RETAIL MARK-UPS AND DISTRIBUTIVE MARGINS A critical analysis of Professor AlIen's Theory

P. Bowbrick

ABSTRACT

It has been argued that it is possible to identify an individual retailer's pricing policy from his buying and selling prices over a period. This argument is proved wrong. Even with constant elasticity demand curves different policies may be confused. With asymmetric or kinked demand curves confusion is probable. The accepted criteria do not classify the wholesale/retail price relationship correctly. A range of prices may be compatible with a given pricing policy, a given demand schedule and a given supply schedule. Discrepancies in the time period used invalidate comparisons. Constant-income policies by multi-product firms are not shown up in single-product analysis. Analysis using market data cannot identify individual firms' policies. Aggregation of individual firms' policies is not possible. The elasticity of demand at wholesale can only be derived from a knowledge of the elasticity of demand at retail and of the retailers' margins in exceptional circumstances.

INTRODUCTION

In the study of a marketing system it is often possible to get details of prices and quantities only at one level of the distribution chain, at processing or at retail for instance. Economists who are interested in the elasticities of demand at several points in the chain have attempted to derive these elasticities from the known elasticity at one point by an analysis of the distributive margins of individual firms. AlIen (1, 2, 3, 4) has used a variant of this approach which is now generally accepted and widely used to show the optimum policy on distributive margins in the face of retail demand curves with different elasticities. He sets out the following thesis:

1. Retailers attempt to maintain as steady an income as possible in the short run. It follows that with an elastic price elasticity of demand they will vary their margins charging more per unit when prices are low (variable margins).
2. With an inelastic price elasticity of demand they will charge a constant absolute margin (fixed margin).
3. With a price elasticity of demand of unity the retail and wholesale prices will vary together in the same proportions (percentage margins).
4. The relationship between the consumers' demand and the demand facing farmers can be derived from the pricing policy of individual retailers.
5. As poor countries are more likely to have an elastic demand for food, they are more likely to have variable or percentage margins.
6. By using data from England, the Netherlands, Bangladesh, Italy and the D.S.A. he shows that poor countries do in fact have percentage margins more often than rich ones. The fact that this empirical result agrees with the expected result in Point 6 tends to confirm the hypothesis that retailers attempt to maintain a steady income in the short run.

The theoretical analysis is quoted with approval by MacArthur and Rashid (5) and Hallett (6) uses Points I, 2, 3, 4 and 5 of the argument. MacArthur and Rashid (5) used the same theoretical foundation both for an analysis of new data and for a reappraisal of AlIen's data and found that the evidence does not support this thesis. However, difficulties with the data are, they suggest, sufficient to explain why the evidence does not support the theory.

Their study shows no clear evidence in the mark-up policies of the type that the theory said would occur. Firstly, they discuss the operational difficulties which arise because many different policies are encountered other than the one assumed in the theory. They also discuss data problems which might invalidate the result. The discussion covers market data in some cases and data on individual firms in others. These difficulties are, they suggest, sufficient to explain why the evidence did not support the theory.

In this paper, the theoretical basis of the thesis will be examined. The hypothesis that most retailers aim to maintain a steady income in the short run will be accepted[1] but the chain of reasoning built on this hypothesis will be examined.

From the premise that retailers attempt to maintain a steady income in the short run, AlIen draws the conclusion that retailers will charge a higher margin when prices are low if the price elasticity of demand is elastic. Implicit in this is the assumption that each retailer sells only one commodity and tries to maintain a steady income from that commodity. If this were not assumed the derivation of elasticities of individual commodities would not be so simple. This assumption will be accepted for the following discussion though it will be relaxed in due course. It will be assumed that there is a single firm selling one commodity.

WHOLESALE/RETAIL PRICE RELATIONSHIP

In the thesis under discussion it is understood that the relationship between retail price and wholesale price at market level can be derived directly from the relationship between retail price and wholesale price at shop level. The observed relationships are plotted on a graph, a regression line is drawn and the relationship is classified as a "percentage margin," a "fixed margin" or a "semi-fixed margin,"[2] according to the slope and intercept of the curve, using the criteria laid down by AlIen or the rather different criteria laid down by MacArthur and Rashid.

