Output and Misallocation Effects in

Monopolistic Third Degree Price Discrimination

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ABSTRACT

This paper shows how the welfare effects of third degree price discrimination may be decomposed into two effects: a misallocation effect and an output effect. It also presents a geometrical analysis which shows how the welfare properties of third degree price discrimination must be assessed using nonlinear demands, and hence how linear demands are not suitable for the analysis.

Key words: price discrimination, monopoly, welfare.

JEL: D42, L12, L13.

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1.- Introduction

Price discrimination under imperfect competition is an important area of economic research both theoretically and empirically. This paper is concerned with third degree price discrimination, which "is a major item under the rubric special topics in any standard neoclassical treatment of monopoly theory" (Battalio and Ekelund, 1972). See Stole (2006) and Armstrong (2006) for excellent recent theoretical surveys, and Verboven (2006) for a review of recent empirical studies. Despite its importance, however, not much is known about the welfare effects of this type of price discrimination. One of the aspects that is known, for instance, although rarely explicitly showed, is that a move from uniform pricing to third degree price discrimination generates two effects: first, price discrimination causes a misallocation of goods from high to low value users (that is, output is not efficiently distributed to the highest-value end) and, second, price discrimination affects total output. Therefore, as price discrimination is viewed as an inefficient way of distributing a given quantity of output between different consumers or submarkets, a necessary condition for price discrimination to increase social welfare is that it increases total output. Put differently, in

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1 Ippolito (1980), Schmalensee (1981) and Layson (1988) study this aspect. This paper generalizes and complements their analysis. Stole (2006) distinguishes a third effect, namely "there may be inter-firm inefficiencies as a given consumer may be served by an inefficient firm (which it would be present under oligopoly price discrimination), perhaps purchasing from a more distant or higher-cost firm to obtain a price discount". Another additional effect would arise if the firm’s pricing policy affects market structure by influencing the entry or exit decision (see, for example, Aguirre, 2000). In order to isolate the two main effects of third degree price discrimination we consider here the case of pure monopoly and that the cost of serving the good is the same in every market.

2 Schmalensee (1981) proves this result assuming nonlinear demand curves, perfectly separated markets and constant marginal cost. Varian (1985) extends it by allowing imperfect arbitrage and marginal cost to be either constant or increasing. Using a revealed-preference argument, Schwartz (1990) generalizes the result to the case in which marginal cost is decreasing. On the other hand, when there are consumption externalities social welfare
order for price discrimination to increase welfare a positive output effect should offset the negative effect of the distributional inefficiency.\footnote{Robinson (1933), Yamey (1974), Ippolito (1980), Schmalensee (1981) and Varian (1985), among others, stress that an increase in total output is only a necessary condition for price discrimination to increase social welfare.} As a result, a focal point of analysis in the literature has been the study of the effects of price discrimination on output.\footnote{Since Robinson (1933) many papers have addressed this issue, including Leontief (1940), Edwards (1950), Silberberg (1970), Löfgren (1977), Smith and Formby (1981), Schmalensee (1981), Shih, Mai and Liu (1988) and Cheung and Wang (1994), among others.} It is known from Pigou (1920) that under linear demands price discrimination does not change output.\footnote{It is assumed throughout the paper that all markets are served under both pricing regimes, uniform pricing and price discrimination. The possibility that price discrimination opens new markets, and that may even yield Pareto improvements, was also considered by Robinson (1933). See, for example, Battalio and Ekelund (1972), Hausman and Mackie-Mason (1988) and Layson (1994) for more recent analysis.} Therefore, given that the output effect is zero, the case of linear demands, although it presents obvious analytical advantages,\footnote{For example, it allows us to obtain explicitly the optimal single price and outputs under uniform pricing.} is not suitable for decomposing the welfare change into the two effects. In the general non-linear case, however, the effect of price discrimination on output may be either positive or negative.

This paper shows how social welfare may be easily broken down into the two effects, a misallocation effect and an output effect, for the general case in which a monopolist sells a good in \( n \) perfectly separated markets. Further, the paper illustrates the usefulness of this decomposition by using a graphical representation and a numerical example. In particular, it considers one demand structure which even though it was already considered by Robinson (1933, 1969) it has been rarely used to study price discrimination: namely, I shall assume that all the strong markets (markets where the optimal discriminatory price exceeds the optimal single price) have concave demands whereas the weak markets (markets where the optimal
discriminatory price is lower than the single price) have convex demands, with at least one
market with strict concavity or convexity. Under these circumstances third degree price
discrimination always increases total output, and therefore the comparison between the
misallocation effect and the output effect is more interesting. From an empirical perspective
Robinson (1933, 1969) considers this case not only more interesting but also more realistic
than the linear case.

