumers' valuation for the add-on, e. The following proposition summarizes the effects of price controls when valuations are heterogeneous and the market is in a fair equilibrium.

Proposition 8. *If the market is in the Shrouded Fair equilibrium, imposing additional price controls increases total surplus and myopic welfare.*

If the market is in the MD Fair equilibrium, imposing additional price controls increases total surplus and myopic welfare if the maximum add-on price ($\overline{p}$) is set below consumers' valuation for the add-on (e); otherwise, price controls have no effect on total surplus or myopic welfare.

Suppose the market is in an unfair equilibrium (Shrouded Unfair or MD Unfair). It can be shown that $p_{1,\mathrm{MDU}}^*$ and $p_{1,\mathrm{SU}}^*$ are decreasing in $\overline{p}$. Therefore, if the market stays within an unfair equilibrium, price controls improve total surplus by increasing the price of the base good, causing low valuation consumers to exit the market. Suppose now that price controls push the market from an unfair equilibrium to a different equilibrium. The only possibilities are that the market moves from the MD Unfair to the MD Fair equilibrium or from the Shrouded Unfair equilibrium to the Shrouded Fair or Voluntarily Unshrouded equilibrium. In any of these scenarios, it can be verified that the price for the base good (p_1^*) rises since the add-on price again decreases. Therefore, the loss from low-valuation uninformed myopes consuming the base good decreases. Moreover, since the market has moved to a fair equilibrium, the market is only subject to one of the three inefficiencies (quantified by (22)-(24)) described on page 23. Hence, inefficiencies decline, and both welfare functions increase.

Proposition 9. *If the market is in the MD Unfair or Shrouded Unfair equilibrium, imposing additional price controls increases total surplus and myopic welfare.*

Finally, suppose price controls are imposed and the market is in the Voluntarily Unshrouded equilibrium. The market can either stay in the Voluntarily Unshrouded equilibrium or move to the Shrouded Fair or Shrouded Unfair equilibria. Welfare losses in the Voluntarily Unshrouded equilibrium are unrelated to the maximum add-on price, $\overline{p}$, since prices are determined by consumers' value for the add-on, e. Hence, if the market stays in the Voluntarily Unshrouded equilibrium, both welfare functions are unaffected.

Now consider the situation when the market moves from the Voluntarily Unshrouded equilibrium to the Shrouded Unfair equilibrium. After the transition, firms earn a larger amount from the add-on since $\alpha_{\text{su}}\overline{p} > e$. As a result, the base good price decreases, and more low-valuation consumers inefficiently opt to buy the base good. In addition, sophisticates now avoid the add-on whereas they did not when it was priced at their valuation, e, in the Voluntarily Unshrouded equilibrium. Consequently, both welfare functions decrease due to the price controls.

The only other possibility is that price controls move the market from the Voluntarily Unshrouded to the Shrouded Fair equilibrium. In the baseline model, both of these equilibria are first best, so welfare is unaffected by such a transition. With heterogeneous valuations, however, both equilibria are subject to the inefficiency of low valuation uninformed myopes consuming the base good. The price of the base good is lower in the Voluntarily Unshrouded equilibrium where $p_1^* = -e$ than in the Shrouded Fair equilibrium where $p_1^* = -\overline{p} \geq -e$. As a result, there is a wider range of base good valuations for which inefficient consumption by uninformed myopes takes place in the Voluntarily Unshrouded equilibrium. On the other hand, there are more uninformed myopes in the population in the Shrouded Fair equilibrium. Whether or not surplus increases as the market moves from the Voluntarily Unshrouded equilibrium to the Shrouded Fair equilibrium depends on which of these effects dominates. It can be shown that price controls strictly increase both welfare measures in this scenario if and only if the maximum add-on price is set such that $\overline{p} < e\sqrt{1-\lambda}$. Specifically, price controls improve welfare if the maximum add-on price is set low relative to consumers' value for it. In this case, price regulation has a large impact on increasing the base good price and reducing the number of uninformed myopes who inefficiently consume it. In addition, price controls improve welfare when disclosure methods are weak (i.e., λ is low); when λ is small, a shift from the

Voluntarily Unshrouded to the Shrouded Fair equilibrium results in a small increase in the overall number of uninformed myopes. This argument applies for both total surplus and myopic welfare. As discussed in Section 5.2, there are no welfare losses suffered by sophisticates in either equilibrium since they consume both the add-on and the base good efficiently.

Proposition 10. *Suppose price controls are imposed to a market that is in the Voluntarily Unshrouded equilibrium.*

If the market stays in the Voluntarily Unshrouded equilibrium, total surplus and myopic welfare are unaffected.

If the market moves to the Shrouded Unfair equilibrium, total surplus and myopic welfare both decrease.

If the market moves to the Shrouded Fair equilibrium, total surplus and myopic welfare increase if the new maximum add-on price is less than $e\sqrt{1-\lambda}$*. Otherwise, total surplus and myopic welfare decrease.*

A comparison of the effects of price controls in the heterogeneous model versus the baseline model is provided in Tables 3 and 4. There are cases in which there is more rationale for price controls in our heterogeneous model than in the baseline model. For example, in the heterogeneous model, price controls can increase welfare within the Shrouded Fair and MD Fair equilibria. Namely, they increase the base good price and decrease the number of low-valuation uninformed myopes who inefficiently buy the base good. In this case, price controls result in a Pareto improvement (whereas they could not in the baseline model). They can also now increase total surplus within the Shrouded Unfair and MD Unfair equilibria. However, there are also cases in which there is *less* rationale for price controls in the heterogeneous 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 uninformed myopes inefficiently buying the base good. In the baseline model, on the other hand, welfare is first-best in both equilibria.

As in the baseline model, both forms of regulation can lead to reductions in total surplus and myopic welfare. Moreover, there are still complementarities between price controls and disclosure mandates: conditional on disclosure being mandated, price controls always improve welfare, and conditional on prices being sufficiently constrained, disclosure mandates always improve welfare. In other words, each form of regulation can prevent the potential problems caused by the other form of regulation.

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 increase or decrease welfare when multiple equilibria can exist. 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.[31] Second, there are 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.

[31] 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). However, to our knowledge, no one has empirically analyzed the impact of externally imposed disclosure regimes on firm pricing.