There are several pitfalls in an analysis using these graphs with wholesale price on one axis and retail price on another and it would be unwise to embark on such an analysis without first familiarising oneself with the practical and conceptual difficulties by plotting the curves of different pricing policies at different levels of price elasticity of demand.[3]

As a first step in the examination of this point a graph should be constructed showing what curves are to be expected when a retailer adopts the constant income hypothesis. This is done in Figure 1, where the curves for unit elasticity, zero elasticity, infinite elasticity and some intermediate curves are shown.

It will be seen from this graph that when demand is perfectly elastic the wholesale price is not at all affected by the retail price. This must be the case as the retailer can adjust his buying price, but not his selling price. This would be classified as an "absolute margin" by MacArthur and Rashid,[4] while AlIen would classify it as a "fixed margin."[5] This is difficult

1 It can be shown in a rather simpler fashion that this policy is common. In a survey covering a sample of 20 Dublin greengrocers it was found that 10 greengrocers adopt this policy. Most of the others considered that this policy would be unworkable, impractical, ridiculous etc.

2 "By a fixed margin is meant a mark-up which is fixed absolutely and. to avoid too many categories, one which declines 3 as price rises and by a percentage margin, one in which retail price is always the same percentage of wholesale price" (4).

3 See Appendix I for such examples.

4 Y = A + BX where Y is the retail price of a given commodity, X is the corresponding wholesale price and A and B are constants. The relevant criteria are Absolute margins occur CH) when B is less than I and A is greater than 0 and (Hi) BX - X is equal to or less than half the value of A (5).

5 "Where the variable element (due to B) in the mark up is less than one third the value of the fixed element (due to A) or where the former is negative and the latter is positive and substantial, a fixed margin is assumed" (1).

to reconcile with AlIen's statement "If retailers are in a position to determine their mark-ups per unit of produce sold so as to give them stable returns in the short run, then the greater the price elasticity of demand for a commodity the more variable will the margin prove to be" (1).

When the price elasticity is unity the relationship between wholesale and retail prices is a straight line passing through the origin. This is classified by AlIen (1) and MacArthur and Rashid (5) as a percentage margin, which agrees with the general thesis.

When the demand curve is of zero elasticity the wholesale / retail curve is a straight line somewhat steeper than that when elasticity is unity. This is in accordance with the observation that when the demand curve is of zero elasticity the retailer will charge the same sum of money per unit sold whatever the price-the relationship between wholesale and retail price changes constantly depending on the retail price. AlIen would classify this curve as indicating a percentage margin as also would MacArthur and Rashid.6 Yet Allen argues: "Where demand, for example, is completely price inelastic it will be necessary for retailers to obtain a constant absolute mark-up in order to maintain stable gross incomes."

The confusion seems to have arisen because the authors were thinking in terms of a normal demand graph with price on one axis and quantity on another. When the data are plotted on a graph with wholesale price on one axis and retail price on the other, quantity is ignored entirely and the curves become very contracted at some points and expanded at others. Thus a curve three inches long on a wholesale/retail price graph of the type used, represents an enormous range of outputs when demand is elastic and only a very narrow range when it is inelastic. Be this as it may, it is clear that the criteria used by AlIen and by MacArthur and Rashid cannot be used in testing this thesis.

Yet another reason why these criteria may not be of much value is demonstrated in Figure 1. When demand is elastic the curves slope up, then level off and then slope down.7 It is immediately apparent that the criteria laid down, which depend on the slope and intercept of a linear regression curve, cannot be very useful in describing a curve of this sort. However, in the empirical studies (1, 2, 3, 4, 5) linear regressions are fitted fairly successfully to data on commodities with an elastic demand. One reason for this is that the bulk of the observations on any crop are likely to occur when the supply is at the same level so they will all be on the rising section of the curve or on the falling section.

Thus, if a retailer is operating at an output where the curve is rising, the linear regression curve will be rising and the policy might be classified as a percentage margin. At other times it might be classified as a fixed margin or a variable margin. Yet the retailer is operating the same policy with the same elastic demand curve. Other theoretical reasons why the observations might be bunched in this way are given below and practical reasons are discussed by MacArthur and Rashid (5).