The rest of the paper is organized as follows. Section 2 develops the basic model and presents
the main results. In section 3, we discuss some recent empirical and theoretical papers in light
of our findings. Finally, section 4 offers concluding remarks.

2. Analysis

Consider a monopolist selling a good in \( n \) perfectly separated markets. The demand function
in market \( i \) (\( i = 1, \ldots, n \)) is given by \( D_i(p_i) \), where \( p_i \) is the price charged in that market and
the inverse demand function is \( p_i(q_i) \), where \( q_i \) is the quantity sold. Unit cost, \( c \), is assumed
to be constant.

Under price discrimination, the optimal policy for the monopolist is given by:

\[
\frac{p_i^d - c}{p_i^d} = \frac{1}{\varepsilon_i(p_i^d)} \quad (i = 1, \ldots, n),
\]

where \( p_i^d \) denotes the optimal price in market \( i \), and \( \varepsilon_i(p_i^d) = -\frac{D_i'(p_i^d)p_i^d}{D_i(p_i^d)} \) is the
price-elasticity in absolute value in market \( i \). That is, the Lerner index in each market is
inversely proportional to its elasticity of demand and the monopolist, therefore, sets a higher price in the market with the lower elasticity of demand. The quantity sold in market \( i \) is \( q_i^d \), \( i = 1, \ldots, n \). The total output under price discrimination is \( Q^d = \sum_{i=1}^{n} q_i^d \).

Under simple monopoly pricing, profits are maximized by charging all consumers a common price \( p^0 \). The Lerner index under uniform pricing is:

\[
\frac{p^0 - c}{p^0} = \frac{1}{\varepsilon(p^0)},
\]

where \( \varepsilon(p^0) \) is the elasticity of the aggregate demand at \( p^0 \). If we let \( D(p) = \sum_{i=1}^{n} D_i(p) \) denote the aggregate demand, then this elasticity is simply the weighted average of the elasticities of each market:

\[
\varepsilon(p^0) = -\left(\sum_{i=1}^{n} \frac{D_i'(p^0)}{D_i(p^0)}\right) = \frac{1}{\sum_{i=1}^{n} D_i(p^0)} \sum_{i=1}^{n} \alpha_i(p^0)\varepsilon_i(p^0),
\]

where the elasticity of market \( i \) is weighted by the "share" of that market at the optimal uniform price, \( \alpha_i(p^0) = D_i(p^0) / \sum_{i=1}^{n} D_i(p^0) \). Let \( q_i^0 \) denote the quantity sold in market \( i \), \( q_i^0 = D_i(p^0) \), \( i = 1, \ldots, n \), and \( Q^0 \) denote the total output, \( Q^0 = \sum_{i=1}^{n} q_i^0 \), under uniform pricing.

A move from uniform pricing to price discrimination generates a welfare change equal to:
that is, the change in welfare is the sum across markets of the cumulative difference between price and marginal cost for each market between the output under single pricing and the output under price discrimination. Following Robinson’s terminology, two types of markets are distinguished: strong markets and weak markets. The set of strong markets collects markets where the optimal discriminatory price exceeds the optimal single price, that is \[ S = \{ i \mid p^d_i > p^0 \} \], and the set of weak markets consists of those where the optimal discriminatory price is lower than the single price, \[ W = \{ i \mid p^d_i < p^0 \} \]. Therefore, the change in welfare can be expressed as:

\[
\Delta W = \sum_{i \in S} \left\{ \int_{q_i^o}^{q_i^d} \left[ p_i(z) - c \right] dz \right\} + \sum_{w \in W} \left\{ \int_{q_w^o}^{q_w^d} \left[ p_w(z) - c \right] dz \right\},
\]

where \( s \in S \) denotes the representative strong market and \( w \in W \) the representative weak market. As output decreases in each strong market and increases in each weak market, the first term in (5) is the aggregate welfare loss across strong markets, whereas the second term is the aggregate welfare gain across weak markets. It is useful to distinguish a submarket \( w \) (for example, it might be the market with the highest elasticity demand) from other weak markets.
markets, so we can express the change in welfare as:

\[
\Delta W = \sum_{s \in S} \left\{ \int_{q_i^w}^{q_i^w + \Delta q_i^w} p_i(z)dz \right\} + \sum_{w \in W - \{s\}} \left\{ \int_{q_w^u}^{q_w^u + \Delta q_w^u} p_w(z)dz \right\} + \int_{q_i^w - \Delta Q_w}^{q_i^w - \Delta Q_w} p_i(z)dz + \int_{q_i^w - \Delta Q_w}^{q_i^w} \left[ p_i(z) - c \right]dz, \quad (6)
\]

where:

\[
\Delta Q_W = \sum_{i \neq W} \Delta q_i = \sum_{s \in S} \Delta q_s + \sum_{w \in W - \{s\}} \Delta q_w \quad \text{and} \quad \Delta q_i = q_i^d - q_i^0, \quad i = 1, \ldots, n.
\]

Without loss of generality, it is assumed that \( \Delta Q_W < 0 \). Note that when output increases with price discrimination it must occur that \( \Delta Q = \Delta Q_W + \Delta q_w > 0 \). Given that \( q_i^d = q_i^0 + \Delta q_i \) and \( p_i(q_i) = u_i'(q_i), \quad i = 1, \ldots, n \), the change in social welfare can be written as:

\[
\Delta W = \sum_{s \in S} \left\{ \int_{q_i^s}^{q_i^s + \Delta q_i^s} u_i(z)dz \right\} + \sum_{w \in W - \{s\}} \left\{ \int_{q_w^u}^{q_w^u + \Delta q_w^u} u_w(z)dz \right\} + \int_{q_i^w - \Delta Q_w}^{q_i^w - \Delta Q_w} u_i(z)dz + \int_{q_i^w - \Delta Q_w}^{q_i^w} \left[ u_i(z) - c \right]dz. \quad (7)
\]

Taking into account that the optimal uniform price satisfies \( p^0 = u_i'(q^0_s) = u_w'(q^0_w), \quad s \in S \) and \( w \in W \), we can express the change in welfare as:

\[
\Delta W = \sum_{s \in S} \left\{ \int_{q_i^s}^{q_i^s + \Delta q_i^s} \left[ u_i(z) - u_i'(q^0_i) \right]dz \right\} + \sum_{w \in W - \{s\}} \left\{ \int_{q_w^u}^{q_w^u + \Delta q_w^u} \left[ u_w(z) - u_w'(q^0_w) \right]dz \right\}
\]

\[
+ \int_{q_i^w - \Delta Q_w}^{q_i^w - \Delta Q_w} \left[ u_i(z) - u_i'(q^0_i) \right]dz + \int_{q_i^w - \Delta Q_w}^{q_i^w} \left[ u_i(z) - c \right]dz, \quad (8)
\]

where the misallocation effect (ME) is:
$$ME = \sum_{s \in S} \left\{ \int_{q_s^0}^{q_s^0 + \Delta q_s} \left[ u_s'(z) - u_s'(q_s^0) \right] dz \right\} + \sum_{w \in \mathcal{W} - \{s\}} \left\{ \int_{q_w^0}^{q_w^0 + \Delta q_w} \left[ u_w'(z) - u_w'(q_w^0) \right] dz \right\}$$
$$+ \int_{q_s^0}^{q_s^0 - \Delta Q_s} \left[ u_s'(z) - u_s'(q_s^0) \right] dz,$$

and the output effect (OE) is:

$$OE = \int_{q_s^0 - \Delta Q_s}^{q_s^0} \left[ u_s'(z) - c \right] dz.$$

The misallocation effect is always negative and represents the welfare loss due to the misallocation of goods from high to low value users. It corresponds with the social loss due to the transfer of $|\Delta Q_s| = \sum_{s \in S} \Delta q_s$ units of production from the strong markets to the weak markets. The output effect can be interpreted as the effect of additional output on social welfare. Obviously, if the quantity effect is positive, $\Delta Q = \Delta Q_w + \Delta q_w > 0$, the output effect on social welfare is positive because the social valuation of the increase in output exceeds the marginal social cost. Note that given that the misallocation effect is always negative, a necessary, but of course not sufficient, condition for third degree price discrimination to increase social welfare is an increase in total output. Note from (8), therefore, that the linear-demand case is not suitable to illustrate the two effects of price discrimination on social welfare, given that the output effect is zero. The following example illustrates how the misallocation effect and the output effect can be differentiated.
Example

