

**DON'T BE IGNORANT:
PRICE DISPERSION IS NOT A MEASURE
OF IGNORANCE IN THE MARKET**

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ABSTRACT

One of Stigler's points in his seminal paper *The Economics of Information* is that "price dispersion is a manifestation - and, indeed, it is the measure - of ignorance in the market." This assertion has remained as part of conventional wisdom since then, (see for instance Philips 1988, p 24) and it has been used extensively for empirical purposes. For example, some work trying to relate inflation with consumer information, has used price dispersion as a proxy for consumer information. In this note I show that there is not an unequivocal implication from consumer ignorance to price dispersion in equilibrium search theory. The exercise will consist in varying a parameter that affects consumers' willingness to acquire information. It is shown that consumers being less informed (more ignorant) will imply greater market power for price-setters, and this will increase markups and prices on average, but there is not a necessary implication for the cross-sectional variance of prices. The intuition of the result is that the increase in market power needs not to affect differentially high-price versus low-price sellers. The main point of this note is that **dispersion cannot be used as a measure of ignorance, in empirical work.**

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INTRODUCTION

One of Stigler's points in his seminal paper *The Economics of Information* is that "price dispersion is a manifestation - and, indeed, it is the measure - of ignorance in the market." This assertion has remained as part of conventional wisdom since then, (see for instance Philips 1988, p 24) and it has been used extensively for empirical purposes. For example, some work trying to relate inflation with consumer information, has used price dispersion as a proxy for consumer information.¹ In this note I show that there is not an unequivocal implication from consumer ignorance to price dispersion in equilibrium search theory. The exercise will consist in varying a parameter that affects consumers' willingness to acquire information. It is shown that consumers being less informed (more ignorant) will imply greater market power for price-setters, and this will increase markups and prices on average, but there is not a necessary implication for the cross-sectional variance of prices. The intuition of the result is that the increase in market power needs not to affect differentially high-price versus low-price sellers. The main point of this note is that **dispersion cannot be used as a measure of ignorance, in empirical work.**

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¹Examples of that are Van Hoomissen (1988b), Reinsdorf (1990), and Lach and Tsiddon (1992).

SEARCH THEORY, PRICE DISPERSION AND INFORMATION

Work on the economics of search was motivated by the observation that price dispersion is a common phenomenon even for homogeneous goods. As Stigler (1961) notes, there is never absolute homogeneity, but many careful empirical studies² have established the existence of price dispersion beyond what one can expect from a hedonic equilibrium (Rosen 1974). Tommasi (1993) looks at the prices of homogeneous groceries (for instance, a particular brand and size of instant coffee) across different supermarkets in the same neighborhood. Prices differ from store to store at any point in time. This could still be explained "hedonically": cashiers may have nicer smiles or lines may be shorter in some stores. But the fact that the ranking of stores by prices tends to vary from week to week is evidence in favor of the "information" as opposed to the "perceived quality differences" hypothesis (see Van Hoomissen 1988a for a similar statement).

One of Stigler's points in his seminal paper *The Economics of Information* is that "price dispersion is a manifestation - and, indeed, it is the measure - of ignorance in the market." This assertion emanates from the intuition that arbitrage is limited by the costs of acquiring information. If buyers knew all the prices (if there were no costs of acquiring information) and if there were no transportation or other transaction costs (this needs to be true for goods to be homogeneous), the law of one price would obtain. So that some degree of "ignorance" is necessary for price dispersion to exist. This led to the intuitive extension of dispersion being increasing in ignorance.

²See for instance Jung (1960), Marvel (1976), Pratt et al (1979). For a recent study see Abbott (1992).

Stigler's analysis was partial in the sense that he analyzed optimal consumer search for a given distribution of prices.³ Explicit analysis of equilibrium including optimizing firms showed that in order for dispersion to obtain, some form of heterogeneity is required (see the survey in McKeena, 1987). I have not found any paper looking directly into the relationship between buyer ignorance and price dispersion, but Carlson and Mc Afee (1983) and MacMinn (1980) provide a natural framework to study the issue. Both papers study equilibrium in a market characterized by heterogeneous firms (different production costs) and consumers (different costs of search). The model in the next section follows closely section III of MacMinn (1980).

THE MODEL

Assume a continuum of consumers (unit mass), with search cost c distributed uniformly on $[0, C]$. Each consumer wants to purchase n units of the homogeneous good at the lowest possible total expenditure (including cost of search). The number of units purchased will be the exogenous parameter to be varied in order to induce different (optimal) degrees of ignorance. The same results could be obtained from varying any other determinant of consumer information (which is of course endogenous), and the results do not depend on the specification of inelastic demand. In any

³Stigler also restricted consumers to a Fixed Sample Size strategy: the number of searches being decided *prior to searching*. This implies that what the customer finds along the way does not affect his decision. Many authors found this unrealistic, and this led to the study of *sequential* rules (Lippman and Mc Call 1979): after receiving each price quotation, the consumer decides whether to continue searching or to accept the quoted price. The solution to such a sequential problem takes the form of a Reservation Price Rule, as it will be shown in the example below.

case, since the exercise consists in constructing a counterexample to a (supposedly) general statement, we need not to worry about specific assumptions.

