Add-on Pricing in Retail Financial Markets and the Fallacies of Consumer Education*

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Abstract

We analyze the consequences of consumer education on prices and welfare in retail financial markets when some consumers are naive about shrouded add-on prices and banks try to exploit this. Allowing for different information and pricing strategies we show that education is unlikely to push banks to full price disclosure, which would be efficient, but instead to a new equilibrium in which banks discriminate between consumer types. Welfare analysis reveals that education, while positive for consumers who learn to make better financial decisions, imposes a negative externality on other consumers when banks respond by setting higher prices. Overall, the welfare effects of consumer education can be negative. Our results identify important pitfalls policy makers should take into account when considering the seemingly harmless intervention of consumer education.

Keywords: Consumer education, financial literacy, pricing strategies, bounded rationality, welfare effects.

JEL Classification: D40, D80, L50

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1 Introduction

> "Personal banking, like lunch, is not free. ... Yet the myth that banks are offering retail customers something for nothing persists to a degree that would be puzzling even if bankers were seen as national treasures. Andrew Bailey, [UK] banking regulation supremo, is the latest figure to set out the damage done by a business model in which the core product is a loss leader, bringing opacity and distortion in its wake. ... [To end this], banks would have to resist the temptation to slap charges on current accounts while continuing with the hefty fees and charges elsewhere that subsidise those accounts at the moment." *Financial Times, Nov. 24, 2011*

When consumers are naive, firms are likely to exploit this. This is especially relevant in retail financial markets where banks intensely compete for customers to open a bank account at their branch, and then have enhanced market power to charge high overdraft fees or to sell high-priced investment products to naive customers.[1] Recent research finds that retail investors pay, on average, an 8 percent premium for popular structured equity products relative to the fair market value of these securities (Henderson and Pearson, 2011). Certainly, not all consumers are naive: some are sophisticated and rationally expect that add-ons such as overdrafts and investment products are overpriced. These consumers typically search for substitution possibilities, e.g., they obtain credit from other sources to avoid overdraft fees, or they build their own diversified stock portfolio to avoid expensive investment funds. As shown by Gabaix and Laibson (2006), the equilibrium pricing strategy of banks in a situation with sufficiently many naive consumers is to compete purely on the price of the base good (bank account) and to shroud information about the price of the add-on (overdrafts, investment products). While the base good is priced below marginal cost, the price of the add-on is above marginal cost.

The consequences for consumers are twofold: First, as described above, sophisticated consumers who rationally expect that add-ons are overpriced will search for substitution possibilities, leading to smaller bank revenues and inefficiencies if substitution costs exceed banks' costs of production. Second, naive consumers who buy the add-on at the high price subsidize the low-priced base good and thereby also

[1] Other well-known examples outside the financial domain are consumers who buy a printer without being aware of the costs of new printer cartridges (e.g., Hall, 1997), or travelers who book a hotel room without considering the extra costs of parking or a minibar.

sophisticated consumers, which raises consumer protection concerns. The question is if and how a policymaker may intervene to increase economic welfare and protect consumers in their decision making.

This paper examines the consequences of consumer education, a simple and popular form of policy intervention to mitigate adverse effects for naive consumers. The issue of financial literacy has received considerable public attention in the light of the recent financial crisis. Several countries and organizations, including the OECD, US, EU, and UK, have launched a number of financial education initiatives recently.[2] Intuition suggests that such initiatives — if effective — will have only positive effects on consumer protection and welfare, and may eventually lead to efficient market outcomes if the educational boost is strong enough to make many naive consumers sophisticated. In contrast, our results show that this simple intuition is wrong. Due to banks' strategic responses, the welfare consequences of consumer education are more complex, and consumer education may actually cause unintended harm to consumers.

We start our analysis by investigating banks' optimal information and pricing strategy when the population of consumers is composed of naive and sophisticated types. Banks can choose between: (i) high shrouded add-on prices for all consumers, (ii) low unshrouded add-on prices for all consumers, or (iii) high shrouded add-on prices for naive consumers and low unshrouded add-on prices for sophisticated consumers. The third strategy represents a particular form of third-degree price discrimination. It is a new and important extension of the literature on pricing strategies with naive and sophisticated consumers, which considers uniform pricing strategies as in (i) and (ii) above (e.g., Gabaix and Laibson, 2006), or price discrimination strategies for product offerings with only a single good or a bundle of goods (e.g. Heidhues and Kőszegi, 2010; Heidhues et al., forthcoming; Heidhues and Kőszegi, 2015), but not price discrimination strategies for product offerings with a unique price for base goods and different prices for avoidable add-ons.

[2]According to OECD recommendations, "financial education is necessary to ensure sufficient levels of investor and consumer protection as well as the smooth functioning, not only of financial markets, but also of the economy." (OECD, 2009, p. 3). Similarly, Ben Bernanke, chairman of the Federal Reserve, stated that "among the lessons of the recent financial crisis is the need for virtually everyone – both young and old – to acquire a basic knowledge of finance and economics." (Bernanke, 2013).

The idea is that when a customer relation is established through the purchase of a base good, banks can collect information from new customers that correlates with their degree of sophistication in making decisions regarding add-on products. For example, banks may analyze information provided by a new customer when opening a bank account (the base good) and also track the customer's usage of the bank account. In particular, banks may monitor all regular incoming and outgoing payments including payments for savings accounts and automatic investment plans. They may then use this information to classify consumers as either naive or sophisticated investors and fine-tune their pricing strategy for investment products (the add-ons) accordingly: consumers classified as naive are offered expensive investment funds with hidden fees, while consumers classified as sophisticated are offered low-priced exchange-traded funds. Another example is that banks may observe customers' overdraft behaviors from their bank accounts and use this information when offering credit cards: consumers that apparently underestimate their usage of overdrafts are classified as naive and offered credit cards with more back-loaded payments (low introductory interest rate relative to the post-introductory rate and high penalty interest rate), while consumers classified as sophisticated are offered more favorable terms and conditions. However, the classification of consumers is unlikely to be perfect and we therefore allow for the possibility that banks may also erroneously classify a naive consumer as sophisticated or vice versa.

Importantly, the form of third-degree price discrimination that we analyze considers situations where banks use different prices for the add-ons but not for the base good, as they can identify consumers' types relatively well only after the purchase of the base good. This is different from related studies, for example, Heidhues et al. (forthcoming) who analyze second-degree price discrimination in which firms provide a menu of offers and naive and sophisticated consumers self-separate by choosing different pairs of a base good and an add-on. Finally, we analyze the effects of consumer education, i.e., increases in the share of sophisticated consumers, on banks' information and pricing strategies and resulting consequences for consumer costs and welfare.

Our first result shows that price discrimination is a symmetric competitive equi-

librium if banks can classify consumers relatively well and the fraction of naive consumers is neither very small nor very large. Otherwise, banks unshroud prices if the fraction of naive consumers is small and shroud the add-on price if the fraction of naive consumers is large. This result has an important consequence. As price discrimination becomes a new equilibrium, fully unshrouded prices, which would be the socially most desirable outcome, will no longer emerge in many situations — even if markets are competitive. This suggests that, in the light of recent technological developments ("Big Data") which both ease and advance possibilities for consumer classification and price discrimination, it is likely less relevant to consider price and welfare changes which assume that banks are pushed from a shrouded into an (unlikely) unshrouded prices equilibrium, but rather how outcomes change if banks move to, or remain in, a price discrimination equilibrium.

The second key result of our model exposes an additional fallacy of consumer education: in contrast to common intuition, education which is good for the single educated consumer may be bad for consumers who remain naive and even for the group of consumers as a whole. Due to a strategic feedback on prices, educating some consumers may entail hidden costs for all other consumers, leading to increased prices and a reduction in overall welfare. Such negative effects, which in our model come in the form of substitution costs for sophisticated consumers, may be substantial. For example, sophisticated consumers who want to avoid overpriced structured equity products have to construct their own investment products using equities and derivatives, which generates high effort, information and search costs.[3]

Finally, we show that providing consumer education without knowing whether banks are able to engage in price discrimination or not yields effects that can go in any direction. Well-intentioned intervention may thus be harmful and a policymaker's

[3]Besides the already mentioned 8% retail premium for structured equity products (Henderson and Pearson, 2011), another example is high-priced investment funds, which often have fees between 1% and 2% per year. Low-priced alternatives, such as exchange-traded funds (ETFs) which often have annual fees as low as 0.1%, were not available in the past. In Germany, for example, this has changed gradually since 2000, potentially because sophisticated consumers would otherwise substitute away. The largest German bank, Deutsche Bank, has offered ETFs under the name *db x-trackers* since 2007. The German savings banks have offered ETFs under the name DEKA since 2008. However, based on anecdotal evidence, these banks almost never actively advertise ETFs or suggest ETFs to their retail clients. Notably, Citibank Deutschland (now called Targobank and part of Credit Mutuel Group) until 2008 did not even allow customers to buy ETFs from external providers into their securities account, officially because of "technical difficulties".

courses of action are again plagued with pitfalls. Overall, our analysis suggests that policymakers are advised to carefully examine consumer and bank behavior before implementing the seemingly harmless intervention of consumer education.

Our study contributes to two main fields in the literature dealing with naive consumers in retail financial markets: information and pricing strategies of banks, and consumer education. Carlin (2009) argues that banks may add complexity to their price structures in order to prevent consumers from becoming informed and purchasing the product at a lower price. Chioveanu and Zhou (2013) propose a model where banks choose price frames and prices to obfuscate price comparisons and sustain positive profits. Carlin and Manso (2011) study the interaction between obfuscation and investor sophistication, and find that investor education may increase obfuscation by banks, leading to more disorientation of investors and lower welfare. In practice, banks may use not only obfuscation strategies but also price discrimination to exploit the naiveté of consumers. Our study contributes to the literature by showing that price discrimination is an equilibrium in competitive markets with naive and sophisticated consumers, and by analyzing important welfare implications of this new equilibrium.

Several empirical studies show that the effect of financial education on consumers' decisions is rather small. Choi et al. (2010), for example, find in an investment experiment with high monetary incentives that more than 80 percent of the participants fail to take into account substantial fees of investment products even when these fees are made transparent and salient. Other studies show that financial counseling or mandatory disclosure do little to improve the decisions of consumers in the mortgage market (Agarwal et al., 2009; Lacko and Pappalardo, 2010). Beshears et al. (2011) provide similar experimental evidence regarding investments in overpriced mutual funds. Bhattacharya et al. (2012) document that only few retail investors are interested in free and independent investment advice, and if they obtain it, hardly follow the advice.[4] Our theoretical results contribute to this empirical literature as they show that the small behavioral effects of financial education may not merely be ineffective on the individual level but may actually be harmful in the aggregate as they

[4]See also De Meza et al. (2008) and Hastings et al. (2013) for a more general review of the literature on financial education.

reduce overall welfare due to banks' strategic reaction via prices.