A Proofs

(For Online Publication)

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:

$$\begin{aligned}\Pi(p_1^*, p_2^*) &= \tfrac{1-\alpha^*}{M}\tfrac{\max\{\overline{u}-\underline{u}_S^*,0\}}{\overline{u}-\underline{u}}\left(p_1^* + p_2^* \cdot \mathbf{1}_{\{p_2^* \leq e\}}\right) \\ &+\tfrac{\alpha^*}{M}\tfrac{\max\{\overline{u}-\underline{u}_N^*,0\}}{\overline{u}-\underline{u}}(p_1^* + p_2^*)\end{aligned} \tag{27}$$

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

$$\begin{aligned}\Pi(p_1^*, p_2^*) &= \tfrac{1-\alpha^*}{M}\mathbf{1}_{\{\overline{u}\geq p_1^*+\min\{p_2^*-e,0\}\}}\left(p_1^* + p_2^* \cdot \mathbf{1}_{\{p_2^* \leq e\}}\right) \\ &+\tfrac{\alpha^*}{M}\mathbf{1}_{\{\overline{u}\geq p_1^*-e\}}(p_1^* + p_2^*)\end{aligned} \tag{28}$$

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:

$$\begin{aligned}\Pi(p_1, p_2) &= (1-\alpha^*)\tfrac{\max\{\overline{u}-\underline{u}_S,0\}}{\overline{u}-\underline{u}}\left(p_1^* + p_2^* \cdot \mathbf{1}_{\{p_2^* \leq e\}} - \varepsilon\right) \\ &+\alpha^*\tfrac{\max\{\overline{u}-\underline{u}_N,0\}}{\overline{u}-\underline{u}}(p_1^* + p_2^* - \varepsilon)\end{aligned} \tag{29}$$

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, $\underline{u}_S = \max\{p_1^* + \min\{p_2^* - e, 0\} - \varepsilon, \underline{u}\}$, and $\underline{u}_N = \max\{p_1^* - e - \varepsilon, \underline{u}\}$. For the case when $\overline{u} = \underline{u}$, this off-equilibrium profit is given by:

$$\begin{aligned}\Pi(p_1, p_2) &= (1-\alpha^*)\mathbf{1}_{\{\overline{u}\geq p_1^*+\min\{p_2^*-e,0\}-\varepsilon\}}\left(p_1^* + p_2^* \cdot \mathbf{1}_{\{p_2^* \leq e\}} - \varepsilon\right) \\ &+\alpha^*\mathbf{1}_{\{\overline{u}\geq p_1^*-e-\varepsilon\}}(p_1^* + p_2^* - \varepsilon)\end{aligned} \tag{30}$$

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 $M \geq 2$.

□

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

First, suppose $p_2^* < \min\{e, \overline{p}\}$. Consider the per-customer profits of a firm that charges $(p_1^*, \overline{p})$. Since $p_2^* < e$, 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

$$\begin{aligned} \pi(p_1^*, \overline{p}) &= p_1^* + \overline{p} \\ &> p_1^* + p_2^* \\ &= \pi(p_1^*, p_2^*) \\ &= 0, \end{aligned} \tag{31}$$

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

Now, suppose $e < p_2^* < \overline{p}$. 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, $p_2^* \notin (e, \overline{p})$.

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

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

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

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

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

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

Case 2: $\alpha(1-\lambda)\overline{p} < e$. Let (p_1^*, p_2^*) be a symmetric equilibrium.

Suppose $p_2^* > e$. Note that Lemma 1 implies that (p_1^*, p_2^*) satisfies:

$$\alpha(1-\lambda)(p_1^* + p_2^*) + [1-\alpha(1-\lambda)]p_1^* = 0, \tag{32}$$

which implies

$$p_1^* = -\alpha(1-\lambda)p_2^*.$$

Consider the per-customer profits of a firm that charges $p_1 = -\alpha(1-\lambda)p_2^*$ and $p_2 = e$:

$$\begin{aligned} \pi &= e - \alpha(1-\lambda)p_2^* \\ &> \alpha(1-\lambda)\overline{p} - \alpha(1-\lambda)p_2^* \\ &\geq 0, \end{aligned}$$

a contradiction. Hence, $p_2^* \leq e$, so by Lemma 1, $p_2^* = \min\{e, \overline{p}\}$, and Lemma 1 implies $p_1^* = -\min\{e, \overline{p}\}$, so the equilibrium is unique for this case.

Case 3: $\alpha(1-\lambda)\overline{p} = e$. Let (p_1^*, p_2^*) be a symmetric equilibrium. Lemma 1 implies $p_2^* \in \{e, \overline{p}\}$. If $p_2^* = e$, Lemma 1 implies that $p_1^* = -e$, and if $p_2^* = \overline{p}$, Lemma 1 implies that $p_1^* = -\alpha(1-\lambda)\overline{p}$.

□

Proof. (**Existence, Proposition 1**)
Case 1: $\alpha(1-\lambda)\overline{p} \geq e$. We must show $(p_1^*, p_2^*) = (-\alpha(1-\lambda)\overline{p}, \overline{p})$ is an equilibrium.

Suppose all firms are charging $(p_1^*, p_2^*) = (-\alpha(1-\lambda)\overline{p}, \overline{p})$, 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 $p_2 \leq e$ and $p_2 \leq e - (p_1 - p_1^*)$. For such (p_1, p_2), the firm's per-customer profits are given by the equation

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

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:

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

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

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

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

Case 2: $\alpha(1-\lambda)\overline{p} \leq e$. We must show $(p_1^*, p_2^*) = (-\min\{e, \overline{p}\}, \min\{e, \overline{p}\})$ is an equilibrium.

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

Case 2.1: $e \leq \overline{p}$. In this case, $p_1^* = -e$ and $p_2^* = e$. We first show that no firm has an incentive to charge $p_1 \neq p_1^*$.

If $p_1 < p_1^*$ and $p_2 \leq p_2^*$, all the customers purchase the base good and the add-on, so

$$\begin{aligned}
\pi(p_1, p_2) &= p_1 + p_2 \\
&< p_1^* + p_2^* \\
&= 0.
\end{aligned}$$

If $p_1 < p_1^*$ and $p_2 > p_2^*$, only myopes purchase the add-on, so

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

If $p_1 > p_1^*$, the firm gets customers only if $p_2 \leq e$ and $e - p_2 \geq p_1 - p_1^*$, in which case all its customers are sophisticated consumers who purchase both the base good and the add-on, and

$$\begin{aligned}
\pi(p_1, p_2) &= p_1 + p_2 \\
&\leq e - e \\
&= 0.
\end{aligned}$$

Hence, firms have no incentive to charge any price other than $p_1 = p_1^* = -e$ for the base good.

Given that $p_1 = -e$, the firm's per-customer profits are given by the equation:

$$\begin{aligned}\pi(-e, p_2) &= -e + p_2 \mathbf{1}_{\{p_2 \leq e\}} + \alpha(1-\lambda) p_2 \mathbf{1}_{\{p_2 > e\}} \\ &\leq -e + \max\{e, \alpha(1-\lambda)\overline{p}\} \\ &= 0.\end{aligned}$$

Hence, $(p_1^*, p_2^*) = (-\min\{e, \overline{p}\}, \min\{e, \overline{p}\})$ is a best response for each firm.