There is also a unit mass of firms. Production costs equal αQ , where Q is output. Firms are characterized by their unit cost α , which belongs to a closed interval of the real line. The upper bound of the interval is smaller than p^* (to be defined), an assumption that will insure that all firms are in operation. p^* represents the maximum price that a consumer is willing to in the search market equilibrium. It is implicitly assumed that the "consumption" reservation price is greater than p^* .

Consumer search: is sequential. A one-to-one mapping from search cost c to reservation price R is defined by:

$$c = n \int_m^R (R-x)dF(x), \quad (1)$$

where x stands for the random price to be found upon additional search and m is the minimum price in the market. Equation (1) states the familiar condition that the marginal cost of search is equated to the marginal benefit. The marginal benefit of an extra search depends on which is the best price currently known and it is equal to the expected price reduction times the number of units being purchased. For a formal derivation of (1), as well as for proofs of existence and uniqueness, see Tommasi (1991).

Let p^* be the reservation price of consumers with the highest cost of search C . Then

$$C = n \left[p^* - E(p) \right],$$

where $E(p)$ is the average price on the market.

Demand: Aggregation of (1) over the distribution of c gives the following expected quantity sold by a firm charging price p : (see Appendix)

$$Q(p) = \max \{0, n^2(p^* - p)/C\} \quad (2)$$

A firm charging more than p^* will make no sales, while for prices below p^* , we obtain positive sales. Demand is linear because of the uniform distribution of search costs on the extensive margin and because of the lack of an intensive margin (the number of units each individual purchases, once he decides to do so, is independent of price).

Profit maximization: Each firm will choose its price in order to maximize $(p - \alpha)Q(p)$, which gives:

$$p = (p^* - \alpha)/2 \quad (3)$$

Equilibrium: Equation (3) maps unit production costs α to prices. It is shown in MacMinn (1980) and Tommasi (1991) that under suitable conditions on the distribution of α , there exists a unique distribution of prices $F(p)$, a transformation of the distribution of unit production costs α , with support in $[m, M]$, where m is the price charged (according to (3)) by sellers with the lowest α , and M the price charged by sellers with the highest α . It is easy to show that $E(p) = [p^* - E(\alpha)]/2$, and $\text{Var}(p) = \text{Var}(\alpha)/4$.

Comparative statics: Notice that from (1), $dR/dn < 0$. This implies $d(p^*)/dn < 0$ and hence $dE(p)/dn < 0$. Market prices are decreasing in n . A smaller n implies that this good is less important for consumers and, for given search costs, consumers will choose to be less informed and hence end up paying higher prices. The average level of prices (of markup over cost) is a manifestation of ignorance in the market. Can we say the same about

price dispersion? The answer is no, since $d\text{Var}(p)/dn=0$.⁴ In this model search intensity (consumer knowledge of prices) determines the location of the equilibrium price distribution, but not its variance. This result is induced by the linearity of demand, which comes from the assumption of uniformly distributed search costs. We could construct examples where reservation prices and price dispersions are positively or negatively correlated, depending on the distribution of search costs. Consumers' lack of information allows sellers to charge higher prices, but there is no need for this effect to be stronger at the upper end of the price distribution than at the lower end. In this example, the incentive is uniform, hence the increase in $E(p)$ without effect on $\text{Var}(p)$.

Notice that if the exercise had consisted of shifting the support of search costs slightly to the right (to $[\epsilon, C+\epsilon]$), the outcome would have been the "Diamond Paradox" (Bagwell and Ramey 1992): all firms charging the same price -- the (common) consumption reservation price. It is not clear how we will measure "ignorance" in such case, but price dispersion will be inversely related to search costs -- another contradiction to the intuition in Stigler 1961.

CONCLUSION

It has been shown that consumer ignorance need not be directly related to price dispersion in an equilibrium search model. Whether the relationship holds empirically is a different matter, but it is

⁴If one were to define dispersion in terms of a coefficient of variation of prices, dispersion will be positively related to consumers' information (inversely related to ignorance).

inappropriate to use price dispersion as a measure of consumer (des)information in empirical work, as it has been done for instance in the literature on inflation and price behavior.

APPENDIX

Derivation of the price-sales locus (2):

Only consumers with $R \geq p$ will buy from a firm charging p . Hence:

$$Q(p) = \int_{c(p)}^C \left[\frac{1}{F(R(c))} \right] \frac{dc}{C},$$

where $c(p) = n \int_m^p (p-x)dF(x)$, and $1/F(R(c))$ is the probability that a consumer with search cost c will visit a particular store. (Notice that $1/F(R)$ equals the expected number of visits for a consumer with reservation price R .)

Using the implicit function theorem,

$$\frac{dc(p)}{dp} = \frac{n}{F(R(c))},$$

so that

$$Q(p) = \frac{n^2}{C} \int_p^{p^*} dp = n^2(p^*-p)/C \quad \square$$

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