Finally, the paper belongs to a recent literature pointing to possible negative effects of transparency. Other papers show that shrouded prices may be good for welfare if, for example, they increase consumption (Glaeser and Ujhelyi, 2010; De Meza and Reyniers, 2012) or allow firms to better price discriminate between low-demand and high-demand consumers (Grubb, 2015). Armstrong and Vickers (2012) study different policy options in relation to shrouded add-ons and also find that transparency may have negative effects on welfare. Piccione and Spiegler (2012) show that when a policymaker tries to increase transparency by harmonizing disclosure formats, firms may respond in equilibrium by using more complex disclosure formats and consumers may be worse off. See also Ellison (2006), Spiegler (2011, 2015), and Armstrong (2015) for overviews of this field.

The paper is organized as follows. Section 2 presents the main model. Section 3 analyzes market equilibria. Section 4 contains the main results regarding effects of price discrimination on consumer costs and welfare. Section 5 then introduces consumer education and shows the respective effects. Finally, Section 6 concludes. The Appendix includes an overview on prices, consumer costs and welfare for the different prices equilibria (Section A1) and all proofs (Section A2).

2 Model

Our baseline model follows the one of Gabaix and Laibson (2006) (henceforth denoted as GL). There is a finite number of banks offering a homogeneous base good and an add-on, which are both produced at zero marginal cost. In contrast to unavoidable surcharges, which are not considered in the model, the add-on is always avoidable for informed consumers. As a particular example further developed below, suppose that banks offer bank accounts as a base good and different types of investment funds as an add-on.

The mass of consumers is normalized to 1. Consumers are of two types: A fraction $\alpha \in (0,1)$ of consumers are *naive* (myopic, in the language of GL), they only consider the price of the base good when deciding to purchase at the bank. The remaining

fraction $1-\alpha$ are *sophisticated* and consider both the price of the base good and the price of the add-on. If banks do not advertise the add-on, sophisticated consumers form Bayesian posteriors about the add-on price.

Let p denote the price of the base good and q the price of the add-on. We focus on symmetric price equilibria throughout the paper and hence omit bank-subscripts whenever doing so causes no confusion. As in GL, banks can decide to *shroud* or *unshroud* add-on prices when consumers make a buying decision about the base good. Both activities are free. Shrouding means that banks suppress information about the price of the add-on. Unshrouding means that banks advertise the price of the add-on broadly. If a bank unshrouds, all sophisticated consumers as well as a fraction $\lambda_F \in [0,1)$ of naive consumers become informed about the price of the add-on and take it into account when purchasing the good. The latter group of *informed naive* consumers is the result of the educational effect of a bank's unshrouding activity. These consumers are initially naive but behave just like sophisticated consumers once a bank unshrouds. The remaining fraction $1-\lambda_F$ of naive consumers do not take the add-on price into consideration even when banks unshroud. This group of *uninformed naive* consumers is either not receptive or not able to use the relevant information.

Consumers have a maximum willingness to pay for the add-on $\bar{q}$, which sets an upper bound for the price q, i.e., $q \leq \bar{q}$. In addition, consumers who are informed about or expect high add-on prices, can avoid the add-on by substituting away at cost $e < \bar{q}$. Hence, banks can charge a maximum add-on price $\bar{q}$ to uninformed naive consumers and e to sophisticated and informed naive consumers.

Following GL we analyze price competition by modeling the demand at bank i as the probability $D(x_i)$ that a consumer purchases a product at that bank. The probability depends on x_i, which denotes the anticipated net surplus from purchasing at bank i minus the anticipated net surplus from purchasing at the best alternative bank.[5]

As banks sell homogenous goods, the anticipated net surplus of uninformed naive

[5]Formally, the demand function can be derived from a random-utility model, where individual a consuming product i has utility $U_{ai} = v - p_i + \varepsilon_{ai}$, with v and p_i denoting the quality and the price of the product, respectively, and ε_{ai} denoting a random idiosyncratic preference component that is i.i.d. across consumers and products. Cf. GL, p. 532-533 and Anderson et al. (1992) for details.

consumers who do not take the add-on price into consideration equals

$$x_i = -p_i + p^*,$$

where p_i and p^* denote the price of the base good at bank i and the price of the base good at the best alternative bank, respectively. For a sophisticated (and an informed naive) consumer, who takes both the price of the base good and the price of the add-on into account, anticipated net surplus equals

$$x_i = -p_i - \min\{Eq_i, e\} + p^* + \min\{Eq^*, e\},$$

where Eq_i and Eq^* represent the expected add-on price at bank i and the expected add-on price at the best alternative bank, respectively. If information is unshrouded, $Eq_i = q_i$ and $Eq^* = q^*$.

A key innovation in our model is that, in addition to fully (un)shrouding add-on prices, banks can make different price offers to consumers who they classify as naive or sophisticated. This strategy results in partial (un)shrouding and is similar to a particular form of third-degree price discrimination.[6] More precisely, we assume that banks can collect information about new customers when a customer relationship is established through the sale of the base good, and then use this information to classify customers. For instance, banks typically learn about new customers by tracking their usage of the bank account (the base good). They can advertise the price of their bank account p broadly to all customers and disseminate special information about low-priced investment funds, such as exchange-traded funds (ETFs), only to those classified as sophisticated. All remaining customers are not made aware of these funds but are offered only actively managed investment funds with high annual fees after they have opened a bank account.[7]

[6]Other extensions of GL include the consideration of price floors (Miao, 2010), price caps (Ko and Williams, 2013) and the differentiation of "socially valuable" and "socially wasteful" products (Heidhues et al., forthcoming).

[7]Importantly, we assume that price discrimination strategies of banks involve a unique price of the base good for naive and sophisticated consumers, but different prices for add-ons. Our main motivation for the assumption of a unique price of the base good is to consider situations where banks can classify consumers with sufficient accuracy only after the purchase of the base good. Note that the assumption is also plausible for situations where banks can classify consumers sufficiently

Thus, banks on the one hand unshroud add-on prices for consumers whom they classify as sophisticated because they assume that these consumers otherwise form Bayesian posteriors about the add-on price and substitute away. The advertised add-on price for these consumers, q_S, cannot exceed e, the substitution costs of sophisticated consumers. On the other hand, banks shroud information from consumers classified as naive. The add-on price for these consumers, q_N, is at most $\bar{q}$, the reservation price of uninformed naive consumers.

We allow for the possibility that banks make mistakes when classifying consumers. With probability $1-\beta$, banks erroneously classify a sophisticated consumer as naive. Further, with probability $1-\gamma$, banks erroneously classify a naive consumer as sophisticated. Intuitively, $\beta, \gamma \in [0,1]$ model the accuracy of banks' consumer classification. The larger these parameters, the better banks can identify a consumer's true type. As long as β and γ are strictly below 1, misclassification implies that banks unshroud the low add-on price q_S for a non-zero fraction of naive consumers while a non-zero fraction of sophisticated consumers will not receive the low-price offer. In equilibrium, the latter group will therefore substitute away because they expect high prices while the former group will earn a rent.[8]

Considering again our example, we thus assume that a fraction $1-\gamma$ of naive consumers are erroneously classified as sophisticated. These naive consumers then profit from the misclassification because they are offered the ETF with low annual fees, although they would have bought the more expensive, actively managed fund, as well. Further, a fraction $1-\beta$ of sophisticated consumers are erroneously classified as naive. These consumers build their own diversified portfolio (i.e., substitute away) at cost e, because they do not get any information about the low-priced add-on and expect that the bank offers an actively managed fund with high annual fees.[9]

The timing of decisions in our model is as follows:

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well *before* the purchase of the base good, but a low price of the base good intended for naive consumers would also attract sophisticated consumers, who can costlessly or at relatively low costs observe such offers and then purchase a low-priced base good.

[8] We show below that a necessary condition for price discrimination to be an equilibrium is that $\beta > 1-\gamma$.

[9] If some or all misclassified sophisticated consumers can observe that other (correctly classified) sophisticated consumers are offered a low-priced add-on and then buy it for e instead of substituting away at costs e, this can be interpreted as a *de facto* higher classification accuracy β.

Period 1

- Banks choose their information and pricing strategy.
  - In the case of *shrouding*, banks suppress information about the add-on. They pick a price for the base good, p, and a price for the add-on, q.
  - In the case of *unshrouding*, banks advertise the add-on price towards all consumers. Unshrouding makes sophisticated consumers and a fraction λ_F of naive consumers aware of the add-on price. Banks also pick prices p and q.
  - In the case of *price discrimination*, banks initially shroud the add-on prices towards all consumers. Banks pick a price for the base good, p, and prices for the add-on, q_N and q_S, for consumers classified as naive and sophisticated, respectively.

Period 2

- Informed consumers (sophisticated and informed naive) always take the price of the add-on into consideration. Informed consumers who do not receive any information about the add-on (because banks shroud), form Bayesian posteriors about the add-on price.
- Uninformed naive consumers do not consider the add-on for their buying decision.
- All consumers choose a bank and buy the base good.

Period 3

- In the case of *price discrimination*, banks collect new customer information and classify customers as naive or sophisticated. Banks then unshroud add-on prices for consumers classified as sophisticated.
- Informed consumers can decide to substitute away at cost e.

Period 4

– Consumers observe the add-on price (if they have not done so already).

– Uninformed consumers buy the add-on if the price is at most their reservation price $\bar{q}$.

– Informed consumers buy the add-on if they have not already substituted away in period 3.

3 Price Equilibria

GL show that there exist two symmetric equilibria in their model: a *shrouded prices* and an *unshrouded prices* equilibrium. The existence of these equilibria depends on the share of naive consumers in the population, the substitution costs, and the upper bound for the add-on price. If the share of naive consumers is relatively large, i.e. $\alpha > \frac{e}{\bar{q}}$, a shrouded prices equilibrium exists. If there are relatively few naive consumers, i.e. $\alpha < \frac{e}{\bar{q}}$, an unshrouded prices equilibrium exists.

Our first result extends the GL-result by showing that banks' ability to classify consumers as naive or sophisticated changes both the thresholds above and the set of symmetric equilibria, leading to a new *price discrimination* equilibrium if the share of naive consumers is an intermediate value.