Consequently, it may be concluded that the criteria offered by AlIen and by MacArthur and Rashid are not appropriate to this discussion, as they classify a margin of a constant sum of money as a percentage margin for instance. It may also be concluded that under any system based on a linear regression, a fixed income policy with a constant, elastic demand could be classified as "fixed margins," "percentage margins" or "variable margins." It will be shown below that where the elasticity of demand is not constant, where the demand curve is

6 Where the fixed element is calculated as negative ... a tendency towards a percentage margin is assumed" (1). "Percentage margins occur where •.. A is negative and B is greater than 1" (5).

7 In fact only the curves for e = 1, e = 0, and e = are straight lines: see Appendix 1

asymmetrical, this result will be normal.

It should not be assumed that the demand curves facing individual firms are of constant elasticity. A straight line demand curve is certainly not unlikely and this would have different elasticities along its length. Figures 2, 3 and 4 show the effect of a straight line demand curve on margins, when a constant income policy is pursued. In Figure 2, the straight line demand curve at retail is shown, and a corresponding wholesale price is derived from it, such that the margin [(retail price-wholesale price) x quantity] is constant. Figure 3 shows the wholesale/retail price curve derived from Figure 2. This is the relationship used by Allen in his analysis. It will be seen that with a linear demand curve the wholesale/retail price curve is negatively sloping at one point, positively sloping at another and more or less level at another so the retailer could be charging a percentage margin one day, a variable margin another, a fixed margin another, depending on the available supply. When the prices observed in a survey are plotted on a graph, or a linear regression curve is fitted, the slope will be negative if prices are high when most of the observations are taken, positive if prices are low and constant if prices are well scattered about the turning point. This causes problems in the analysis of the policy of individual retailers, as a retailer with a constant policy might appear to have any of several other policies. Thus, Points 2, 3 and 4 of the thesis are false, unless the demand curve is perfectly elastic, perfectly inelastic or of unit elasticity.

KINKED DEMAND CURVES

So far the analysis has been discussed in terms of a single retailer selling a single commodity. If the behaviour of an individual retailer in a market is considered the possibility of kinked demand curves, one form of asymmetrical demand curve, arises.

If the kinked demand curves described by Sweezy (11) do exist then the force of the last two arguments is crushing, for he argues that in an oligopolistic market the retailer bases his actions not on a statistical demand curve, but on an imagined demand curve based on the probable reactions of his rivals. Thus the pricing policy of an individual firm is not normally based on the demand facing the individual firm nor on the market demand curve, but on an imagined curve. This curve is asymmetrical, a kinked demand curve.

The kinked demand curve exists when an individual retailer believes that if he lowers his price, his rivals will quickly match his cuts in price, so his imagined demand curve is inelastic downwards. At the same time he believes that his rivals will only slowly follow any increase in price, so that his price will be above the market price for a period at least and he will lose trade. His imagined demand curve is then elastic to an increase in price. This type of kinked demand curve is believed to be fairly common, particularly in a small neighbourhood or in a retail market, where consumers have ready access to price news.

The shape of the kink depends entirely on what the retailer expects his rivals' response will be, so in certain cases the effect will be the opposite, with the imagined demand curve very elastic to a fall in price and rather less elastic to a rise in price.

In a developing country where bargaining and 'luck money'[8] are a normal part of retailing it is possible that the retailer will have an imagined demand curve that is relatively elastic to price reductions, as he can offer reductions to individual customers without it becoming generally known in the market. These reductions can be offered to selected customers, presumably those with the most elastic demands, thus obtaining some of the

8 In English markets a farmer who has sold a sheep may return the buyer a small sum of money as 'luck money.' In Africa the retailer may give an amount in addition to the amount bargained for as a gift, the size of the gift varying accordill8 to the charm and looks of the buyer as much as anything else (l2, 13).

benefits of discriminating monopoly. At the same time the retailer may believe, ,and it is emphasised that it is the belief that is important, that an increase in price will be matched by rivals, perhaps because the current price is unusually low, so the demand curve is inelastic to a rise in prices.