Consider a monopolist selling a good in three perfectly separated markets. The demand functions are given by $D_1(p_1) = (1 - p_1)^{1/2}$, $D_2(p_2) = (1 - p_2)$ and $D_3(p_3) = (1 - p_3)^2$ and the inverse demand functions are $p_1(q_1) = 1 - q_1^2$, $p_2(q_2) = 1 - q_2$ and $p_3(q_3) = 1 - q_3^{1/2}$, where $q_i$ is the quantity sold in that market. An interesting property of these types of demands is that $\epsilon_1(p) = (1/2)\epsilon_2(p)$ and $\epsilon_2(p) = (1/2)\epsilon_3(p)$. Unit cost is assumed to be $c=0.1$. Under price discrimination the optimal prices are $p_1^d = 0.7 > p_2^d = 0.55 > p_3^d = 0.4$. The optimal uniform price is given by $p^0 = 0.578$. Therefore, the strong market, market 1, has strictly concave demand, and there are two weak markets: market 2 has linear demand and market 3 (the most elastic) has strictly convex demand. It is well known that when all weak markets have strictly convex demands ($D_w'' > 0$) or linear, and all the strong markets strictly concave demands ($D_w'' < 0$), then price discrimination increases total output. In particular, a move from uniform pricing to price discrimination generates the following changes in the output sold at each market: $\Delta q_1 = -0.101$, $\Delta q_2 = 0.028$ and $\Delta q_3 = 0.181$. Note that $\Delta Q = \Delta Q_3 = 0.108$. It is easy to check that the misallocation effect and the output effect are given, respectively, by $ME = -0.009$ and $OE = 0.037$. Therefore, given that the output effect is greater than the misallocation effect (in absolute value), $OE > |ME|$, price

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9 In order to understand the computational problems note that even for this very simple example the optimal uniform price solves the equation (from (2) and (3)) $1.5 p - 1.05 + (1 - p)^{0.5} (2 p - 1.1) + (1 - p)^{1.5} (3 p - 1.2) = 0$.

10 See, for example, Robinson (1933), Edwards (1950), Silberberg (1970), Löfgren (1977), Schmalensee
discrimination increases social welfare, $\Delta W = 0.027$.

Figure 1 shows the welfare effect of third degree price discrimination and its decomposition into the misallocation effect, which is the sum of the red areas, and the output effect, which is represented by the blue area. As in the numerical example, the figure shows a case in which the output effect is greater than the misallocation effect.$^{11}$

Figure 1. Price discrimination and welfare: output and misallocation effects.

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$^{11}$ Other interesting geometrical analysis can be found in Robinson (1933), Battalio and Ekelund (1972) and Yamey (1974). This note is more closely related with the geometrical analysis by Ippolito (1980), Schmalensee (1981) and Layson (1988).
3.- **Discussion**

In this section, we discuss some implications of the above analysis from a theoretical perspective and from an empirical point of view.

3.1.- **Theoretical considerations**

Schmalensee (1981) stated that when the demands of submarkets are all concave or convex then total output, and therefore welfare, may either increase or decrease. Shih, Mai and Liu (1988), Holmes (1989) and Cheung and Wang (1994) address partially this problem of indeterminacy. Their analysis, however, is far from complete, since they are unable to explain, for example, why under constant elasticity demands third degree price discrimination always increases total output. Aguirre (2007) shows that when both markets have strictly concave (convex) demands a sufficient (necessary) condition for price discrimination to increase total output is that the demand of the strong market is more concave than the demand of the weak market.

Along this line of research, Cowan (2006) analyzes the welfare effects of third degree price discrimination when demand in one market is a shifted version of demand in the other market and both markets are served under uniform pricing. He assumes that demand is $Q = a + bq(p)$, where $a \geq 0$, $b > 0$, and $q(p)$ is the underlying demand function. The additive term ($a$) and the multiplicative term ($b$) vary across markets. He shows that the welfare effect of price discrimination is negative if the discriminatory welfare, as a function of the shift factor, is concave and that two sufficient conditions for concavity are that the slope of
demand is log-concave and the convexity of demand is non-decreasing in the price. Since all demand functions commonly used in models of imperfect competition satisfy either one or both of these conditions, and given that the conditions for price discrimination to raise welfare are rather stringent in his model, Cowan (2006) concludes that "the expectation is that price discrimination will reduce welfare". Hence, Cowan (2006) allows us to conclude that if demands are affine transformations one to another then it should be expected that third degree price discrimination yield a welfare loss. Put differently, the output effect (which in the context studied by Cowan may be even negative) should not be expected to offset the negative effect of the distributional inefficiency.