PROPOSITION 1 (Price Equilibria)**.** *Let*

$$\alpha^{\dagger} = \min\left(\frac{e}{\bar{q}}, \frac{e(1-\beta)}{e(1-\beta)+(\bar{q}-e)\gamma}\right) \tag{1}$$

and

$$\alpha^{\ddagger} = \max\left(\frac{e}{\bar{q}}, \frac{e\beta}{e\beta+(\bar{q}-e)(1-\gamma)}\right). \tag{2}$$

If $\alpha < \alpha^{\dagger}$, there exists an equilibrium, in which banks unshroud the add-on price and set $q = e$ (unshrouded prices equilibrium). If $\alpha^{\dagger} < \alpha < \alpha^{\ddagger}$, there exists an equilibrium, in which banks engage in price discrimination with $q_S = e$ and $q_N = \bar{q}$ (price discrimination equilibrium). If $\alpha^{\ddagger} < \alpha$, there exists an equilibrium, in which banks shroud the add-on price and set $q = \bar{q}$ (shrouded prices equilibrium).

All proofs are in the Appendix.

Proposition 1 is illustrated in Figure 1. If the share of naive consumers is small ($\alpha < \alpha^\dagger$), banks optimally sell the add-on to every consumer. As sophisticated consumers substitute away if they observe (or expect) add-on prices larger than e, banks set price $q = e$ and unshroud. From the first-order condition ($p+q = \frac{D(0)}{D'(0)} = \mu$) it follows that the price of the base good is equal to $\mu - e$ in the unshrouded prices equilibrium.

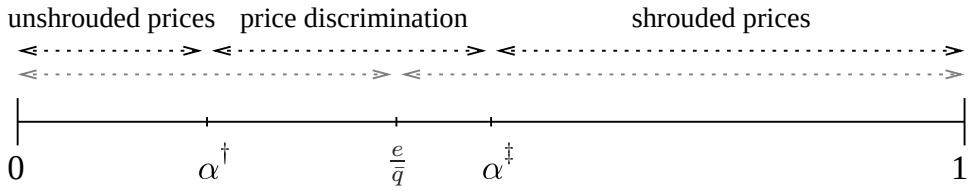


Figure 1: Price Equilibria with (and without) Price Discrimination. For a situation where banks can classify consumers relatively well, the upper dashed lines illustrate that price discrimination is an equilibrium pricing strategy if the share of naive consumers α is an intermediate value. Without the possibility to use price discrimination, banks either choose unshrouded prices or shrouded prices depending on α (lower dashed lines).

If the share of naive consumers is in the intermediate range ($\alpha^\dagger < \alpha < \alpha^\ddagger$), price discrimination is an equilibrium strategy. A necessary condition is that $\alpha^\dagger < \alpha^\ddagger$, which holds if and only if $\beta > 1-\gamma$, i.e., errors from misclassification are small. Banks choose the highest possible add-on price $q_N = \bar{q}$ as a standard, which they shroud, and make special offers $q_S = e$ to consumers who they classify as sophisticated. If $\beta < 1$, some sophisticated consumers are misclassified and do not receive the special offer. These consumers see that banks shroud, conclude that $Eq = \bar{q}$ and hence substitute away. Banks accept this as the share of naive consumers is sufficiently large such that it pays to shroud the high add-on price. On the other hand, if $\gamma < 1$, there are some naive consumers who buy the add-on at a price $q_S = e$ that is strictly below their reservation price $\bar{q}$. Banks accept this as well, as the share of naive consumers is not large enough for it to pay to ignore sophisticated consumers and shroud the add-on completely. Note that price discrimination yields higher revenue for banks on the add-on. However, competition on the base-good market forces banks to pass

this extra revenue to consumers in the form of lower base-good prices.[10] In the price discrimination equilibrium, the price of the base good is therefore lower than in the unshrouded prices equilibrium. From the first-order condition we get that it is equal to $\mu - \alpha\gamma\bar{q} - e(\alpha(1-\gamma) + (1-\alpha)\beta)$.[11]

Finally, a shrouded prices equilibrium exists if the share of naive consumers is large ($\alpha > \alpha^{\ddagger}$). In this case, banks sell the add-on at the highest possible price $q = \bar{q}$ to naive consumers only. Information is shrouded because unshrouding decreases the fraction of uninformed consumers. Sophisticated consumers observe that banks shroud, rationally expect that $Eq = \bar{q}$, and hence substitute away. Again, all extra revenue on the add-on is competed away in the base-good market, leading to a price for the base good equal to $\mu - \alpha\bar{q}$.

Note that a necessary condition for price discrimination to be an equilibrium is that the interval $[\alpha^{\dagger}, \alpha^{\ddagger}]$ exists, which is equivalent to $\beta > 1 - \gamma$. If this condition is not fulfilled, Proposition 1 is equivalent to the main result in GL, as the following corollary summarizes.

COROLLARY 1 (No Price Discrimination)**.** *Suppose that $\beta \leq 1 - \gamma$. This implies that $a^{\dagger} = \alpha^{\ddagger} = \frac{e}{\bar{q}}$. There exists an unshrouded prices equilibrium if $\alpha < \frac{e}{\bar{q}}$ and a shrouded prices equilibrium if $\alpha > \frac{e}{\bar{q}}$.*

Next, if errors are relatively small and in addition sophisticated consumers can be classified perfectly ($1 - \gamma < \beta = 1$), price discrimination always dominates unshrouding. In consequence, the unshrouded prices equilibrium no longer exists.

COROLLARY 2 (No Unshrouding)**.** *Suppose that $1 - \gamma < \beta = 1$. This implies that $\alpha^{\dagger} = 0$ and $\alpha^{\ddagger} = \frac{e}{e + (\bar{q} - e)(1-\gamma)}$. There exists a price discrimination equilibrium if $\alpha < \alpha^{\ddagger}$ and a shrouded prices equilibrium if $\alpha > \alpha^{\ddagger}$.*

Similarly, if errors are small and uninformed naive consumers can be classified perfectly ($1 - \beta < \gamma = 1$), price discrimination dominates shrouding. Thus, the shrouded prices equilibrium no longer exists.

[10] Hence, banks' pricing strategies represent a particular form of loss-leader pricing. See Lal and Matutes (1994).

[11] See the Appendix for details.

COROLLARY 3 (No Shrouding)**.** *Suppose that* $1-\beta<\gamma=1$*. This implies that* $\alpha^{\dagger}=\frac{e(1-\beta)}{e(1-\beta)+(\bar{q}-e)}$ *and* $\alpha^{\ddagger}=1$*. There exists an unshrouded prices equilibrium if* $\alpha<\alpha^{\dagger}$ *and a price discrimination equilibrium if* $\alpha>\alpha^{\dagger}$*.*

Together Corollary 2 and 3 imply that if both consumer types are classified perfectly ($\beta=\gamma=1$), neither shrouding nor unshrouding can be an equilibrium, and only the price discrimination equilibrium remains.[12]

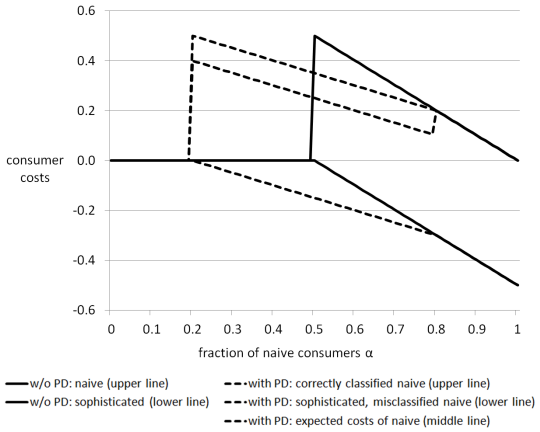
4 Consumer Costs and Welfare

An immediate question is who benefits from banks' ability to use price discrimination? In the following, we analyze in detail the impact of price discrimination on consumer costs and economic welfare. Our analysis follows an equilibrium approach, i.e., we compare equilibrium outcomes in cases where banks can use price discrimination to equilibrium outcomes in cases where price discrimination is not possible. Note that if banks price discriminate, total costs of consumption of ex-ante naive consumers depend on whether consumers become informed about add-ons or stay uninformed as banks partially unshroud. We interpret the fraction of naive consumers who become informed as the probability that an ex-ante naive consumer becomes informed and thus calculate the *expected costs* of consumption of ex-ante naive consumers.

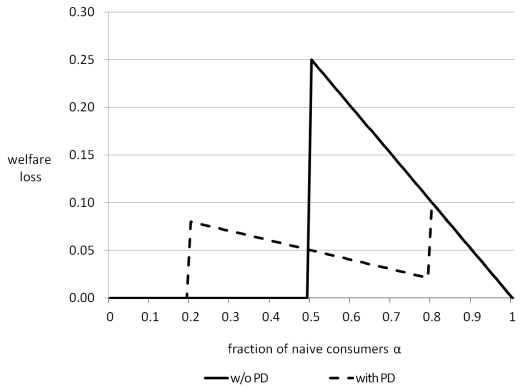
Our first result shows that sophisticated consumers always gain from price discrimination, whereas naive consumers may lose depending on which equilibrium is replaced.

PROPOSITION 2 (Consumer Costs)**.** *Sophisticated consumers always gain from price discrimination, i.e., their costs of consumption are strictly lower than in a corresponding shrouded or unshrouded prices equilibrium* ($\alpha^{\dagger}<\alpha<\alpha^{\ddagger}$)*. Expected costs of ex-ante naive consumers decrease relative to a shrouded prices equilibrium* ($\frac{e}{\bar{q}}<\alpha<\alpha^{\ddagger}$) *but increase relative to an unshrouded prices equilibrium* ($\alpha^{\dagger}<\alpha<\frac{e}{\bar{q}}$)*.*

[12]There exists a non-empty interval to the right of $\alpha^{\dagger}$ in which both the price discrimination and the unshrouded prices equilibria co-exist. A similar interval exists to the right of $\alpha^{\ddagger}$ in which the price discrimination and the shrouded prices equilibria co-exist. The sizes of these intervals depend on λ_F (see the proof of Proposition 1 for details). Since the multiplicity of equilibria is not immediately relevant for the results in our model, we do not consider this issue any further in the following.



(a) Consumer Costs



(b) Welfare Loss

Figure 2: Consumer Costs and Welfare Loss with (and without) Price Discrimination. The left panel shows equilibrium consumer costs and the right panel shows welfare losses for particular combinations of parameters without price discrimination (solid lines) or with price discrimination (dashed lines). Parameters are $\bar{q} = 1, e = 0.5, \mu = 0$ and $\beta \leq 1-\gamma$ without price discrimination and $\beta = \gamma = 0.8$ with price discrimination. Resulting equilibrium thresholds are $\alpha^\dagger = \alpha^\ddagger = 0.5$ without price discrimination or $\alpha^\dagger = 0.2$ and $\alpha^\ddagger = 0.8$ with price discrimination.