Changes in demand

The kinked demand curve may also arise not when the retailer is considering changing his price but when he is considering his response to a change in demand.

If demand falls, because of a change in the weather for instance, the retailer may believe that his rivals will match any fall in prices, so he will be selling the same quantity at a reduced price. If it is generally accepted in the trade that demand has fallen the retailer may feel that his price change will be understood by his competitors as being a response to changes in demand rather than as being the opening shot in a price war. As a result the imagined demand curve is inelastic downwards. If he leaves his price the same, inertia or the fear of retaliation may prevent his rivals from changing theirs. If he raises his price in response to a fall in demand he will be particularly likely to lose business, so the demand curve will be elastic with respect to rises in price.

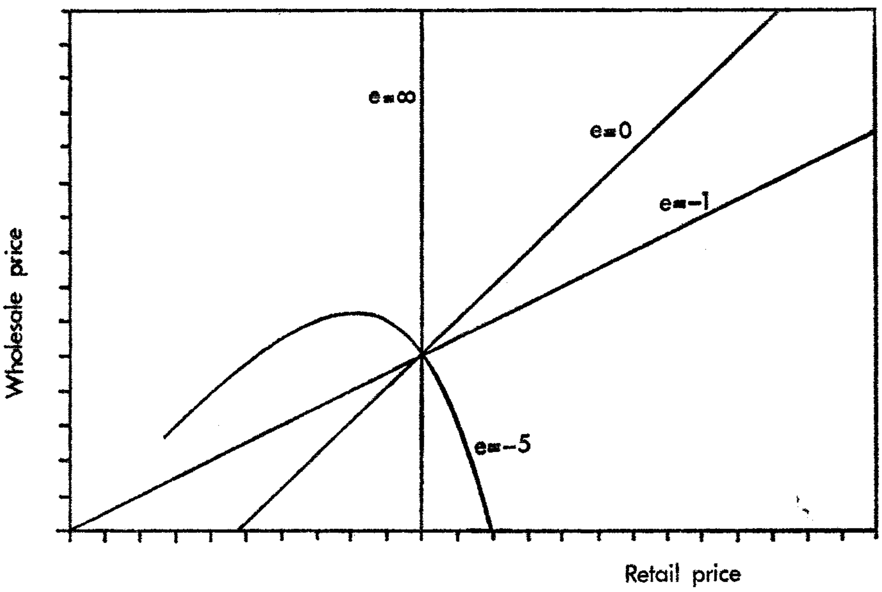

Figure 1: Relationship between wholesale and retail prices under constant-revenue policy: constant elasticity demand curves