Case 2.2: $e > \overline{p}$. If $e > \overline{p}$, then $(p_1^*, p_2^*) = (-\overline{p}, \overline{p})$, and all consumers will purchase the add-on regardless of what prices firms charge for it. The firm will attract customers (myopic or sophisticated) if and only if $p_1 + p_2 \leq p_1^* + p_2^*$. Hence, for any (p_1, p_2), the firm's per-customer profit is given by the equation

$$\begin{aligned}\pi(p_1, p_2) &= (p_1 + p_2)\mathbf{1}_{\{p_1 + p_2 \leq p_1^* + p_2^*\}} \\ &\leq p_1^* + p_2^* \\ &= \pi(p_1^*, p_2^*).\end{aligned}$$

Hence, $(p_1^*, p_2^*) = (-\overline{p}, \overline{p})$ is a best response for each firm.

□

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

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:

- $\overline{p} \geq \frac{e}{\alpha} \implies (p_1^*, p_2^*) = (-\alpha\overline{p}, \overline{p})$
- $\overline{p} \in (e, \frac{e}{\alpha}) \implies$ No equilibrium
- $\overline{p} \leq e \implies (p_1^*, p_2^*) = (-\overline{p}, \overline{p})$

Possible disclosure (non-shrouding) equilibria:

- $\overline{p} \geq \frac{e}{\alpha(1-\lambda)} \implies$ No equilibrium
- $\overline{p} \in \ e, \frac{e}{\alpha(1-\lambda)} \implies (p_1^*, p_2^*) = (-e, e)$
- $\overline{p} \leq e \implies$ No equilibrium

Shrouding Equilibria:
Note that since firms are shrouding the price of the add-on, there exist measure α of myopes and measure $1-\alpha$ of sophisticates.

Suppose there exists a symmetric shrouding equilibrium (p_1^*, p_2^*). Since firms are shrouding, consumers are unable to observe the add-on price, so consumers' decision over which firm to frequent and whether to purchase the add-on is independent of the add-on prices that firms actually charge. Hence, it is optimal for firms that shroud the price of the add-on to charge $p_2 = \overline{p}$; increasing p_2 increases firms' profits from myopes without decreasing the profit earned from sophisticates. Therefore, $p_2^* = \overline{p}$.

Case 1: $\overline{p} \geq \frac{e}{\alpha}$
Only myopes purchase the add-on, so Lemma 1 implies p_1^* satisfies:

$$\alpha(p_1^* + \overline{p}) + (1-\alpha)p_1^* = 0, \quad \text{i.e.,} \tag{33}$$

$$p_1^* = -\alpha\overline{p}. \tag{34}$$

Case 2: $\overline{p} \in (e, \frac{e}{\alpha})$
Only myopes purchase the add-on, so p_1^* satisfies:

$$\alpha(p_1^* + \overline{p}) + (1-\alpha)p_1^* = 0, \quad \text{i.e.,} \tag{35}$$

$$p_1^* = -\alpha\overline{p}. \tag{36}$$

However, *this isn't an equilibrium.* To see this, consider the per-customer profits of a firm charging $(-\alpha\overline{p}, e)$ and unshrouding:

$$\begin{aligned} \pi &= -\alpha\overline{p} + e \\ &> -\alpha \frac{e}{\alpha} + e \\ &= 0. \end{aligned} \tag{37}$$

Hence, there's no shrouding equilibrium if $\overline{p} \in (e, \frac{e}{\alpha})$.

Case 3: $\overline{p} \leq e$
Then all consumers purchase the add-on, so Lemma 1 implies $p_1^* = -\overline{p}$.

Disclosure Equilibria:

Since firms are disclosing the price of the add-on, there exist measure $\alpha(1-\lambda)$ of myopes and measure $1-\alpha(1-\lambda)$ of sophisticated consumers.

Let (p_1^*, p_2^*) represent a symmetric equilibrium with disclosure. By Lemma 1, $p_2^* \in \{e, \overline{p}\}$. Suppose $p_2^* = \overline{p}$. Since firms prefer shrouding to disclosure if each yields the same profit, no firm charging $p_2 = \overline{p}$ will choose to disclose the price of its add-on. Hence, $p_2^* = e$, all consumers purchase the add-on, and Lemma 1 implies $p_1^* = -e$.

Case 1: $\overline{p} > \frac{e}{\alpha(1-\lambda)}$.

Consider the per-customer profits of a firm that charges $(-e, \overline{p})$:

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

contradicting the optimality of (p_1^*, p_2^*), so there is no equilibrium in this case.

Case 2: $\overline{p} = \frac{e}{\alpha(1-\lambda)}$

Consider the per-customer profit of a firm that charges $(-e, \overline{p})$ and shrouds:

$$\begin{aligned}\pi(-e, \overline{p}) &= -e + \alpha(1-\lambda)\overline{p} \\ &= 0.\end{aligned}$$

Since firms prefer shrouding to disclosure when they yield the same profit, $(-e, e)$ with disclosure is not an equilibrium in this case.

Case 3: $\overline{p} \in \quad e, \frac{e}{\alpha(1-\lambda)}$

The analysis before Case 1 proved that $(-e, e)$ is the only possible equilibrium in any of the cases.

Case 4: $\overline{p} = e$. Then Lemma 1 implies $p_2^* = \overline{p}$, so each firm prefers to shroud, so no disclosure equilibrium can be supported.

Case 5: $\overline{p} < e$

Recall that any disclosure equilibrium has the property that $p_2^* = e$. In this case, that is clearly not possible. Hence, there is no symmetric equilibrium with disclosure if $\overline{p} < e$.

$\square$

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

Shrouding equilibria:

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

Disclosure (non-shrouding) equilibria:

- If $\overline{p} \in \quad e, \frac{e}{\alpha(1-\lambda)}$, then $(p_1^*, p_2^*) = (-e, e)$ is a disclosure equilibrium

Gabaix and Laibson (2006) prove (see their Proposition 1) that if $\overline{p} \geq \frac{e}{\alpha}$, then $(p_1^*, p_2^*) = (-\alpha\overline{p}, \overline{p})$ is a shrouding equilibrium.