Proposition 2 is illustrated in panel (a) of Figure 2, which shows equilibrium consumer costs for a particular combination of parameters. In this example, banks are always in an unshrouded prices equilibrium for $\alpha < \alpha^\dagger = 0.2$ and in a shrouded prices equilibrium for $\alpha > \alpha^\ddagger = 0.8$. Without price discrimination, these regions expand until they meet at $\alpha = e/\bar{q} = 0.5$. In contrast, if price discrimination is possible and effective ($\beta > 1-\gamma$), it replaces the other two equilibria for $0.2 < \alpha < 0.8$. The figure reveals that naive consumers who are classified correctly (upper dashed line) are the ones who potentially lose from price discrimination. They pay the high add-on price $\bar{q}$ whenever $\alpha > 0.2$. For $0.2 < \alpha < 0.5$ this is much more than they would pay in an otherwise unshrouded prices equilibrium. However, for $0.5 < \alpha < 0.8$ they benefit, because the base good price is now lower compared to the otherwise shrouded prices equilibrium due to more add-on sales to sophisticated consumers. Hence, correctly classified naive consumers face lower (higher) costs of consumption when banks price discriminate compared to a shrouded (unshrouded) prices equilibrium. Note that the same holds also in expectation for ex-ante naive consumers (middle dashed line). Finally, sophisticated consumers as well as naive consumers who are misclassified by

banks (lower dashed line) always gain from price discrimination.

The effects on consumer costs lead to the following effects on economic welfare.[13]

PROPOSITION 3 (Economic Welfare)**.** *Price discrimination strictly increases economic welfare relative to a shrouded prices equilibrium ($\frac{e}{\bar{q}} < \alpha < \alpha^{\ddagger}$) and weakly decreases economic welfare relative to an unshrouded prices equilibrium ($\alpha^{\dagger} < \alpha < \frac{e}{\bar{q}}$).*

In terms of economic welfare, price discrimination represents a clear improvement relative to a shrouded prices equilibrium, because less sophisticated consumers substitute away as they become informed about the low-priced add-on. The better banks can target sophisticated consumers, the lower is the fraction of consumers substituting away and thus the higher is economic welfare. If consumer classification is perfect ($\beta = 1$), the welfare loss is zero, just as in the unshrouded prices equilibrium. If $\beta < 1$, however, price discrimination decreases welfare in the case where banks would unshroud prices otherwise.

Figure 2 (b) illustrates Proposition 3, showing that price discrimination (dashed line) decreases the loss in welfare relative to a shrouded prices equilibrium ($0.5 < \alpha < 0.8$) but increases the loss in welfare relative to an unshrouded prices equilibrium ($0.2 < \alpha < 0.5$).

Table 1 in the Appendix summarizes the effects on prices, consumer costs, and welfare.

5 The Effects of Consumer Education

Suppose now that the policymaker can educate a fraction $\lambda_P \in [0, 1)$ of naive consumers before banks decide on their information and pricing strategy. We assume that this intervention increases the share of sophisticated consumers in the population prior to, and independent of, any potential educational effect of a bank's (partial) unshrouding strategy from $1 - \alpha$ to $1 - (1 - \lambda_P)\alpha$. To abstract from implementation costs we assume that educating consumers is free.

[13]Note that economic welfare is fully captured by consumer costs in our model, because bank equilibrium profit is constant. As banks produce at zero marginal cost, bank profit per consumer is determined by the average total price of the base good and the add-on. In equilibrium, this price is determined by the demand function D and is equal to $\mu = \frac{D(0)}{D'(0)}$ in any equilibrium.

There are two potential reasons for such an intervention. The first is that market outcomes are inefficient because some consumers — the sophisticated — exert costly effort to substitute add-ons that can costlessly be produced by banks. This inefficiency arises whenever banks shroud the add-on or price discriminate but do not reach all sophisticated consumers. The inefficiency is low if substitution costs are low, e.g., because consumers' information and search costs are low and third-party suppliers can efficiently produce and offer the add-on. However, this is often not the case, especially if innovative products are involved. For example, structured equity products are typically offered at a high premium to consumers (Henderson and Pearson, 2011). Replication of such equity strategies is costly for consumers, and third-party suppliers who do not have a pre-existing customer relationship (through the base good) have high marketing costs. The second reason for intervention is that some consumers — the naive — pay too much for the add-on and thus serve as a cash cow which subsidizes low base good prices for sophisticated consumers. Again, this may happen when banks either shroud the add-on or choose (imperfect) price discrimination.

5.1 Price Equilibria

Our first result shows that policy intervention shifts equilibrium thresholds as specified in Proposition 1 to the right.

LEMMA 1 (Price Equilibria with Consumer Education)**.** *Suppose the policymaker increases the share of sophisticated consumers by $\lambda_P\alpha$. Let $\alpha^{\S} = \frac{1}{1-\lambda_P}\alpha^{\dagger}$ and $\alpha^{\sharp} = \frac{1}{1-\lambda_P}\alpha^{\ddagger}$. An unshrouded prices equilibrium exists if $\alpha < \alpha^{\S}$, a price discrimination equilibrium exists if $\alpha^{\S} < \alpha < \alpha^{\sharp}$, and a shrouded prices equilibrium exists if $\alpha^{\sharp} < \alpha$.*

Figure 3 illustrates the effect of policy intervention on equilibrium thresholds and corresponding equilibrium intervals. As can be seen, both the area where banks unshroud prices and the area where banks price discriminate in equilibrium increases, whereas the area in which banks shroud prices becomes smaller. The size of the right shift depends on λ_P. The more naive consumers are affected by consumer education, the greater is the effect on banks' equilibrium behavior and corresponding market outcomes.

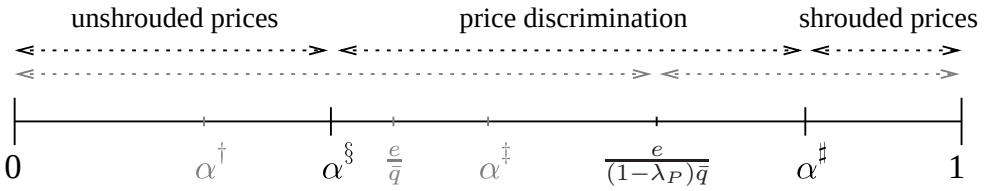


Figure 3: Price Equilibria with (and without) Consumer Education. For a situation where banks can classify consumers relatively well, the upper dashed lines illustrate the new equilibrium thresholds after consumer education in terms of the share of ex-ante naive consumers ($\alpha^{\S}$ and $\alpha^{\sharp}$). These new thresholds are higher than the thresholds before consumer education ($\alpha^{\dagger}$ and $\alpha^{\ddagger}$) because education makes a fraction of ex-ante naive consumers sophisticated. The lower dashed lines show the new threshold for unshrouded prices or shrouded prices if price discrimination is not possible ($\frac{e}{(1-\lambda_P)\overline{q}}$ after education vs. $\frac{e}{\overline{q}}$ before education).

Note that the ability of banks to react to a higher share of sophisticated consumers via price discrimination makes it more difficult for the policymaker to achieve an unshrouded prices equilibrium. In particular, when banks are in a shrouded prices equilibrium before policy intervention, consumer education may lead to an unshrouded prices equilibrium if banks cannot engage in price discrimination and to a price discrimination equilibrium otherwise. This suggests that there are important interaction effects between consumer education and price discrimination. We will address these effects below.

5.2 Effects on Consumer Costs and Welfare

Obviously, intervention is unnecessary if banks are in an unshrouded prices equilibrium. In this case, no consumer substitutes away and all consumers pay the same prices. The main question is, therefore, "What effects does policy intervention have when banks are in a shrouded or in a price discrimination equilibrium?" As the following proposition shows, increasing consumer sophistication generates both losses and gains for different types of consumers.

PROPOSITION 4 (Effects of Consumer Education on Consumer Costs)**.** *Consumer education has zero effect on consumer costs if banks are in an unshrouded prices equilibrium before intervention ($\alpha < \alpha^{\dagger}$). In all other cases, ex-ante naive*

consumers who are educated through the intervention gain, i.e., they have lower consumer costs than before. However, sophisticated consumers and in most cases also naive consumers who stay naive are on the losing side: their costs of consumption increase.[14]

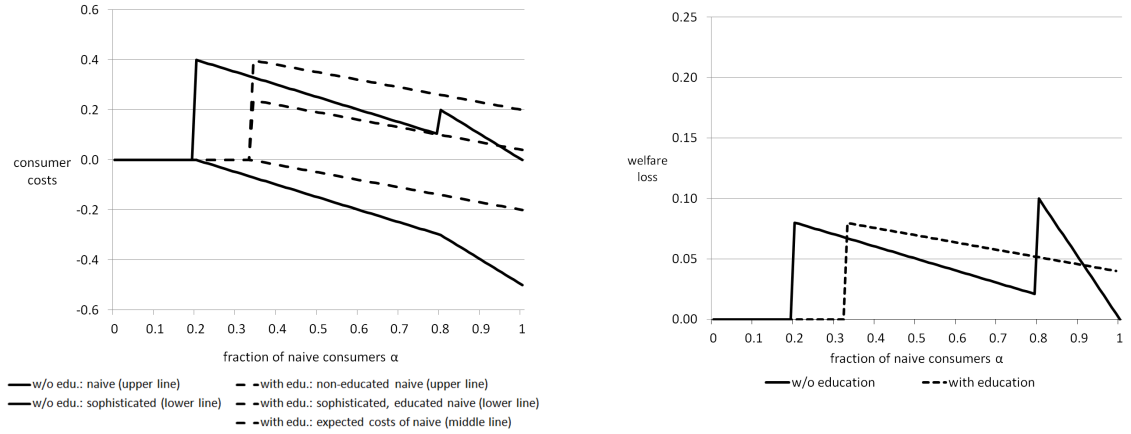
Proposition 4 is illustrated in panel (a) of Figure 4, which considers the same combination of parameters as panel (a) of Figure 2. The solid lines show consumer costs before consumer education for sophisticated (lower solid line) and naive consumers (upper solid line) in an unshrouded prices equilibrium ($\alpha < 0.2$), a price discrimination equilibrium ($0.2 < \alpha < 0.8$) and a shrouded prices equilibrium ($\alpha > 0.8$), respectively.[15] The dashed lines show consumer costs after education with new equilibrium thresholds equal to $\alpha^{\S} = 0.33$ and $\alpha^{\sharp} = 1.33$. The upper dashed line shows the costs for consumers who are "immune" to education, i.e., who are naive ex ante and remain naive also if the policymaker intervenes. The lower dashed line shows consumer costs for sophisticated consumers and for ex-ante naive consumers who are educated through the intervention. The middle dashed line shows expected costs of ex-ante naive consumers. Importantly, the effect of consumer education is given by the difference between the dashed and solid lines for the different types of consumers.