However, although very interesting, the analysis of Cowan seems restrictive. Our findings in the following two examples illustrate how the output effect may be positive and potentially dominate the misallocation effect when all markets have strict convex demands or strict concave demands.

A) Constant elasticity demand curves

Assume that the demand function in market $i$ ($i=1,2$) is given by $D_i(p_i) = a_i p_i^{-\varepsilon_i}$, where $a_i$ is a positive parameter and $\varepsilon_2 > \varepsilon_1 > 1$ is the elasticity of demand. It is well known that third degree price discrimination always increases total output with this kind of demands.\footnote{Formby, Layson and Smith (1983), using Lagrange techniques, demonstrate that monopolistic price discrimination increases output over a wide range of constant elasticities. Aguirre (2006) provides a more general and simple proof by using the Bernoulli inequality.} This result contrasts with that of Cowan (2006): he obtains that when the underlying demand function is iso-elastic output and, therefore, welfare decreases (see proposition 1 and 2). It
should be pointed out that under iso-elastic demands it is always possible to write the demand of the strong market as a concave transformation of the demand of the weak market. Note that:

\[ a_i p^{-\varepsilon_i} = D_1(p) = \Psi(D_2(p)) = k \left( D_2(p) \right)^{\frac{\varepsilon_i}{\varepsilon_i'}} = a_i \left( a_2 \right)^{\frac{\varepsilon_i}{\varepsilon_i'}} \left( a_2 p^{-\varepsilon_i} \right)^{\frac{\varepsilon_i}{\varepsilon_i'}}, \]

where \( k = a_i \left( a_2 \right)^{\frac{\varepsilon_i}{\varepsilon_i'}} > 0 \), \( \Psi' > 0 \) and \( \Psi'' < 0 \).

Given that the output effect is positive this family of demands is appropriate to analyze the trade-off between output and misallocation effects.

B) Constant adjusted concavity demand curves

Shih, Mai and Liu (1988) propose the following class of constant adjusted-concavity demand curves: \( p_i = a_i - b_i q_i^{a_i+1} \) \((i = 1, \ldots, n, a_i, b_i > 0, A > -1)\), where \( q_i \frac{p_i'(q_i)}{p_i(q_i)} = A \) is the Robinson’s adjusted-concavity term. Shih, Mai and Liu (1988) shows that when \( A > 0 \) (that is, with strictly concave demand curves) price discrimination reduces output. Note that weak markets have more demand concavity than strong markets. It is easy to find examples where this result is reversed. For example, assume that the inverse demand functions are given by \( p_1 = 1 - q_1^4 \) and \( p_2 = 1 - q_2^3 \) therefore the demand functions are given by \( D_1(p_1) = (1 - p_1)^{\frac{1}{4}} \) and \( D_2(p_2) = (1 - p_2)^{\frac{1}{3}} \). Note that the demand in submarket 1 is a strictly concave transformation of the demand in submarket 2: \( D_1(p) = \Psi(D_2(p)) = \left( D_2(p) \right)^{\frac{1}{2}} \), with \( \Psi' > 0 \) and \( \Psi'' < 0 \).
Under third-degree price discrimination the optimal prices are \( p_1^d = 0.8 > p_2^d = 0.66 \), when we assume that unit costs are zero. The optimal uniform price is given by \( p^0 = 0.738 \). It is easy to check that total price discrimination increases total output: \( \Delta q_1 = -0.046 \), \( \Delta q_2 = 0.065 \) and \( \Delta q = 0.019 \).