Consider the case where $\overline{p} \leq e$. We show that $(p_1^*, p_2^*) = (-\overline{p}, \overline{p})$ is a shrouding equilibrium. Suppose a firm charges (p_1, p_2). Regardless of p_2, all consumers that visit the firm will purchase the add-on, since $p_2 \leq \overline{p} \leq e$. The firm will attract customers if and only if $p_1 + p_2 \leq p_1^* + p_2^*$. Hence, for any (p_1, p_2), the firm's per-customer profit is given by the equation

$$\begin{aligned}
\pi(p_1, p_2) &= (p_1 + p_2)\mathbf{1}_{\{p_1+p_2 \leq p_1^*+p_2^*\}} \\
&\leq p_1^* + p_2^* \\
&= \pi(p_1^*, p_2^*).
\end{aligned}$$

Hence, (p_1^*, p_2^*) is a best response, so $(p_1^*, p_2^*) = (-\overline{p}, \overline{p})$ with shrouding is a symmetric equilibrium.

Finally, consider the case where $\overline{p} \in \left(e, \frac{e}{\alpha(1-\lambda)}\right)$. We show that $(p_1^*, p_2^*) = (-e, e)$ is a disclosure equilibrium. Suppose a firm charges (p_1, p_2).

Case 1: The firm shrouds

If the firm shrouds, only myopes (who compose measure $\alpha(1-\lambda)$ of the population since other firms disclose their add-on prices) will purchase the add-on.[32] The firm attracts consumers if and only if $p_1 \leq p_1^*$. Therefore, the firm's per-customer profit is given by the equation

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

Hence, the firm cannot earn positive profit by shrouding.

Case 2: The firm discloses

If the firm discloses its add-on price, the proof that $(-e, e)$ is a best response is analogous to the proof in Case 2 of the existence proof for Proposition 1. The only difference is that here, if $\overline{p} = \frac{e}{\alpha(1-\lambda)}$, the $(-e, e)$ equilibrium cannot be supported because $(-e, \overline{p})$ with shrouding yields the same profit as $(-e, e)$ with disclosure, and firms prefer shrouding to disclosure when they yield the same profits. □

Proof. (**Propositions 3 and 4**) These follow directly from Figures 1 and 2. □

Proof. (**Proposition 5**)

Once we establish that

- $p_{1,\mathrm{SU}}^* = -e$ and $p_{1,\mathrm{MDU}}^* = -e$ have unique solutions (when viewed as a function of $\overline{p}$), and

[32] Sophisticated consumers rationally infer that the firm charges $p_2 < \overline{p}$ if it shrouds.

- $e < \overline{p}^{\dagger}_{\text{SU}} < \overline{p}^{\dagger}_{\text{MDU}}$,

the rest of the proof follows the same as it does in the homogeneous case.[33]

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

$$\begin{aligned} \frac{\partial p^*_{1,\text{SU}}}{\partial \overline{p}} &= -\frac{\alpha}{2} - \frac{4\alpha(\overline{u}+e) - 2\alpha(\overline{u} - \alpha(\overline{p}-e))}{4\sqrt{(\overline{u} - \alpha(\overline{p}-e))^2 + 4\alpha\overline{p}(\overline{u}+e)}} \\ &< 0. \end{aligned} \tag{38}$$

$\overline{p}^{\dagger}_{SU}$ is simply the solution to the equation above. $\overline{p}^{\dagger}_{MDU}$ 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 $e < \overline{p}^{\dagger}_{\text{SU}} < \overline{p}^{\dagger}_{\text{MDU}}$. To see this, note that

$$\begin{aligned} \frac{\partial p^*_{1,\text{SU}}}{\partial \alpha} &= \frac{-(\overline{p}-e)}{2} - \frac{4\overline{p}(\overline{u}+e) - 2(\overline{p}-e)(\overline{u} - \alpha(\overline{p}-e))}{4\sqrt{(\overline{u} - \alpha(\overline{p}-e))^2 + 4\alpha\overline{p}(\overline{u}+e)}} \\ &= \frac{-(\overline{p}-e)}{2} - \frac{4\overline{pu} + 4\overline{p}e - 2(\overline{p}-e)\overline{u} + 2\alpha(\overline{p}-e)^2}{4\sqrt{(\overline{u} - \alpha(\overline{p}-e))^2 + 4\alpha\overline{p}(\overline{u}+e)}} \\ &< 0. \end{aligned} \tag{39}$$

From (38) and (39), it's clear that

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

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

[33] 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.

Lemma 2. *Total surplus and Myopic welfare in the five equilibria are given by the equations:*

$$\Lambda^*_{s,MDF} = -\frac{\alpha(1-\lambda)\min\{\overline{p}^2, e^2\}}{2(\overline{u}-\underline{u})} \tag{40}$$

$$\Lambda^*_{s,SF} = -\frac{\alpha\overline{p}^2}{2(\overline{u}-\underline{u})} \tag{41}$$

$$\Lambda^*_{s,VU} = -\frac{\alpha(1-\lambda)e^2}{2(\overline{u}-\underline{u})} \tag{42}$$

$$\Lambda^*_{m,MDF} = -\frac{(1-\lambda)\min\{\overline{p}^2, e^2\}}{2(\overline{u}-\underline{u})} \tag{43}$$

$$\Lambda^*_{m,SF} = -\frac{\overline{p}^2}{2(\overline{u}-\underline{u})} \tag{44}$$

$$\Lambda^*_{m,VU} = -\frac{(1-\lambda)e^2}{2(\overline{u}-\underline{u})} \tag{45}$$

$$\Lambda^*_{s,MDU} = -\frac{p^{*2}_{1,MDU} + [1-\alpha(1-\lambda)](2\overline{u}e + e^2)}{2(\overline{u}-\underline{u})} \tag{46}$$

$$\Lambda^*_{s,SU} = -\frac{p^{*2}_{1,SU} + (1-\alpha)(2\overline{u}e + e^2)}{2(\overline{u}-\underline{u})}. \tag{47}$$

$$\Lambda^*_{u,SU} = \frac{-(2-\alpha)p^{*2}_{1,SU} + 2(1-\alpha)\overline{u}p^*_{1,SU}}{2\alpha(\overline{u}-\underline{u})} \tag{48}$$

$$\Lambda^*_{u,MDU} = \frac{-(2-\alpha)p^{*2}_{1,MDU} + 2(1-\alpha)\overline{u}p^*_{1,MDU} - \alpha\lambda(2\overline{u}e + e^2)}{2\alpha(\overline{u}-\underline{u})} \tag{49}$$