As Figure 4 (a) shows, consumer costs are unaffected for $\alpha < 0.2$. If $0.2 < \alpha < 0.33$, costs of naive consumers decrease independent of whether they are actually educated by the intervention or not, since banks unshroud prices in the new equilibrium anyway. For larger α, the effect on costs depends on whether a naive consumer is educated or not. On the one hand, ex-ante naive consumers who are educated always have lower consumer costs after intervention (lower dashed line) than before (upper solid line). Ex-ante naive consumers who remain naive, on the other hand, have higher costs after intervention (upper dashed line) than before (upper solid line). Sophisticated consumers, however, lose for sure: they always face higher consumer costs after intervention (lower dashed line) than before (lower solid line). Thus, while

[14]The only case in which naive consumers who remain naive can gain is if banks are pushed from a shrouded prices to a price discrimination equilibrium and the probability of being misclassified is sufficiently high. Formally, $\alpha^{\ddagger} < \alpha < \alpha^{\sharp}$ and $(1-\alpha)\bar{q} > (1-(1-\lambda_P)\alpha)(\gamma\bar{q} + e(1-\gamma) - e\beta)$. See the Appendix for details.

[15]In the case of price discrimination, consumer costs for naive consumers depend on whether they are classified correctly or misclassified. The Figure shows expected costs.

the intervention decreases the costs of the target group — ex-ante naive consumers who become educated — it simultaneously increases the costs of other consumers.



(a) Consumer Costs

(b) Welfare Loss

Figure 4: Consumer Costs and Welfare Loss with (and without) Consumer Education. The solid lines in the left panel represent consumer costs before education for sophisticated (lower solid line) and naive consumers (upper solid line). The dashed lines in this panel represent consumer costs after education for sophisticated and educated naive (lower dashed line), non-educated naive consumers who are immune to education (upper dashed line) and expected costs of ex-ante naive consumers (middle dashed line). The right panel shows corresponding welfare losses with and without consumer education. Parameters are $\bar{q} = 1, e = 0.5, \mu = 0, \beta = \gamma = 0.8$ and a potential educational effect $\lambda_P = 0.4$. Resulting equilibrium thresholds are $\alpha^\dagger = 0.2$ and $\alpha^\ddagger = 0.8$ without consumer education (solid lines) or $\alpha^\S = 1/3$ and $\alpha^\sharp = 4/3$ with consumer education (dashed lines).

Note that consumer education can even lead to an increase in *expected costs* of ex-ante naive consumers alone. This happens in panel (a) of Figure 4 if $\alpha \geq 0.95$. For other combinations of parameters, this area can even be larger (e.g., $\alpha > 0.7$ for $\bar{q}$=1, e=0.3, $\beta = \gamma$=0.7, μ=0 and λ_P=0.3). In these cases, the benefit for the educated naive consumers is already offset by the damage to those who remain naive. Thus, even a policymaker who focuses exclusively on the welfare of naive consumers and neglects any impact on the sophisticated should refrain from intervention in this case.

The previous proposition shows that increasing consumer sophistication causes both harm and good in terms of consumer costs. Whenever the former outweighs the latter, policy intervention leads to a negative effect on welfare as the following proposition summarizes.

PROPOSITION 5 (Welfare Effects of Consumer Education)**.** *Consumer education has no effect on welfare if banks are in an unshrouded prices equilibrium before intervention ($\alpha < \alpha^{\dagger}$). It has a clear positive effect on welfare only if banks are pushed into an unshrouded prices equilibrium after intervention ($\alpha^{\dagger} < \alpha < \alpha^{\S}$). In all other cases, welfare effects can be negative. In particular, effects are always negative if a shrouded prices equilibrium ($\alpha^{\sharp} < \alpha$) or a price discrimination equilibrium ($\alpha^{\S} < \alpha < \alpha^{\ddagger}$) remains. Effects are ambiguous if banks are pushed from shrouded prices towards price discrimination ($\alpha^{\ddagger} < \alpha < \alpha^{\sharp}$).*

Panel (b) of Figure 4 illustrates how consumer education affects welfare, as stated in Proposition 5. The solid line shows the welfare loss before policy intervention in the respective price equilibria. The dashed line indicates the welfare loss in the new equilibrium situations after consumer education. The difference between the two lines is the net effect on welfare due to policy intervention. As can be seen, there are two areas in which the effect is positive because the welfare loss is smaller after intervention than before. These are the areas where banks are pushed from price discrimination to unshrouded prices ($0.2 < \alpha < 0.33$), and partially the area where banks are in a shrouded prices equilibrium before intervention and choose price discrimination thereafter ($0.8 < \alpha < 0.91$).[16] The welfare effect is zero in the area where banks unshroud the add-on price independent of whether the policymaker intervenes or not ($\alpha < 0.2$). Otherwise, the welfare effect is negative ($0.33 < \alpha < 0.8$ and $\alpha > 0.91$). In the former case ($0.33 < \alpha < 0.8$), banks adjust prices but the underlying equilibrium strategy — price discrimination — remains. In the latter case ($\alpha > 0.91$), banks are pushed from shrouded prices to price discrimination. Because a key element of shrouding and price discrimination is that all or a fraction of sophisticated consumers substitute away, the effect on welfare is negative as more consumers become sophisticated due to the policy intervention. In other words, intervention may well be successful on an individual level, as it induces some consumers to make individually better decisions — they no longer buy the expensive add-on. However, as long as

[16]Note that policy intervention also has a positive effect if it pushes banks directly from a shrouded prices equilibrium to an unshrouded prices equilibrium. This is the case either if a price discrimination equilibrium does not exist or if λ_P is sufficiently large such that $\alpha^{\ddagger} < \frac{1}{1-\lambda_P}\alpha^{\dagger}$. This case is not reflected in the example.

banks' pricing strategies induce these consumers to substitute away and thus behave inefficiently, intervention may fail on a social level — economic welfare decreases.

In the example, consumer education can have a positive effect on welfare ($0.8 < \alpha < 0.91$) or a negative effect on welfare ($0.91 < \alpha$) if banks are pushed from shrouded prices to price discrimination. In the proof of Proposition 5 we show that the effect is negative whenever the error probability in classifying sophisticated consumers $1-\beta$ is relatively high and/or education makes relatively many consumers sophisticated, i.e., $\lambda_P \alpha$ is high. The reason is the following: If the educational boost is strong, banks adjust to this by switching from shrouded prices to price discrimination. Sophisticated consumers now buy the add-on if and only if banks offer it to them at a low price, otherwise they substitute away. If banks target sophisticated consumers inaccurately, substitution may actually increase and welfare declines.[17]

5.3 Pitfalls for Policy Intervention

The above results show that policy intervention has a negative effect on welfare if the increase in the degree of consumer sophistication is too small to change banks' equilibrium pricing strategies, or if relatively many consumers substitute away in a new price discrimination equilibrium. One possible course of action the policymaker may consider is to boost the educational impact of his intervention on naive consumers, i.e., increase λ_P. Not only do the chances of success of such an attempt seem rather bleak in the light of the available evidence (see, e.g., Choi et al., 2010), but Figure 5 shows that an increase in λ_P may, in fact, worsen the situation in terms of welfare until the boost is strong enough to push banks towards unshrouded prices.

In this example, parameters are chosen such that banks unshroud the add-on price if and only if the fraction of naive consumers after education is below 0.2.[18] Starting with an ex-ante share of 70 percent naive consumers, policy intervention thus pushes banks from a price discrimination equilibrium to an unshrouded prices equilibrium

[17] In our model, the error probability $1-\beta$ is exogenous and not affected by policy intervention. If β is endogenous, it is intuitive that, if anything, policy intervention will increase the likelihood of misclassification because the composition of consumer groups has changed. This makes it even more likely that the welfare effect will be negative.

[18] Again, the parameters are the ones we have considered before (e.g., Figure 4 (b)).

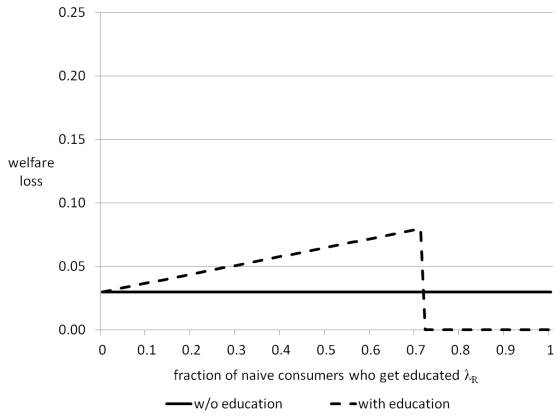
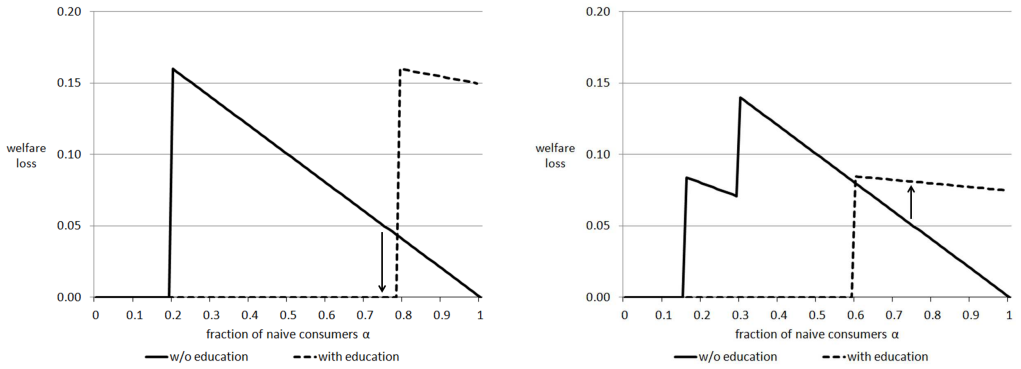


Figure 5: Welfare Effects of an Increase in the Educational Impact λ_P. Parameters are $\bar{q} = 1, e = 0.5, \beta = \gamma = 0.8$ and a fraction of naive consumers before consumer education $\alpha = 0.7$.

if and only if $\lambda_P > 5/7$. In this case, intervention has a positive effect on welfare as it reduces the welfare loss from 0.03 before the intervention to zero afterwards. For smaller values of λ_P, however, policy intervention increases the welfare loss up to 0.08, i.e., more than double the welfare loss before intervention. This shows that a boost in the educational effect of the intervention may in principle be a good idea, but only if the boost is strong enough.