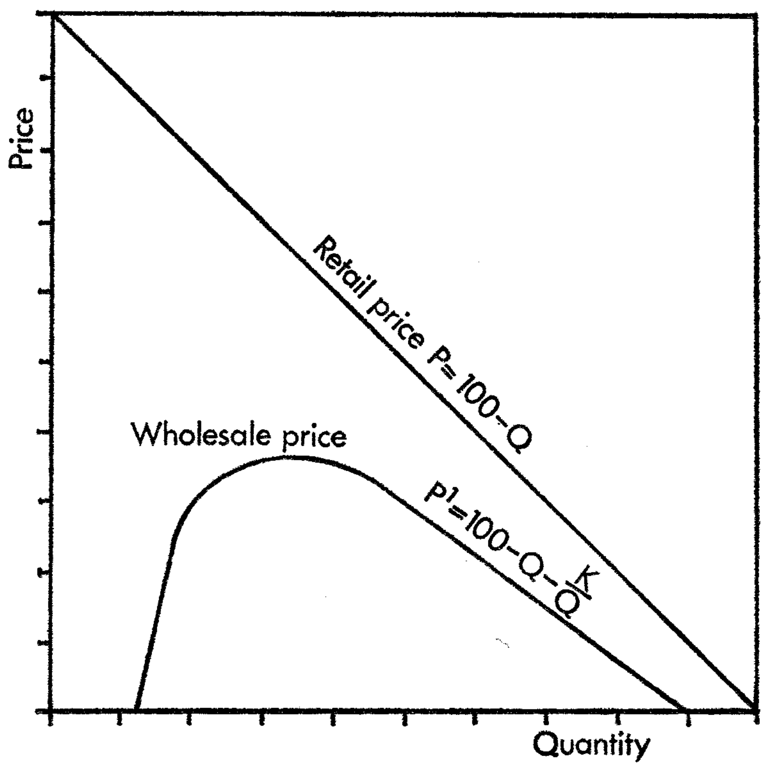

Figure 2: Wholesale price corresponding to certain retail prices under constant-income policy; linear demand curve

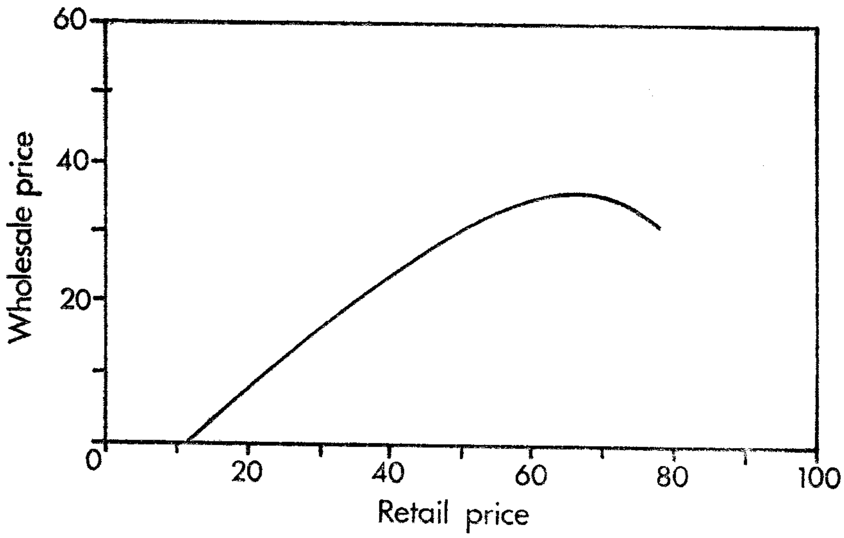

Figure 3: Relationship between wholesale price and retail price: constant revenue policy, linear demand curve (See Table 3)

If demand rises, the retailer knows that rivals will match any increase in price, so he will not lose any customers to them and the effect of a moderate increase in prices will be to keep revenue constant. Thus, the demand curve will be extremely inelastic upwards. If he reduces his price in response to the rise in demand he will gain customers from his rivals, who will not notice the loss as they have an increased sale to the remaining customers. Thus the imagined demand curve will be elastic downwards.

Seasonal changes in demand may take place as winter vegetables are demanded instead of summer salads, or as sprouts are demanded for Christmas dinner, so there may be a demand that is constantly declining or increasing over a period of months. In either case, the retailer who follows the trend in market price will face an inelastic demand, if he adjusts his price in the same direction as the rest of the retailers. The fact that the market demand curve or the individual retailer's demand curve, calculated from price and sales data, is elastic, is irrelevant to the decision-making process.