Proof. Since ℓ_1 (equation (22)) is the only source of inefficiency in the fair equilibria, our welfare functions in these equilibria are given by $\Lambda_s = -\alpha^*\ell_1$ and $\Lambda_m = -(1-\lambda^*)\ell_1$. Since prices for the base good are $p^*_1 = -\min\{\overline{p}, e\}$, $-\overline{p}$, and $-e$ in the MD Fair, Shrouded Fair, and Voluntarily Unshrouded equilibria, respectively, total surplus in these equilibria simplifies to:

$$\Lambda^*_{s,\text{MDF}} = -\frac{\alpha(1-\lambda)\min\{\overline{p}^2, e^2\}}{2(\overline{u}-\underline{u})} \tag{50}$$

$$\Lambda^*_{s,\text{SF}} = -\frac{\alpha\overline{p}^2}{2(\overline{u}-\underline{u})} \tag{51}$$

$$\Lambda^*_{s,\text{VU}} = -\frac{\alpha(1-\lambda)e^2}{2(\overline{u}-\underline{u})} \tag{52}$$

In addition, myopic welfare is given by:

$$\Lambda^*_{m,\mathrm{MDF}} = -\frac{(1-\lambda)\min\{\overline{p}^2, e^2\}}{2(\overline{u}-\underline{u})} \tag{53}$$

$$\Lambda^*_{m,\mathrm{SF}} = -\frac{\overline{p}^2}{2(\overline{u}-\underline{u})} \tag{54}$$

$$\Lambda^*_{m,\mathrm{VU}} = -\frac{(1-\lambda)e^2}{2(\overline{u}-\underline{u})} \tag{55}$$

All three of the inefficiencies expressed in (22)-(24) are present in the unfair equilibria (MD Unfair and Shrouded Unfair). Since ℓ_1 is due to myopes while ℓ_2 and ℓ_3 are due to sophisticates, total surplus in these equilibria is, therefore: $\Lambda_s = -\alpha^*\ell_1 - (1-\alpha^*)(\ell_2+\ell_3)$. This expression can be rewritten for these equilibria as follows:

$$\Lambda^*_{s,\mathrm{MDU}} = -\frac{p^{*2}_{1,\mathrm{MDU}} + [1-\alpha(1-\lambda)](2\overline{u}e + e^2)}{2(\overline{u}-\underline{u})} \tag{56}$$

$$\Lambda^*_{s,\mathrm{SU}} = -\frac{p^{*2}_{1,\mathrm{SU}} + (1-\alpha)(2\overline{u}e + e^2)}{2(\overline{u}-\underline{u})}. \tag{57}$$

In any equilibrium, total surplus is the weighted average of sophisticated welfare and myopic welfare,

$$\Lambda^*_s = \alpha\Lambda^*_m + (1-\alpha)\Lambda^*_{\mathrm{soph}}. \tag{58}$$

Sophisticated welfare in the Shrouded Unfair equilibrium can be expressed,

$$\begin{aligned} \Lambda^*_{\text{soph, SU}} &= (\overline{u}-\underline{u})^{-1}\int_{p^*_{1,\mathrm{SU}}}^{\overline{u}} u - p^*_{1,\mathrm{SU}}\,\mathrm{d}u - \Lambda_{\mathrm{FB}} \\ &= \frac{1}{2}(\overline{u}-\underline{u})^{-1}\Big[(\overline{u}-p^*_{1,\mathrm{SU}})^2 - (\overline{u}+e)^2\Big]. \end{aligned} \tag{59}$$

Combining (47), (58), and (59), and solving for $\Lambda^*_{\mathrm{u,SU}}$,

$$\Lambda^*_{\mathrm{u,SU}} = \frac{-(2-\alpha)p^{*2}_{1,\mathrm{SU}} + 2(1-\alpha)\overline{u}p^*_{1,\mathrm{SU}}}{2\alpha(\overline{u}-\underline{u})} \tag{60}$$

By analagous arguments, myopic welfare in the MD Unfair equilibrium can be expressed,

$$\Lambda^*_{\mathrm{u,MDU}} = \frac{-(2-\alpha)p^{*2}_{1,\mathrm{MDU}} + 2(1-\alpha)\overline{u}p^*_{1,\mathrm{MDU}} - \alpha\lambda(2\overline{u}e+e^2)}{2\alpha(\overline{u}-\underline{u})} \tag{61}$$

□

Proof. (**Proposition 6**) By Proposition 5, in both scenarios, the market moves to the MD Fair equilibrium, so the result follows directly from (40)-(45). □

Proof. (**Proposition 7**)

Note that if the Shrouded Unfair equilibrium exists, $\alpha_p^{\mathrm{SU}}\overline{p} \geq e$, from which it follows that $p_{1,\mathrm{SU}}^{*2} \geq e^2$. It follows from (40), (43), (47), and (48) that if the market moves from the Shrouded Unfair equilibrium to the MD Fair equilibrium, total surplus and myopic welfare increase.

The last two claims follow from (46), (47), (48), and (49).

□

Proof. (**Proposition 8**) If price controls are implemented in the Shrouded Fair equilibrium, then the market will remain in the Shrouded Fair equilibrium. It follows from (41) and (44) that total surplus and myopic welfare increase.

If price controls are implemented in the MD Fair equilibrium, then the market will remain in the MD Fair equilibrium. It follows from (40) and (43) that total surplus and myopic welfare increase if and only if the new price cap is less than e; otherwise, the price controls have no effect on total surplus or myopic welfare.

□

Proof. (**Proposition 9**)

If price controls are imposed in the MD Unfair equilibrium, then the market will either stay in the MD Unfair equilibrium or move to the MD Fair equilibrium. If price controls are imposed in the Shrouded Unfair equilibrium, then the market will either stay in the Shrouded Unfair equilibrium or move to the Voluntarily Unshrouded or Shrouded Fair equilibrium. The result then follows from (40)-(47) and (48)-(49).

□

Proof. (**Proposition 10**)

This follows from (41), (42), (44), (45), (47), and (48).

□

B Heterogeneous Add-on Valuations

Proposition 11. *Assume add-on valuations are uniformly distributed in* $[\underline{e}, \overline{e}]$*, and* e_i *is independent of* u_i *and the dummy for consumer* i *being myopic. Then in any equilibrium, firms earn zero profit, the price of the add-on is equal to* $\overline{p}$*, and firms disclose the price of the add-on if and only if it is mandated.*

Moreover, there exist thresholds, $\overline{p}^{\dagger\dagger}_{MDU}$ *and* $\overline{p}^{\dagger\dagger}_{SU}$*, such that:*

(i) $\overline{p}^{\dagger\dagger}_{MDU} > \overline{p}^{\dagger\dagger}_{SU} > \overline{e}$*,*

(ii) if disclosure is mandatory, a symmetric, pure strategy equilibrium exists if and only if $\overline{p} \geq \overline{p}^{\dagger\dagger}_{MDU}$ *or* $\overline{p} \leq \underline{e}$*,*

- *(a) if* $\overline{p} \geq \overline{p}^{\dagger\dagger}_{MDU}$*, we call the equilibrium* **MD Unfair***,*
- *(b) if* $\overline{p} \leq \underline{e}$*, we call the equilibrium* **MD Fair***,*