A second important pitfall occurs because the welfare effects of consumer education critically depend on whether banks can price discriminate or not. If the policymaker is unable to assess the pricing strategies of banks correctly, the welfare effect of policy intervention may go either way.

Figure 6 illustrates this situation. In panels (a) and (b) we consider a case in which the banks' ability to price discriminate makes consumer education harmful. Suppose that the policymaker observes that banks are in a shrouded prices equilibrium. The fraction of ex-ante naive consumers is $\alpha = 0.75$ and the educational effect is $\lambda_P = 0.75$. Then, as panel (a) shows, the welfare effect of consumer education is positive and the welfare loss is actually reduced to zero, because banks are pushed into an unshrouded prices equilibrium, if price discrimination is not possible. In contrast, the effect is negative, i.e., the welfare loss increases, if banks can price discriminate (panel (b)). Here the banks' ability to price discriminate raises the bar to reach an unshrouded prices equilibrium through consumer education, and so price discrimination becomes



(a) Welfare Effects w/o PD

(b) Welfare Effects with PD

Figure 6: Pitfalls for Policy Intervention. The left panel illustrates welfare losses without consumer education (solid line) and with education (dashed line) for a situation where price discrimination is not possible ($\beta \leq 1-\gamma$). The right panel illustrates corresponding welfare losses if price discrimination is possible and effective ($\beta = 0.5$, $\gamma = 0.7$). Parameters in both panels are $\bar{q} = 1, e = 0.2$ and $\mu = 0$. The ex-ante fraction of naive consumers is $\alpha = 0.75$ and the educational effect is $\lambda_P = 0.75$. The arrows show a welfare gain from education (the welfare loss is reduced to zero) for the situation in panel (a) and a welfare loss from education for the situation in panel (b).

the equilibrium strategy.

6 Conclusion

When banks exploit naive consumers, educating consumers looks like a promising idea. First, education should lead to better consumer decisions and hence lower consumer costs. Second, it should eventually cause banks under competitive pressure to disclose and to lower prices, thereby increasing welfare because sophisticated consumers no longer substitute away. Following this idea, policymakers who are concerned with excessive fees and financial damages to consumers in retail financial markets have started financial education initiatives all over the world in recent years.

Our analysis suggests that the effects of consumer education are actually more complex. If consumer education is sufficiently effective such that banks unshroud prices in equilibrium, all consumers indeed benefit and economic welfare increases. However, this effect is unlikely to realize if banks can use information to classify consumers and thereby price discriminate between naive and sophisticated types.

Our results show that price discrimination is a symmetric equilibrium if banks are able to classify consumers relatively well, and if the fraction of naive consumers is neither very small nor very large. In consequence, a price equilibrium with fully unshrouded prices, which would socially be most efficient, becomes less likely to be achieved through consumer education. Moreover, empirical findings suggest that consumer education often has relatively little impact on individual behavior, either because naive consumers are unreceptive to new information, or because they are simply unwilling to be told how they should decide.

If a boost from financial education does not lead to unshrouded prices for all consumers, our results show that educating consumers may in fact decrease economic welfare. Welfare effects critically depend on the overall fraction of naive consumers, the success of consumer education, the reservation price for the add-on, substitution costs for sophisticated consumers, and the efficiency of price discrimination. Often, policymakers can only speculate about these things. Hence, the potential benefits of consumer eduction may be accompanied by several significant fallacies.

As a general message our analysis suggests that policymakers may not want to jump too quickly, or rely exclusively, on consumer education to solve problems of consumer protection or inefficient information and pricing strategies of banks. Consumer education is no panacea.

Appendix A1

Table 1: Prices, Consumer Costs and Welfare Loss

The table provides an overview on base good and add-on prices (which together represent consumer costs), substitution costs, shares of consumers of the respective consumer groups (uninformed/ informed naive and uninformed/ informed sophisticated) and welfare losses for alternative price equilibria: unshrouded prices, price discrimination or shrouded prices.

	Naive		Sophisticated	
Unshrouded prices	Uninformed	Informed	Informed	Uninformed
Base good	$\mu - e$			
Add-on	e	e	e	
Substitution				
Share of consumers	$(1-\lambda_F)\alpha$	$\lambda_F \alpha$	$1-\alpha$	
Welfare loss	0			

	Naive			Sophisticated	
	ok classified	misclassified		ok classified	misclassified
Price discrimination	Uninformed		Informed	Informed	Uninformed
Base good	$\mu - \alpha\gamma\bar{q} - e(\alpha(1-\gamma) + (1-\alpha)\beta)$				
Add-on	$\bar{q}$	e	e	e	
Substitution					e
Share of consumers	$\gamma\alpha$	$(1-\lambda_F)(1-\gamma)\alpha$	$\lambda_F(1-\gamma)\alpha$	$\beta(1-\alpha)$	$(1-\beta)(1-\alpha)$
Welfare loss	$(1-\beta)(1-\alpha)e$				

	Naive		Sophisticated	
Shrouded prices	Uninformed	Informed	Informed	Uninformed
Base good	$\mu - \alpha\bar{q}$			
Add-on	$\bar{q}$			
Substitution				e
Share of consumers	α			$1-\alpha$
Welfare loss	$(1-\alpha)e$			

Appendix A2: Proofs

The proofs use various arguments and results from GL and Caplin and Nalebuff (1991). In particular, the existence of a symmetric equilibrium is guaranteed by Caplin and Nalebuff (1991). Given the specification of demand $D(x_i)$, equilibrium prices are determined by the first-order condition $p+q = \frac{D(0)}{D'(0)} =: \mu$. The latter is equal to the average profit of a bank per consumer and represents a simple parametrization of the degree of competition in the industry.

Proof of Proposition 1 (Price Equilibria):

Note that if $\beta \leq 1-\gamma, \alpha^\dagger = \alpha^\ddagger = \frac{e}{\bar{q}}$. In this case, Proposition 1 is equivalent to Proposition 1 in GL (see also Corollary 1). Suppose therefore that $\beta > 1-\gamma$, i.e., $\alpha^\dagger < \frac{e}{\bar{q}} < \alpha^\ddagger$.

Case 1: Suppose that $\alpha < \alpha^\dagger$. We show that unshrouding is an equilibrium. Suppose all banks except bank i unshroud. If bank i unshrouds as well, it optimally sets $q = e$, yielding profit

$$\begin{aligned}(p+e)(1-\lambda_F)\alpha D(-p+p^*) \quad + \quad (p+e)(1-(1-\lambda_F)\alpha)D(-p-e+p^*+e) \quad (3)\\ = (p+e)D(-p+p^*).\end{aligned}$$

The first term of (3) captures the profit bank i makes from uninformed naive consumers, the second term captures the profit it makes from sophisticated and informed naive consumers. Solving the first-order condition yields a base good price $p = -e+\mu$.

Alternatively, bank i can decide to shroud the add-on price or engage in price discrimination. GL show that shrouding is suboptimal if $\alpha < \frac{e}{\bar{q}}$, which holds in our case since $\alpha < \alpha^\dagger \leq \frac{e}{\bar{q}}$.

We now show that price discrimination does not exceed the profit from unshrouding either. With price discrimination, bank i optimally sets prices equal to the maximum willingness to pay of sophisticated and naive consumers, respectively, i.e., $q_S = e$ and $q_N = \bar{q}$. Because other banks unshroud, a fraction λ_F of naive consumers become informed and behave just as sophisticated. Accordingly, price discrimination yields

profit

$$
\begin{aligned}
&(p+\bar{q})(1-\lambda_F)\alpha\gamma D(-p+p^*)\\
&+p\lambda_F\alpha\gamma D(-p-e+p^*+e)\\
+\ &(p+e)(1-\lambda_F)\alpha(1-\gamma)D(-p+p^*)\\
+\ &(p+e)\lambda_F\alpha(1-\gamma)D(-p-e+p^*+e)\\
+\ &(p+e)(1-\alpha)\beta D(-p-e+p^*+e)\\
+\ &p(1-\alpha)(1-\beta)D(-p-e+p^*+e)\\
=\ &\Big(p+\bar{q}(1-\lambda_F)\alpha\gamma+e(\alpha(1-\gamma)+(1-\alpha)\beta)\Big)D(-p+p^*).
\end{aligned}
\tag{4}
$$

The first and second term of (4) capture the profit bank i makes from naive consumers who are classified correctly (which happens with ex-ante probability γ). On the one hand, this includes a fraction $1-\lambda_F$ of uninformed naive consumers who pay the high add-on price $\bar{q}$. On the other hand, this includes a fraction λ_F of informed naive consumers who are also offered the high-priced add-on but substitute away. The third and fourth term represent the profit from misclassified naive consumers (which happens with ex-ante probability $1-\gamma$) who are offered the low add-on price and hence pay only e. On the one hand, this includes a fraction $1-\lambda_F$ of uninformed naive consumers; on the other hand, this includes a fraction λ_F of informed naive consumers. The fifth term shows profits from sophisticated consumers who are classified correctly (which happens with ex-ante probability β) and pay e. Finally, the sixth term captures the profit from misclassified informed consumers who erroneously do not receive the low price offer, therefore rationally expect that $Eq=\bar{q}$ and hence substitute away.

Comparing (3) and (4) reveals that unshrouding yields strictly higher profit than

price discrimination if and only if

$$\begin{aligned} e &> \bar{q}(1-\lambda_F)\alpha\gamma + e(\alpha(1-\gamma)+(1-\alpha)\beta) \\ e &> \bar{q}(1-\lambda_F)\alpha\gamma + e\alpha(1-\gamma) + e\beta - e\alpha\beta \\ e(1-\beta) &> \alpha(\bar{q}(1-\lambda_F)\gamma + e(1-\gamma) - e\beta) \\ \frac{e(1-\beta)}{e(1-\beta)+(\bar{q}(1-\lambda_F)-e)\gamma} &> \alpha, \end{aligned}$$

which holds as $\alpha < \alpha^{\dagger} = \min\left(\frac{e}{\bar{q}}, \frac{e(1-\beta)}{e(1-\beta)+(\bar{q}-e)\gamma}\right)$. Thus, unshrouding is an equilibrium.

