A Note on the Effect of Price Discrimination on Entry
Research Note

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This note examines the impact of price discrimination by a dominant firm on entry. It shows that banning price discrimination may have a positive or a negative effect on entry, consumer welfare, prices, and scale of entry. These results contrast to the positive conclusions of Armstrong and Vickers (1993). © 1999 Elsevier Science Inc.

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I. Introduction

Does banning price discrimination promote entry? The answer to this question has important public policy ramifications. Banning price discrimination would be beneficial to consumers if doing so always promoted competition. It seems that an incumbent who is serving multiple markets is likely to respond more aggressively to entry in any given market if price discrimination is allowed than if it is prohibited, hence entry is less likely to occur when price discrimination is allowed. Following this argument, Armstrong and Vickers (1993) concluded that banning price discrimination tends to encourage entry.

Despite the policy relevance of the question raised above, the literature on price discrimination has paid little attention to the issue (an exception is the afore-mentioned paper by Armstrong and Vickers (1993)). Armstrong and Vickers (1993) studied a model with a dominant firm serving two identical markets, one captive and the other facing possible competition from a price-taking entrant. In this note, we demonstrate that Armstrong and Vickers (1993) conclusion that price discrimination generally has a negative effect on entry is problematic. We have re-examined their results using the same model but with non-identical markets. By considering both the difference in the degree of

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competitive threat across markets, as done by Armstrong and Vickers (1993), and the difference in market demands, we have found that banning price discrimination may encourage or discourage entry, depending on the price elasticity of the captive market and that of the competitive market. Our welfare analysis indicates that when banning price discrimination discourages entry, consumer surplus may increase under price discrimination relative to no discrimination. We will also show that other conclusions on the effects of banning price discrimination on entry by Armstrong and Vickers (1993) may be reversed as well once the identical markets assumption is relaxed. In particular, we will demonstrate by an example that banning price discrimination may raise prices in both markets, in contrast to the Armstrong and Vickers (1993) assertion that prices in both markets may fall; we will also illustrate an opposite conclusion to theirs that allowing price discrimination may decrease the scale of entry by the potential entrant.

II. Model and Results
We consider a linear version of the Armstrong and Vickers (1993) model, but allow demands to differ across markets. There is a dominant firm (the incumbent) serving two markets, one is captive and the other faces possible competition from a price-taking entrant. The entrant faces a fixed entry cost. Aside from this cost, the entrant’s entry decision depends solely on the expected post-entry price in the competitive market; the higher this price, the more likely it will enter. In the case entry occurs, the dominant incumbent sets the post-entry prices in the two markets based on the demand of the captive market and the residual demand of the competitive market.

The demand is $q = a - bp$ for the competitive market and $q = a - \beta p$ for the captive market, where $q$ denotes quantity, $p$ denotes price, and $a$, $b$, $\alpha$, and $\beta$ are positive constants. For simplicity, the monopolist’s marginal cost of production is assumed to be zero. The supply of the entrant is $q = kp$, where $k > 0$ can be interpreted as the entrant’s scale of entry. It follows that the monopolist’s residual demand in the competitive market after entry is $q = a - (b + k)p$. As all demands are linear, if the price intercept of the residual demand in the competitive market, $a/(b + k)$, is greater than that of the captive market, $a/\beta$, then, to the monopoly, the competitive market is less elastic than the captive market for any given price; on the other hand, if $a/(b + k) < a/\beta$, then to the monopoly the competitive market is more elastic than the captive market for any given price.

Elasticity Analysis
It is well-known that, in general, if the residual demand of the competitive market is less elastic than the demand of the captive market at the optimal uniform price (i.e., the nondiscriminatory price), then the post-entry price in the competitive market is higher under price discrimination than under no discrimination; on the other hand, if the residual demand of the competitive market is more elastic than the demand of the captive market at the optimal uniform price, then the post-entry price in the competitive market is lower under price discrimination than under no discrimination.1

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1 This result follows from the classic analysis of Robinson (1933). A sufficient condition for this to hold is that the profit function in each market is concave, such as is the case in our linear model. When profit functions are not concave, Nahata et al. (1990) showed that both prices may rise or fall under price discrimination. For a survey of the literature on price discrimination, see Varian (1989).
It follows from the preceding discussion that if \( a(b + k) > a\beta \), then the competitive market will be less elastic to the monopoly than the captive market at the optimal uniform price. Hence, based on the above-mentioned well-known result, if \( a(b + k) > a\beta \), then the post-entry price in the competitive market will be higher under price discrimination than under no discrimination. In this case, banning price discrimination will discourage entry. Similarly, if \( a(b + k) < a\beta \), then the post-entry price in the competitive market will be lower under price discrimination than under no discrimination. Therefore, banning price discrimination will encourage or discourage entry, depending on whether the price intercept of the residual demand in the competitive market is less or greater than the price intercept of the demand in the captive market.