(iii) if disclosure is voluntary, a symmetric, pure strategy equilibrium exists if and only if $\overline{p} \geq \overline{p}^{\dagger\dagger}_{SU}$ *or* $\overline{p} \leq \underline{e}$*,*

- *(a) if* $\overline{p} \geq \overline{p}^{\dagger\dagger}_{SU}$*, we call the equilibrium* **Shrouded Unfair***,*
- *(b) if* $\overline{p} \leq \underline{e}$*, we call the equilibrium* **Shrouded Fair***.*

Proof. Let E_e denote the expected value of e ($E_e = \frac{\underline{e}+\overline{e}}{2}$), and let $\alpha^{\dagger}_{\text{su}}(\cdot)$ and $\alpha^{\dagger}_{\text{mdu}}(\cdot)$ be defined by the equations

$$\begin{aligned}
\alpha^{\dagger}_{\text{su}}(\overline{p}) &= \frac{-\overline{u} + \alpha(\overline{p} - E_e) + \sqrt{(\overline{u} - \alpha(\overline{p} - E_e))^2 + 4\alpha\overline{p}(\overline{u} + E_e)}}{2\overline{p}} \\
\alpha^{\dagger}_{\text{mdu}}(\overline{p}) &= \frac{-\overline{u} + \alpha(1-\lambda)(\overline{p} - E_e) + \sqrt{(\overline{u} - \alpha(1-\lambda))(\overline{p} - E_e))^2 + 4\alpha(1-\lambda)\overline{p}(\overline{u} + E_e)}}{2\overline{p}}
\end{aligned}$$

It is easily verified there exist unique values of $\overline{p}$ (call them $\overline{p}^{\dagger\dagger}_{\text{SU}}$ and $\overline{p}^{\dagger\dagger}_{\text{MDU}}$) that satisfy the equations

$$\begin{aligned}
\overline{p}^{\dagger\dagger}_{\text{SU}}\alpha^{\dagger}_{\text{su}}(\overline{p}^{\dagger\dagger}_{\text{SU}}) &= \overline{e} \\
\overline{p}^{\dagger\dagger}_{\text{MDU}}\alpha^{\dagger}_{\text{mdu}}(\overline{p}^{\dagger\dagger}_{\text{MDU}}) &= \overline{e}.
\end{aligned}$$

Once the following three lemmas are established, the result follows from analogous reasoning as used in Proposition 5.

Lemma 3. *In any equilibrium, firms earn zero profits.*

Lemma 4. *Regardless of whether or not disclosure is mandated, there does not exist a symmetric equilibrium in which* $p_2^* \in (\underline{e}, \overline{e})$.

Lemma 5. *Regardless of whether or not disclosure is mandated, in any equilibrium,* $p_2^* = \overline{p}$.

□

Proof. (**Lemma 3**) Analogous to homogeneous valuations case—firms would have incentive to lower the price of the base good by ε and capture all consumers' demand. □

Proof. (**Lemma 4**) Suppose $\underline{e}, < p_2^* < \overline{e}$. Since firms earn zero profit in equilibrium, they earn positive profits from all myopic customers and from sophisticated customers with $e_i \geq p_2^*$, and they lose money to sophisticated customers with $e_i < p_2^*$. By lowering the add-on price by ε, they will capture all demand from other firms' sophisticated customers *except* those whose add-on valuation is less than $p_2^* - \varepsilon$, who are unprofitable customers that the firm does not want. As $\varepsilon \to 0$, the loss in revenues from selling the add-on at a reduced price goes to 0, as does any effect from bringing new consumers into the market, but the gain from capturing all demand from the participating sophisticated consumers with add-on valuation in the region $[p_2^* - \varepsilon, \overline{e}]$ *does not* go to zero, contradicting the optimality of p_2^*.[34] □

Proof. (**Lemma 5**)

Recall from Lemma 3 that firms will earn zero profits in equilibrium.

Let p_2^* be an equilibrium price of the add-on. Clearly, one of the following conditions must hold:

(i) $p_2^* \geq \overline{e}$

(ii) $p_2^* \in (\underline{e}, \overline{e})$

(iii) $p_2^* \leq \underline{e}$

Suppose $p_2^* < \overline{p}$.

If $\overline{p} > p_2^* \geq \overline{e}$, then firms earn zero from selling the add-on to sophisticated consumers (the measure of sophisticates who buy it is zero), so raising p_2 to $\overline{p}$ increases profits (because the myopes will still buy it).

[34] Basically, when p_2 goes down by ε, the firm gets a discontinuous jump in the measure of profitable customers it serves, whereas the per-customer profits (among the set of profitable customers) is continuous in p_2. So by letting $\varepsilon \to 0$, the firm can still earn positive profits from all myopes and from sophisticates with $e_i \geq p_2^*$, they get a discontinuous jump in such consumers that they face, and the measure of unprofitable customers they face (sophisticates with $e_i \geq p_2^*$) is unaffected.

(ii) is ruled-out by Lemma 4.

Suppose $p_2^* \leq \underline{e}$. Then all customers purchase the base good and add-on, so the zero profit condition implies $p_1^* + p_2^* = 0$. By raising p_2 to $\overline{p}$, a firm would push all its sophisticated customers out and keep its myopic customers. Since $\overline{p} > p_2^*$, this firm would earn positive profits, contradicting the optimality of p_2^*. □

Proposition 12. *If disclosure mandates move the market from the Shrouded Unfair equilibrium to the Mandatory Unfair equilibrium, then total surplus increases if and only if*

$$(p_{1,SU}^{*2} - p_{1,MDU}^{*2}) - \alpha\lambda \left[\overline{u}(\overline{e} + \underline{e}) + \frac{\overline{e}^2 + \overline{e}\underline{e} + \underline{e}^2}{3}\right] > 0,$$

and myopic welfare increases if and only if

$$(2-\alpha)(p_{1,SU}^{*2} - p_{1,MDU}^{*2}) + 2(1-\alpha)\overline{u}(p_{1,MDU}^{*} - p_{1,SU}^{*}) - \alpha\lambda \left[\overline{u}(\overline{e} + \underline{e}) + \frac{\overline{e}^2 + \overline{e}\underline{e} + \underline{e}^2}{3}\right] > 0.$$

If disclosure mandates push the market from the Shrouded Fair to Mandatory Fair, total surplus and myopic welfare both increase.