Case 2: Suppose that $\alpha > \alpha^{\ddagger}$. We show that an equilibrium exists, in which all banks shroud the add-on price. Suppose all banks except bank i shroud. If bank i shrouds as well, it optimally sets $q = \bar{q}$, yielding profit

$$\begin{aligned} (p+\bar{q})\alpha D(-p+p^*) \quad + \quad p(1-\alpha)D(-p-e+p^*+e) \qquad (5) \\ = (p+\alpha\bar{q})D(-p+p^*). \end{aligned}$$

The first term of (5) captures the profit from naive consumers who buy the add-on at the high price $\bar{q}$. The second term captures the profit from sophisticated consumers who rationally expect the add-on to be priced at $Eq = \bar{q}$ and hence substitute away.

Again, we can use results from GL who show that unshrouding leads to lower profit if $\alpha > \frac{e}{\bar{q}}$, which holds in our case as $\alpha > \alpha^{\ddagger} \geq \frac{e}{\bar{q}}$. It thus again remains to be shown that price discrimination does not increase profit either.

If all banks shroud, all naive consumers are uninformed unless they are misclassified by bank i and erroneously get informed about the add-on. Hence, the profit from price discrimination is equal to:

$$
\begin{aligned}
&(p+\bar{q})\alpha\gamma D(-p+p^*) \\
+\ &(p+e)\alpha(1-\gamma)(1-\lambda_F)D(-p+p^*) \\
+\ &(p+e)\alpha(1-\gamma)\lambda_F D(-p-e+p^*+e) \\
+\ &(p+e)(1-\alpha)\beta D(-p-e+p^*+e) \\
+\ &p(1-\alpha)(1-\beta)D(-p-e+p^*+e) \\
=\ &\Big(p+\alpha\gamma\bar{q}+e(\alpha(1-\gamma)+(1-\alpha)\beta)\Big)D(-p+p^*).
\end{aligned} \tag{6}
$$

The first term of (6) captures the profit bank i makes from naive consumers who are classified correctly and hence pay the high add-on price $\bar{q}$. The second and third term capture the profit from naive consumers who are misclassified (which happens with ex-ante probability $1-\gamma$). These consumers are offered the low add-on price and hence pay only e. A fraction $(1-\lambda_F)$ of these consumers stay uninformed while a fraction λ_F become informed. The fourth term captures the profit from sophisticated consumers who are classified correctly (which happens with ex-ante probability β). The fifth term captures the profit from misclassified sophisticated consumers who erroneously do not receive the low price offer, therefore rationally expect that $Eq=\bar{q}$ and hence substitute away.

Comparing (5) and (6) reveals that shrouding yields strictly higher profit than price discrimination if and only if

$$
\begin{aligned}
\alpha\bar{q} &> \alpha\gamma\bar{q}+e(\alpha(1-\gamma)+(1-\alpha)\beta) \\
\alpha\bar{q} &> \alpha(e-e\gamma-e\beta+\bar{q}\gamma)+\beta e \\
\alpha(\bar{q}-e+e\gamma+e\beta-\bar{q}\gamma) &> \beta e \\
\alpha(e\beta+(\bar{q}-e)(1-\gamma)) &> \beta e \\
\alpha &> \frac{\beta e}{e\beta+(\bar{q}-e)(1-\gamma)} \\
\alpha &> \alpha^{\ddagger}.
\end{aligned}
$$

Thus, shrouding is an equilibrium.

Case 3: Finally, suppose $\alpha^\dagger < \alpha < \alpha^\ddagger$. We show that price discrimination is an equilibrium. Suppose all other banks engage in price discrimination. If bank i price discriminates as well, it makes profit

$$\Big(p + \alpha\gamma\bar{q} + e(\alpha(1-\gamma) + (1-\alpha)\beta)\Big)D(-p+p^*) \tag{7}$$

equivalent to Equation (6).[19]

Alternatively, if bank i shrouds, profit is equal to

$$\begin{aligned} & (p+\bar{q})\alpha\gamma D(-p+p^*) \\ +\ & (p+\bar{q})\alpha(1-\gamma)(1-\lambda_F)D(-p+p^*) \\ +\ & p\alpha(1-\gamma)\lambda_F D(-p-e+p^*+e) \\ +\ & p(1-\alpha)D(-p-e+p^*+e) \\ = & \Big(p+\bar{q}\alpha(\gamma+(1-\gamma)(1-\lambda_F))\Big)D(-p+p^*). \end{aligned} \tag{8}$$

The first term of (8) captures the profit bank i makes from uninformed naive consumers who are classified correctly (by all other banks who price discriminate) and hence pay the high add-on price $\bar{q}$. The second and third term capture the profit from naive consumers who are misclassified (by all other banks who price discriminate). A fraction $(1-\lambda_F)$ of these consumers stay uninformed and also pay the high add-on price $\bar{q}$ (second term). A fraction λ_F become informed and substitute away (third term). The fourth term captures the profit from sophisticated consumers who substitute away (or buy the low-priced add-on from a competitor).

Comparing (7) and (8) reveals that price discrimination yields strictly higher profit than shrouding if and only if

[19] We assume that all banks follow the same classification of consumers.

$$
\begin{aligned}
\alpha\gamma\bar{q} + e(\alpha(1-\gamma) + (1-\alpha)\beta) &> \bar{q}\alpha(\gamma + (1-\gamma)(1-\lambda_F)) \\
\beta e + \alpha(\gamma\bar{q} + e - e\gamma - e\beta) &> \alpha(\bar{q}\gamma + \bar{q}(1-\gamma)(1-\lambda_F)) \\
\beta e &> \alpha(\bar{q}\gamma + \bar{q}(1-\gamma)(1-\lambda_F) - e + e\gamma + e\beta - \bar{q}\gamma)) \\
\beta e &> \alpha(e\beta + \bar{q}(1-\gamma)(1-\lambda_F) - e(1-\gamma)) \\
\beta e &> \alpha(e\beta + (\bar{q} - \bar{q}\lambda_F - e)(1-\gamma)) \\
\frac{\beta e}{e\beta + (\bar{q}(1-\lambda_F) - e)(1-\gamma)} &> \alpha,
\end{aligned}
$$

which holds as $\alpha < \alpha^{\ddagger} = \max\left(\frac{e}{\bar{q}}, \frac{e\beta}{e\beta + (\bar{q}-e)(1-\gamma)}\right)$.

Furthermore, profit from unshrouding is equal to

$$(p+e)D(-p+p^*) \tag{9}$$

equivalent to Equation (3). Comparing (7) and (9) reveals that price discrimination yields strictly higher profit than unshrouding if and only if

$$
\begin{aligned}
\alpha\gamma\bar{q} + e(\alpha(1-\gamma) + (1-\alpha)\beta) &> e \\
\alpha(\gamma\bar{q} + e - e\gamma - e\beta) &> e - e\beta \\
\alpha &> \frac{e(1-\beta)}{e(1-\beta) + (\bar{q}-e)\gamma} \\
\alpha &> \alpha^{\dagger}.
\end{aligned}
$$

Thus, price discrimination is an equilibrium. *Q.E.D.*

Proof of Proposition 2 (Consumer Costs):

Sophisticated consumers either buy the add-on at price e or exert substitution costs of the same amount. Thus, total costs of consumption of sophisticated consumers depend on the price of the base good. Generally, if price discrimination is possible, i.e., $\alpha^{\dagger} < \frac{e}{\bar{q}} < \alpha^{\ddagger}$, the price of the base good equals

$$\mu - \alpha\gamma\bar{q} - e(\alpha(1-\gamma) + (1-\alpha)\beta)$$

for $\alpha^\dagger < \alpha < \alpha^\ddagger$. If price discrimination is not possible, an unshrouded prices equilibrium exists for $\alpha^\dagger < \alpha < \frac{e}{\bar{q}}$ with a base good price equal to $\mu - e$. Since $\alpha > \alpha^\dagger$, the former price is lower than the latter price. Similarly, for $\frac{e}{\bar{q}} < \alpha < \alpha^\ddagger$ a shrouded prices equilibrium exists if price discrimination is not possible. In this case, the base good price equals $\mu - \alpha\bar{q}$. Again, since $\alpha < \alpha^\ddagger$, the former price is lower than the latter price. This proves the first statement.

Next, consider prices of naive consumers. If price discrimination is not possible, naive consumers pay a total price of $\mu - e + e = \mu$ in an unshrouded prices equilibrium ($\alpha < \frac{e}{\bar{q}}$) and a total price of $\mu - \alpha\bar{q} + \bar{q} = \mu + (1-\alpha)\bar{q}$ in a shrouded prices equilibrium ($\frac{e}{\bar{q}} < \alpha$). If price discrimination is possible ($\alpha^\dagger < \alpha < \alpha^\ddagger$), naive consumers who are correctly classified (with probability γ) buy the add-on at $p_N = \bar{q}$, and naive consumers who are misclassified (with probability $1 - \gamma$) buy the add-on at $p_S = e$. The expected total price for naive consumers is equal to

$$\begin{aligned} &\mu - \alpha\gamma\bar{q} - e(\alpha(1-\gamma) + (1-\alpha)\beta) + \gamma\bar{q} + (1-\gamma)e \\ &\qquad = \mu + (1-\alpha)(\gamma\bar{q} + e(1-\gamma) - e\beta). \end{aligned} \tag{10}$$

Since $e < \bar{q}$ and $\beta < 1$, it immediately follows that this price is higher than μ (unshrouded prices equilibrium) but lower than $\mu + (1-\alpha)\bar{q}$ (shrouded prices equilibrium). This proves the second statement.

In a price discrimination equilibrium ($\alpha^\dagger < \alpha < \alpha^\ddagger$), naive consumers who are misclassified pay a total price

$$\mu - \alpha\gamma\bar{q} - e(\alpha(1-\gamma) + (1-\alpha)\beta) + e.$$

Since $\alpha^\dagger < \alpha$, this price is lower than μ (unshrouded prices equilibrium), and consequently also lower than $\mu + (1-\alpha)\bar{q}$ (shrouded prices equilibrium). This proves the third statement.