The preceding results can also be obtained through direct derivations. Straightforward calculations show that the optimal discriminatory prices in the competitive and the captive markets are \( a[2(b + k)] \) and \( a(2\beta) \), respectively, and the optimal uniform price is a weighted sum of these discriminatory prices, given as \( w_1[a(2(b + k))] + w_2[a(2\beta)] \), where \( w_1 = (b + k)/(\beta + b + k) \) and \( w_2 = \beta/(\beta + b + k) \). The post-entry price in the competitive market under price discrimination, \( a[2(b + k)] \), is greater or less than that under no discrimination, \( w_1[a(2(b + k))] + w_2[a(2\beta)] \), if \( a(b + k) \) is greater or less than \( a\beta \), from which the above conclusions follow.

From the above, it follows that if \( a/b \leq a/\beta \) (implying that the competitive market is more elastic than the captive market for any price), then \( a(b + k) < a\beta \); thus, banning price discrimination tends to encourage entry. If \( a/b > a/\beta \) (implying that the competitive market is less elastic than the captive market for any price), then \( a(b + k) < a\beta \) for large \( k \), and \( a(b + k) > a\beta \) for small \( k \); thus, banning price discrimination may encourage or discourage entry, depending on whether the entrant’s scale coefficient, \( k \), makes the residual demand of the competitive market more or less elastic than the captive market.

At this point, we comment on the main result in Armstrong and Vickers (1993), that banning price discrimination tends to encourage entry. Under their identical markets assumption, the competitive market is always more elastic to the monopoly than the captive market; thus, the post-entry price in the competitive market is lower with price discrimination than without, from which their conclusion on entry follows.

**Welfare Analysis**

We study, next, the effect of banning price discrimination on consumer welfare. In comparing consumer welfare under the alternative pricing regimes, there are four possible scenarios for consideration, depending on the level of the entrant’s fixed entry cost. First, when the entry cost is high, entry will not occur, regardless whether the incumbent can

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2. We assume both markets are served by the monopolist under uniform pricing. This requirement certainly will not make our analysis vacuous.

3. Suppose the identical market demand function in the two markets is \( D(p) \) and the entrant’s supply function is \( S(p) \). Then, the elasticity of the residual demand in the competitive market is \( p[D'(p) - S'(p)]/[D(p) - S(p)] \), which can be rewritten as \( e(p) + [e(p) - \eta(p)]S(p)/(D(p) - S(p)) \) (call this \( E(p) \)), where \( e(p) = pD'(p)/D(p) \) is the elasticity of demand of the competitive market, as well as the captive market, and \( \eta(p) = pS'(p)/S(p) \) is the elasticity of supply of the entrant. As \( e(p) < 0 \) and \( \eta(p) > 0 \), it follows that the residual demand of the competitive market is more elastic than the captive market for any price (i.e., \( E(p) < e(p) \) for all \( p \)).

4. Our welfare analysis is focused on consumer surplus only. The effect of banning price discrimination on total profits (and therefore on total welfare) is, in general, ambiguous, as it depends on the relative efficiency of the entrant to the incumbent monopoly. An exception is the first case below, in which it is well-known that total welfare is lower under price discrimination than under no discrimination.
price discriminate or not. In this case, welfare analysis of price discrimination is well-known with linear demands: consumer surplus is lower under price discrimination than under no discrimination [see, e.g., Varian (1985)]. Second, when entry cost is low, entry will occur under any pricing policy by the incumbent monopoly. In this case, the usual analysis concerning consumer surplus can also be applied, as the price-setting monopolist is faced with the same demand in the captive market and the same residual demand in the competitive market under either pricing policy, implying that with linear demands consumer surplus is lower under price discrimination than under no discrimination.

When the entry cost is moderate, entry may occur in one pricing regime but not in the other, leading to the next two possibilities. The third case we consider is when entry occurs under uniform pricing but not under price discrimination. From the second case above, consumer surplus is higher under uniform pricing than under price discrimination when entry occurs under either pricing policy. When entry does not occur under price discrimination, price in the competitive market is raised (from \(a/[2(b + k)]\) to \(a/[2b]\)), while price in the captive market remains the same compared with that in which entry occurs. This further decreases consumer welfare under price discrimination. Consequently, consumer surplus is greater under uniform pricing than under price discrimination in the present case.