Proof. Consider the possible sources of inefficiencies (relative to first best):

- Myopes with valuations such that $u_i + e_i < 0$ consume the base good and add-on whenever $u_i + e_i \in [p_1^*, 0)$.
  - This exists in *all* equilibria.
  - Let $\ell_1^\dagger$ denote the per capita losses *across myopes* associated with this consumption:

$$\ell_1^\dagger = (\overline{u} - \underline{u})^{-1}(\overline{e} - \underline{e})^{-1} \int_{\underline{e}}^{\overline{e}} \int_{p_1^*-e}^{-e} u + e \; du \; de \;=\; \frac{p_1^{*2}}{2(\overline{u} - \underline{u})} \tag{62}$$

- In the unfair equilibria, sophisticated consumers with valuations satisfying $u_i \in [p_1^*, -e_i)$ consume the base good (and forego the add-on).
  - Let $\ell_2^\dagger$ denote the per capita losses *across sophisticates* associated with this consumption:

$$\ell_2^\dagger = (\overline{u} - \underline{u})^{-1}(\overline{e} - \underline{e})^{-1} \int_{\underline{e}}^{\overline{e}} \int_{p_1^*}^{-e} u \; du \; de \;=\; \frac{p_1^{*2} - \frac{\overline{e}^2 + \overline{e}\underline{e} + \underline{e}^2}{3}}{2(\overline{u} - \underline{u})} \tag{63}$$

- In the unfair equilibria, sophisticated consumers such that $u_i + e_i \in [0, \overline{u} + \overline{e}]$ forego consumption of the add-on.

– Let $\ell_3^\dagger$ denote the per capita losses *across sophisticates* associated with this consumption:

$$\ell_3^\dagger = (\overline{u}-\underline{u})^{-1}(\overline{e}-\underline{e})^{-1} \int_{\underline{e}}^{\overline{e}} \int_{-e}^{\overline{u}} e \; du \; de \; = \frac{\overline{u}E_e + \frac{\overline{e}^2+\overline{e}\underline{e}+\underline{e}^2}{3}}{\overline{u}-\underline{u}} \tag{64}$$

Note that since $\underline{e} > 0$, in the first best outcome, each consumer i consumes the base good and add-on if and only if $u_i + e_i \geq 0$, otherwise the consumer does not participate in the market. Hence, the first best per capita surplus is given by

$$\Lambda_{\text{FB}} = (\overline{u}-\underline{u})^{-1}(\overline{e}-\underline{e})^{-1} \int_{\underline{e}}^{\overline{e}} \int_{-e}^{\overline{u}} u + e \; du \; de = \frac{\overline{u}^2 + \overline{u}(\overline{e}+\underline{e}) + \frac{\overline{e}^2+\overline{e}\underline{e}+\underline{e}^2}{3}}{2(\overline{u}-\underline{u})} \tag{65}$$

In the fair equilibria, Λ_s and Λ_m are given by the equations:

$$\Lambda_s \;=\; -\alpha^* \ell_1^\dagger \tag{66}$$
$$\Lambda_m \;=\; -(1-\lambda^*)\ell_1^\dagger \tag{67}$$

Since prices in these equilibria are given by $(p_1^*, p_2^*) = (-\overline{p}, \overline{p})$, (66) and (67) become

$$\Lambda_{s,\text{SF}}^* \;=\; \frac{-\alpha\overline{p}^2}{2(\overline{u}-\underline{u})} \tag{68}$$
$$\Lambda_{s,\text{MDF}}^* \;=\; \frac{-\alpha(1-\lambda)\overline{p}^2}{2(\overline{u}-\underline{u})} \tag{69}$$
$$\Lambda_{m,\text{SF}}^* \;=\; \frac{-\overline{p}^2}{2(\overline{u}-\underline{u})} \tag{70}$$
$$\Lambda_{m,\text{MDF}}^* \;=\; \frac{-(1-\lambda)\overline{p}^2}{2(\overline{u}-\underline{u})} \tag{71}$$

In the unfair equilibria, Λ_s is given by the equation

$$\Lambda_s = -\alpha^* \ell_1^\dagger - (1-\alpha^*)(\ell_2^\dagger + \ell_3^\dagger). \tag{72}$$

It follows that $\Lambda_{s,\text{SU}}^*$ and $\Lambda_{s,\text{MDU}}^*$ are given by the equations:

$$\Lambda_{s,\text{SU}}^* \;=\; -\frac{p_{1,\text{SU}}^{*2} + (1-\alpha)\left[\overline{u}(\overline{e}+\underline{e}) + \frac{\overline{e}^2+\overline{e}\underline{e}+\underline{e}^2}{3}\right]}{2(\overline{u}-\underline{u})} \tag{73}$$
$$\Lambda_{s,\text{MDU}}^* \;=\; -\frac{p_{1,\text{MDU}}^{*2} + (1-\alpha(1-\lambda))\left[\overline{u}(\overline{e}+\underline{e}) + \frac{\overline{e}^2+\overline{e}\underline{e}+\underline{e}^2}{3}\right]}{2(\overline{u}-\underline{u})} \tag{74}$$

To solve for the welfare of (ex ante) myopic consumers in the unfair equilibrium, we will first solve for the welfare of the ex ante sophisticated consumers in these equilibria and use the fact that total surplus is the weighted average of the welfare of these two groups:

$$\Lambda_s^* = \alpha\Lambda_m^* + (1-\alpha)\Lambda_{\text{soph}}^*. \tag{75}$$

In the unfair equilibria, none of the sophisticated consumers consume the add-on. Hence, the per capita surplus of ex ante sophisticated consumers (relative to first best) is given by

$$\begin{aligned}\Lambda_{\text{soph}}^* &= (\overline{u}-\underline{u})^{-1}(\overline{e}-\underline{e})^{-1}\int_{\underline{e}}^{\overline{e}}\int_{p_1^*}^{\overline{u}} u - p_1^* \, \mathrm{d}u \; \mathrm{d}e - \Lambda_{\text{FB}} \\ &= \frac{(\overline{u}-p_1^*)^2 - \left[\overline{u}^2 + \overline{u}(\overline{e}+\underline{e}) + \frac{\overline{e}^2+\overline{e}\underline{e}+\underline{e}}{3}\right]}{2(\overline{u}-\underline{u})} \end{aligned} \tag{76}$$

Combining (73), (74), (75) and (76), it easily follows that $\Lambda_{m,\text{SU}}^*$ and $\Lambda_{m,\text{MDU}}^*$ are given by

$$\Lambda_{m,\text{SU}}^* = \frac{-(2-\alpha)p_{1,\text{SU}}^{*2} + 2(1-\alpha)\overline{u}p_{1,\text{SU}}^*}{2\alpha(\overline{u}-\underline{u})} \tag{77}$$

$$\Lambda_{m,\text{MDU}}^* = \frac{-(2-\alpha)p_{1,\text{MDU}}^{*2} + 2(1-\alpha)\overline{u}p_{1,\text{MDU}}^* - \alpha\lambda\left[\overline{u}(\overline{e}+\underline{e}) + \frac{\overline{e}^2+\overline{e}\underline{e}+\underline{e}^2}{3}\right]}{2\alpha(\overline{u}-\underline{u})} \tag{78}$$