Finally, in a price discrimination equilibrium ($\alpha^\dagger < \alpha < \alpha^\ddagger$), naive consumers who

are correctly classified pay a total price

$$\begin{aligned}
&\mu - \alpha\gamma\bar{q} - e(\alpha(1-\gamma) + (1-\alpha)\beta) + \bar{q} \\
&= \mu - \alpha\gamma\bar{q} - e\alpha(1-\gamma) - e(1-\alpha)\beta + \alpha\bar{q} + (1-\alpha)\bar{q} \\
&= \mu + \alpha(1-\gamma)(\bar{q} - e) + (1-\alpha)(\bar{q} - e\beta).
\end{aligned}$$

Since $e < \bar{q}$ and $\beta < 1$, it immediately follows that this price is higher than μ (unshrouded prices equilibrium). Since $\alpha < \alpha^{\ddagger}$, this price is lower than $\mu + (1-\alpha)\bar{q}$ (shrouded prices equilibrium). This proves the last statement. *Q.E.D.*

Proof of Proposition 3 (Economic Welfare):

Consider Table 1 in Appendix A1. In an unshrouded prices equilibrium, all consumers buy the add-on; hence the welfare loss is zero. In a price discrimination equilibrium, the fraction of sophisticated consumers who substitute away is equal to $(1-\beta)(1-\alpha)$. In a shrouded prices equilibrium, this fraction is equal to $1-\alpha$. *Q.E.D.*

Proof of Lemma 1 (Price Equilibria with Consumer Education):

Denote $\tilde{\alpha} := (1-\lambda_P)\alpha$ the fraction of naive consumers after policy intervention. The result follows from Proposition 1 replacing α by $\tilde{\alpha}$. *Q.E.D.*

Proof of Proposition 4 (Effects of Consumer Education on Consumer Costs):

If an unshrouding equilibrium exists with and without intervention ($\alpha < \alpha^{\dagger}$), all consumers face the same costs of consumption μ. Thus, policy intervention has no effect. This proves the first statement.

In all other cases, expected consumer costs change through policy intervention. Consider first the sophisticated consumers. Their costs of consumption solely depend on the price of the base good, which is $\mu - e$ in an unshrouded prices equilibrium, $\mu - \alpha\bar{q}$ in a shrouded prices equilibrium, and

$$\mu - \alpha\gamma\bar{q} - e(\alpha(1-\gamma) + (1-\alpha)\beta) = \mu - \alpha(\gamma\bar{q} + e(1-\gamma) - e\beta) - e\beta$$

in a price discrimination equilibrium (always before policy intervention). It can easily

be seen that, if policy intervention lowers the fraction of naive consumers from α to $(1-\lambda_P)\alpha$, the price of the base good in a price discrimination or shrouded prices equilibrium increases. Further, if banks are pushed from a shrouded prices to a price discrimination equilibrium or from a price discrimination to an unshrouded prices equilibrium, the price of the base good increases as well, since $\mu - \alpha\bar{q} < \mu - \alpha(\gamma\bar{q} + e(1-\gamma) - e\beta) - e\beta$ if $\alpha^\ddagger < \alpha < \alpha^\sharp$ and $\mu - \alpha(\gamma\bar{q} + e(1-\gamma) - e\beta) - e\beta < \mu - e$ if $\alpha^\dagger < \alpha < \alpha^\S$. Hence, consumer costs for sophisticated consumers always increase.

With regard to ex-ante naive consumers, consumer costs depend on whether a naive consumer becomes informed through education (with probability λ_P) or remains uninformed (with probability $1-\lambda_P$).

Consider first ex-ante naive consumers who remain uninformed. Just like sophisticated consumers, these consumers always pay a higher base good price. Since they remain naive, their costs for the add-on are unchanged except if banks are pushed from a shrouded prices to a price discrimination equilibrium. In this case, they are misclassified with positive probability which may lower their consumer costs. In particular, their costs decrease if $\alpha^\ddagger < \alpha < \alpha^\sharp$ and $\mu - \alpha\bar{q} + \bar{q}$ is larger than

$$\begin{aligned}\mu - (1-\lambda_P)\alpha\gamma\bar{q} - e((1-\lambda_P)\alpha(1-\gamma) + (1-(1-\lambda_P)\alpha)\beta) + \gamma\bar{q} + (1-\gamma)e \\ = \mu + (1-(1-\lambda_P)\alpha)(\gamma\bar{q} + e(1-\gamma) - e\beta),\end{aligned}$$

which holds if λ_P is sufficiently small (cf. Equation 10 in the proof of Proposition 2).

Consider next the ex-ante naive consumers who become informed. These consumers pay a higher base good price just as all other consumers, but always save on the add-on. We consider all possible cases separately.

1) If banks are pushed from price discrimination to unshrouded prices ($\alpha^\dagger < \alpha < \alpha^\S$), consumer costs change from

$$\begin{aligned}\mu - \alpha\gamma\bar{q} - e(\alpha(1-\gamma) + (1-\alpha)\beta) + \gamma\bar{q} + (1-\gamma)e \\ = \mu + (1-\alpha)(\gamma\bar{q} + e(1-\gamma) - e\beta)\end{aligned}$$

to μ, which constitutes a decline since $e < \bar{q}$.

2) If a price discrimination equilibrium exists with and without intervention ($\alpha^\S <$

$\alpha < \alpha^{\ddagger}$), costs change from

$$\mu - \alpha\gamma\bar{q} - e(\alpha(1-\gamma) + (1-\alpha)\beta) + \gamma\bar{q} + (1-\gamma)e$$

to

$$\mu - (1-\lambda_P)\alpha\gamma\bar{q} - e((1-\lambda_P)\alpha(1-\gamma) + (1-(1-\lambda_P)\alpha)\beta) + e.$$

Thus, policy intervention decreases consumer costs, if and only if

$$\begin{aligned}
\mu - (1-\lambda_P)\alpha\gamma\bar{q} - e((1-\lambda_P)\alpha(1-\gamma) + (1-(1-\lambda_P)\alpha)\beta) + e & \\
< \ \mu - \alpha\gamma\bar{q} - e(\alpha(1-\gamma) + (1-\alpha)\beta) + \gamma\bar{q} + (1-\gamma)e & \\
\lambda_P\alpha\gamma\bar{q} + e\lambda_P\alpha(1-\gamma) - e\lambda_P\alpha\beta + e \ < \ \gamma\bar{q} + (1-\gamma)e & \\
\alpha\lambda_P(\gamma\bar{q} + e - \gamma e - e\beta) \ < \ (\bar{q}-e)\gamma & \\
\alpha \ < \ \frac{1}{\lambda_P}\,\frac{(\bar{q}-e)\gamma}{e(1-\beta) + (\bar{q}-e)\gamma}. &
\end{aligned}$$

Since the right hand side is larger than one (which can easily be derived from the fact that $\alpha^{\S} < 1$), the condition is fulfilled for all α.

3) If banks are pushed from shrouded prices to price discrimination ($\alpha^{\ddagger} < \alpha < \alpha^{\sharp}$), costs change from $\mu + (1-\alpha)\bar{q}$ to

$$\mu - (1-\lambda_P)\alpha\gamma\bar{q} - e((1-\lambda_P)\alpha(1-\gamma) + (1-(1-\lambda_P)\alpha)\beta) + e.$$

Thus, policy intervention decreases consumer costs, if and only if

$$\begin{aligned}
\mu - (1-\lambda_P)\alpha\gamma\bar{q} - e((1-\lambda_P)\alpha(1-\gamma) + (1-(1-\lambda_P)\alpha)\beta) + e \ &< \ \mu + (1-\alpha)\bar{q} \\
-(1-\lambda_P)\alpha\gamma\bar{q} - e(1-\lambda_P)\alpha(1-\gamma) + e(1-\lambda_P)\alpha\beta + \alpha\bar{q} \ &< \ \bar{q} + e\beta - e
\end{aligned}$$

$$\alpha < \frac{\bar{q} + e\beta - e}{\bar{q} + e\beta - (\gamma\bar{q} + (1-\gamma)e - \lambda_P(e(1-\beta) + (\bar{q}-e)\gamma))}.$$

By the same argument as before the right hand side is larger than one, so the condition is fulfilled for all α.

4) Finally, if a shrouded prices equilibrium exists with and without policy intervention ($\alpha^{\sharp} < \alpha$), costs change from $\mu + (1-\alpha)\bar{q}$ to $\mu - (1-\lambda_P)\alpha\bar{q} + e$. Thus, policy

intervention decreases costs, if and only if

$$\begin{aligned} \mu - (1-\lambda_P)\alpha\bar{q} + e &< \mu + (1-\alpha)\bar{q} \\ -\alpha\bar{q} + \lambda_P\alpha\bar{q} + e &< \bar{q} - \alpha\bar{q} \\ \alpha &< \frac{1}{\lambda_P}\left(1 - \frac{e}{\bar{q}}\right). \end{aligned}$$

Again, the right hand side is larger than one, because $\alpha^\sharp < 1$. Thus, costs decrease. *Q.E.D.*

Proof of Proposition 5 (Welfare Effects of Consumer Education):

Consider Table 1 in Appendix A1. If an unshrouded prices equilibrium exists with and without policy intervention ($\alpha < \alpha^\dagger$), the welfare loss is always zero. This proves the first statement.

If banks are pushed from price discrimination to an unshrouded prices equilibrium ($\alpha^\dagger < \alpha < \alpha^\S$), the welfare loss falls from $(1-\beta)(1-\alpha)e$ to zero. This proves the second statement.

The third statement summarizes the results for the remaining cases. If banks are pushed from shrouded prices to price discrimination ($\alpha^\ddagger < \alpha < \alpha^\sharp$), the welfare loss changes from $(1-\alpha)e$ to $(1-\beta)(1-(1-\lambda_P)\alpha)e$. Accordingly, the net effect of policy intervention is positive if and only if

$$\begin{aligned} (1-\alpha)e &> (1-\beta)(1-(1-\lambda_P)\alpha)e \\ (1-\alpha)e &> (1-(1-\lambda_P)\alpha)e - \beta(1-(1-\lambda_P)\alpha)e \\ 0 &> \lambda_P\alpha e - \beta(1-(1-\lambda_P)\alpha)e \\ \beta(1-(1-\lambda_P)\alpha)e &> \lambda_P\alpha e \\ \beta &> \frac{\lambda_P\alpha}{1-(1-\lambda_P)\alpha}. \end{aligned}$$

Depending on β, λ_P and α, this condition may or may not hold. This proves the fourth statement.

Finally, if a shrouded prices equilibrium exists without and with policy intervention ($\alpha^\sharp < \alpha$), the welfare loss is $(1-\alpha)e$ and $(1-(1-\lambda_P)\alpha)e$, respectively. Thus,

welfare decreases by $\lambda_P \alpha e$ through policy intervention. Similarly, if a price discrimination equilibrium exists without and with policy intervention ($\alpha^{\S} < \alpha < \alpha^{\ddagger}$), the welfare loss is equal to $(1-\beta)(1-\alpha)e$ and $(1-\beta)(1-(1-\lambda_P)\alpha)e$, respectively. Thus, welfare decreases by $(1-\beta)\lambda_P \alpha e$ in this case. This proves the last statement. *Q.E.D.*

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