The last case is where entry occurs under price discrimination but not under uniform pricing. Based on the elasticity analysis above, this case is likely when \(a(b + k) > a/b\). Simple calculations yield that in this case prices are \(p_c = a/[2(b + k)]\) and \(p_m = a/[2b]\), respectively, for the competitive and captive markets under price discrimination, and are \(p_u = (a + \alpha)/(2b + \beta)\) for both markets under uniform pricing. Consumer surplus is \(CS_{pd} = (a - bp_c)^2/(2b) + (a - bp_m)^2/(2b)\) under price discrimination, and \(CS_u = (a - bp_u)^2/(2b) + (a - \beta p_u)^2/(2b)\) under uniform pricing. It is easy to check that if \(a(\beta - k) < a(b + k)\), then \(p_u\) is greater than both \(p_c\) and \(p_m\), implying that both terms in \(CS_u\) are less than the corresponding terms in \(CS_{pd}\), resulting in \(CS_u < CS_{pd}\). If the condition \(a(\beta - k) < a(b + k)\) is not satisfied, then the ranking between \(CS_u\) and \(CS_{pd}\) is ambiguous.

In summary, the first three cases above indicate that consumer welfare is increased by banning price discrimination, if doing so does not change the entrant’s decision on entry or promotes entry. The first two cases considered above correspond to the usual result that with linear demands, consumers prefer uniform pricing to price discrimination. The conclusion in the third case confirms the assertion in the introduction that banning price discrimination would be beneficial to consumers if doing so promoted competition. The fourth case signifies that allowing price discrimination may improve consumer welfare when entry occurs only under price discrimination.
Further Discussion

In the following, we briefly consider, through examples, the effect of banning price discrimination on prices and on scale of entry. These examples also show that other important results by Armstrong and Vickers (1993) may also be reversed once their identical markets assumption is relaxed. First, we provide an example to show that banning price discrimination may increase prices in both markets, in contrast to the Armstrong and Vickers (1993) assertion that prices in both markets may fall. To see this, consider again the above linear model and let \( a = 10, \alpha = 4, \) and \( b = \beta = k = 2. \) Simple calculations show that the optimal uniform price is 1.75 without entry, and 1.17 with entry. The optimal discriminatory price with entry is 1.25 for the competitive market, and 1.0 for the captive market. The entrant’s profit is 1.3689 without price discrimination, and 1.5625 with price discrimination, where \( f \) denotes the entrant’s fixed entry cost. So, if 1.3689 < \( f \) < 1.5625, then entry will occur if price discrimination is allowed but will not occur otherwise. In this case, banning price discrimination will result in a uniform price of 1.75 in both markets. Hence, allowing price discrimination lowers price from 1.75 to 1.25 in the competitive market, and from 1.75 to 1 in the captive market.

So far, we have not considered the possibility of choice of entry scale by the entrant. Adding this choice will not change the elasticity analysis which gives the above observations. We illustrate next that opposite conclusions on scale of entry to those of Armstrong and Vickers (1993) can also be obtained. Armstrong and Vickers (1993, p. 348) observed that in their model it is reasonable to expect the entrant to reduce its scale of entry if price discrimination by the incumbent is allowed. Here, we provide an example in which the entrant’s optimal scale of entry is higher with price discrimination than without. Consider the previous numerical example, but allow \( k \) to vary. Assume that \( f = k \) (i.e., the fixed entry cost for the entrant is equal to the entry scale chosen). Simple calculations show that the optimal entry scale under discriminatory pricing is 0.59, and the optimal entry scale under uniform pricing is 0.43.\(^8\) Hence, in this example, the optimal entry scale under discriminatory pricing is greater than that under uniform pricing.

III. Conclusion

In conclusion, we have shown in this note that banning price discrimination may have a positive or negative effect on entry. In Armstrong and Vickers (1993), the identical markets assumption allowed them to consider the impact on entry due solely to the difference in the degree of competitive threat across markets. But, as shown in this note, the difference in competitive threat across markets may be overwhelmed by the difference in market demands. When that happens, price discrimination has a positive instead of a negative effect on entry. An implication of our analysis is that one cannot make any general conclusions on the effect of price discrimination on entry following from an analysis with some ideal assumptions regarding markets, and any policy recommendation has to be made based on a complete evaluation of the market conditions.

\(^8\) The entrant chooses \( k \) to maximize its post-entry profit, which is \( ka^2/[8(b + k)^2] - k \) under discriminatory prices, and \( k(a + a)^2/[8(b + \beta + k)^2] - k \) under uniform pricing. Solving these maximization problems gives these values for optimal scale.
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References