It trivially follows from the equations above that if disclosure mandates push the market from the Shrouded Unfair equilibrium to the Mandatory Unfair equilibrium, then *total surplus increases* if and only if

$$(p_{1,\text{SU}}^{*2} - p_{1,\text{MDU}}^{*2}) - \alpha\lambda \;\; \overline{u}(\overline{e}+\underline{e}) + \frac{\overline{e}^2+\overline{e}\underline{e}+\underline{e}^2}{3} \;\; > 0,$$

and *myopic welfare* increases if and only if

$$(2-\alpha)(p_{1,\text{SU}}^{*2} - p_{1,\text{MDU}}^{*2}) + 2(1-\alpha)\overline{u}(p_{1,\text{MDU}}^* - p_{1,\text{SU}}^*) - \alpha\lambda \;\; \overline{u}(\overline{e}+\underline{e}) + \frac{\overline{e}^2+\overline{e}\underline{e}+\underline{e}^2}{3} \;\; > 0.$$

If disclosure mandates push the market from the Shrouded Fair to Mandatory Fair, total surplus and myopic welfare both increase—prices are unaffected, and disclosure causes a reduction in harmful consumption of the products. The only other possible consequence of disclosure mandates is to push the market from the Shrouded Unfair equilibrium to a region where no equilibrium exists, in which case the welfare effects are indeterminate. □

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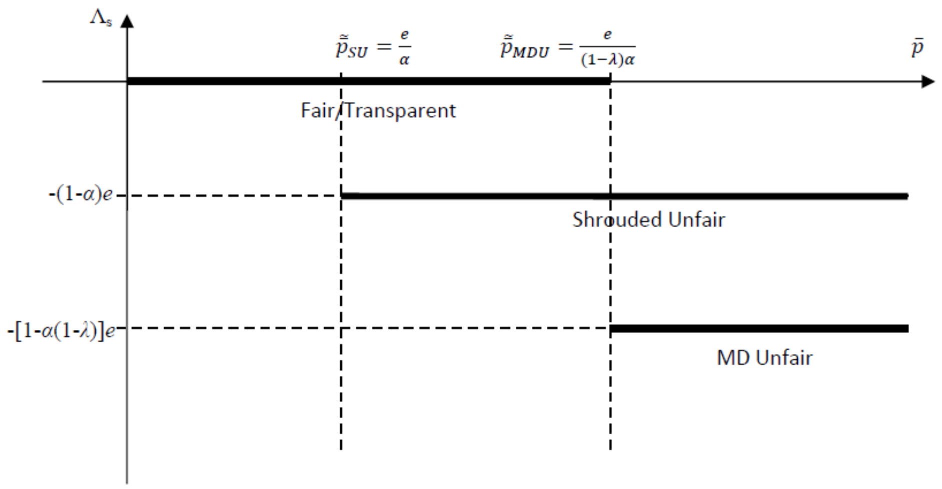
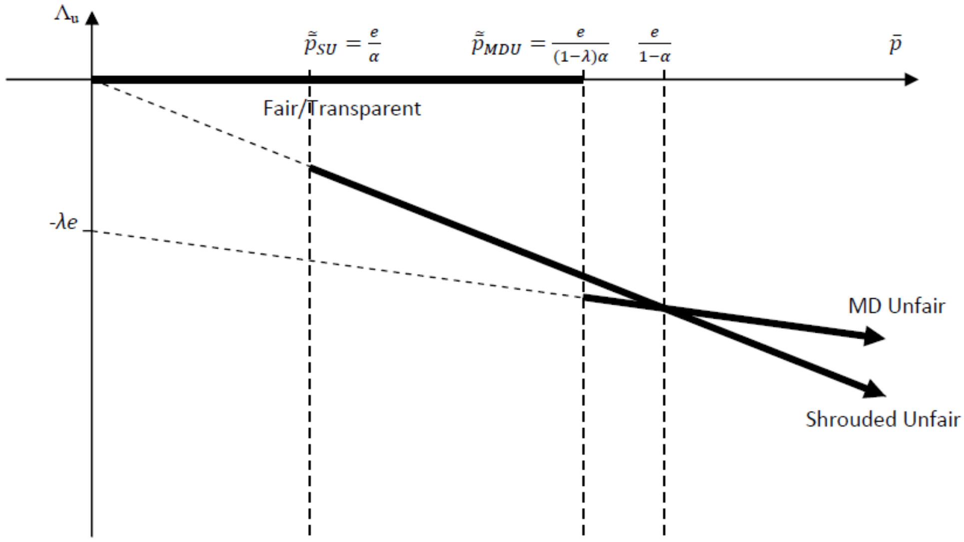
Figure 1: Total Surplus (Baseline Model)



We plot total surplus, Λ_s, as a function of the maximum add-on price, $\overline{p}$, 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, $\overline{p}$, 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 $\alpha\lambda(2\overline{u}e + e^2) < p^{*2}_{1,\text{SU}} - p^{*2}_{1,\text{MDU}}$ **Total Surplus Decreases** if the market moves to the MD Unfair equilibrium and $\alpha\lambda(2\overline{u}e + e^2) > p^{*2}_{1,\text{SU}} - p^{*2}_{1,\text{MDU}}$
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 $\overline{p} > \frac{e}{1-\alpha}$ **Myopic Welfare Decreases** if the market moves to the MD Unfair equilibrium and $\overline{p} < \frac{e}{1-\alpha}$	**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:

$$\Gamma = (2-\alpha)(p_{1,\mathrm{SU}}^{*2} - p_{1,\mathrm{MDU}}^{*2}) + 2(1-\alpha)\overline{u}(p_{1,\mathrm{MDU}}^{*} - p_{1,\mathrm{SU}}^{*}) - \alpha\lambda(2\overline{u}e + e^2).$$

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 $\overline{p} < e\sqrt{1-\lambda}$ **Total Surplus Decreases** if (i) the market moves to the Shrouded Unfair equilibrium or (ii) the market moves to the Shrouded Fair equilibrium with $\overline{p} > e\sqrt{1-\lambda}$
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, $\overline{p} < e$

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 $\overline{p} < e\sqrt{1-\lambda}$ **Myopic Welfare Decreases** if (i) the market moves to the Shrouded Unfair equilibrium or (ii) the market moves to the Shrouded Fair equilibrium with $\overline{p} > e\sqrt{1-\lambda}$
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, $\overline{p} < e$

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.