3.2.- **Empirical implications**

In section 2, we have argued that the case in which all the strong markets have concave demands and the weak markets convex demands, with at least one market with strict concavity or convexity, is more interesting that the linear case. These circumstances guarantee that third degree price discrimination increases total output, and therefore the comparison between the misallocation effect and the output effect is more meaningful. From an empirical perspective, Robinson (1933, 1969) also considers this case not only more interesting but also more realistic than the linear case: "The above analysis suggests that on the whole it is more likely that the introduction of price discrimination will increase output than that it will reduce it. Moreover there is some reason, beside these purely formal considerations, to suppose that cases in which the less elastic demand curve is more convex than the more elastic demand curve (so that price discrimination will increase output) are likely to be common." If Robinson is right we would have a more optimistic point of view concerning third-degree price discrimination. \(^{13}\)

\(^{13}\) Robinson (1933) uses the terms convex and concave just in opposite sense to that in this note. To avoid misunderstandings some authors like Shih, Mai and Liu (1988) call a demand curve satisfying \( D''(.)>0 \) (\( D''(.)<0 \)) \( R \)-concave (\( R \)-convex), where "R" stands for Robinson.
Of course, the shape of the demands in the different submarkets is entirely an empirical question. Unfortunately, to the best of my knowledge there are no studies in the literature analyzing the relation between price elasticity and curvature of the submarkets demand. This aspect, however, has been analyzed in some general equilibrium macro models. Recent works introduce a kinked (concave) demand curve as a way to obtain real rigidities in order to explain the failure of nominal frictions to generate persistent effects of monetary policy shocks. Dossche, Heylen and Van den Poel (2006), for instance, use scanner data from a large euro area supermarket chain in search of empirical evidence on the existence of the kinked demand curve and on the size of its curvature. They find wide variation in the estimated price elasticity and the curvature of demand among different products. Although the demand for the median product is concave, the fraction of products showing convex demand is significant (42% of the items). Their results are taken to support the introduction of a kinked (concave) demand curve in general equilibrium macro models. Unfortunately, however, their analysis does not provide information concerning the relationship between the elasticity of demand and curvature of strong markets in comparison with weak markets.

The analysis of Acquaye and Traxler (2005) provides some empirical evidence on the Robinson's conjecture. They use data from Hubbell, Marra and Carlson (2000) to examine the case of potential price discrimination in Bt cotton. Hubbell et al. (2000) present, using data for 1996, the Bt cotton demand of cotton growers in Alabama, Georgia, North Carolina and South Carolina divided into regions (Upper South and Lower South) with different levels of insect resistance to pesticides and therefore with two derived demand curves. The total Bt cotton seed demand for the region comprises the Upper South (North Carolina and South Carolina) with no resistance experience (US/NR) and the Lower South (Alabama and Georgia) with some resistance experience (LS/R). Demand for Bt cotton is less elastic when
Acquaye and Traxler (2005) use the demand curves for US/NR and LS/R from Hubbell et al. (2000) and determine the effects of price discrimination on quantities, prices and welfare. They find that price discrimination would result in an increase in total output and welfare.\textsuperscript{14} Figure 2 (which is based on the Fig. 1 in Acquaye and Traxler, 2005) shows the decomposition of the change in welfare into output and misallocation effects. The initial situation is that under uniform pricing the monopolist states of 32$/acre, selling quantities $a$ and $b$ in the two markets (with a marginal cost of about 16.88$/acre). Following Acquaye and Traxler’s computations, under price discrimination the price in the more elastic market (US/NR) would decrease (to point $c$, about 25.92$/acre) and the quantity would increase (from point $b$ to point $f$) while the price in the less elastic market (LS/R) would increase (point $d$, about $33.09$/acre) and the quantity would decrease (from point $a$ to point $g$). Price discrimination would then increase welfare because the positive output effect (blue area) would offset the negative effect of the distributional inefficiency (red areas). (See Table 2 in Acquaye and Traxler, 2005, for computations of outputs and welfare changes).

\textsuperscript{14} Acquaye and Traxler (2005) make an exercise of simulation. In the Bt cotton case, the fact that the innovator (Monsanto) was not price discriminating at the time the data for that study were collected may have been due to the difficulty in preventing arbitrage between markets.
Figure 2. Output and misallocation effects due to price discrimination of Bt cotton seed in Southern US. Note. Based on the graphical analysis by Acquaye and Traxler (2005, Figure 1). (TF: Technology fee $/acre).
4.- **Concluding remarks**

Understanding the welfare effects of monopolistic third-degree price discrimination is at the heart of much theoretical and empirical research concerning price discrimination under imperfect competition and also an important issue for public policy since policy towards price discrimination should be based on good economic knowledge of markets. This paper shows how the welfare effects of third degree price discrimination may be decomposed into two effects: a misallocation effect and an output effect. It also presents a geometrical analysis which is valuable to illustrate the advantage of using nonlinear demands, instead of linear demands, in order to understand the welfare properties of third degree price discrimination.
References