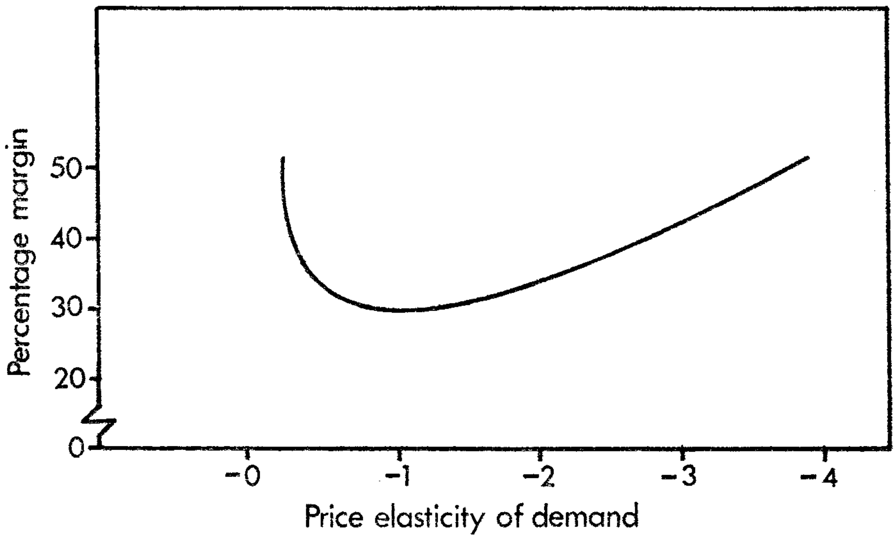

Figure 4: Percentage margin at different levels of price elasticity: constant revenue policy, linear demand curve

As the ordinary linear demand curve is asymmetrical in the same way as the kinked demand curve, being more elastic above the current price and less elastic below it, the implications to the wholesale price and to the wholesale/retail price relationship will be much the same as those illustrated in Figures 2, 3 and 4.

Changes in supply

The kinked demand curve can also arise when response to a change in supply is considered. When supplies fall, a retailer may believe that if he keeps his price unchanged his competitors will nevertheless increase their prices. The expected result will be that his sales will increase. If he reduces his price his sales will increase even more, but he may believe that this will spark off a price war. A price war is more likely to erupt when the market demand is elastic and a fall in sales means a fall in total revenue, for in these circumstances the other oligopolists are more likely to search for reasons why their sales are falling. When market demand is inelastic a fall in sales means a rise in total revenue and the other oligopolists, being better off than before, are less likely to react to undercutting. If the retailer were to match the price increases of his rivals he might believe that he would have the same market share and smaller sales.

It must be re-emphasised here that the imagined demand curve, although it may be based on past experience, is largely determined by the beliefs of the retailer which may be irrational or inconsistent. As a result no two retailers in a market may have the same imagined demand curve.

In the analysis of the kinked demand curve the retailer is always using the present moment as a reference point. When the supply falls or rises over a period as it will at the beginning of winter and the end of spring, the retailer is faced with the same problem each day or each week over an extended period. He may have to adjust to a rise in supply each week over an eight-month period. Thus he may well be on the extremely elastic part of his imagined demand curve for a period of eight weeks, when his statistical demand curve remains unchanged.

Supply and demand changes

It is not uncommon for a change in supply to take place at the same time as a change in demand, e.g. lettuces go out of season at the same time as the demand for winter vegetables increases. There are, of course, sound reasons why this should be so: no one developed winter salads because there is no demand for them and, in the short run, fewer lettuce are planted for the autumn and winter because costs are higher and demand is lower. The imagined demand curve, the imagined result of a simultaneous change in supply and demand, could be inelastic, elastic or even backward sloping. Thus, a wide variety of margins may be observed at any point of time, even if the retailers all adopt the same pricing strategy.

To sum up the effects of a kinked demand curve, the action that would be appropriate under a constant-income strategy will depend on whether the elasticity used is based on the market demand, the demand curve facing the individual retailer or the demand curve imagined by the individual retailer. The imagined demand curve, in particular, may bear little or no relation to the market demand curve, so aggregation is not likely to be of any value. This means that Points 2, 3 and 4, that retailers will vary their margins with an elastic price elasticity of demand, that they will charge a fixed margin with an inelastic price elasticity of demand and that they will charge a percentage margin with a unit elasticity of demand, are of no relevance when there is reason to believe that there is a kinked demand curve.

So far the discussion has been in terms of the maximum price the retailer could charge and still sell all he has to offer. His demand curve is this maximum. The wholesale price curve which has been developed indicates the maximum wholesale price he can pay if he is to earn his constant net revenue. However, the actual wholesale price may be quite different. Small retailers usually buy in a wholesale market where the supply is perfectly elastic-they can buy no more at a higher price than the market price and they can buy nothing at a lower price so the market price is the minimum supply price. From this constant purchase price a retailer can calculate what retail price he will have to charge at each level of sales to pay this wholesale price. This is the minimum retail price. This is shown in Figure 5 where the market price is a horizontal straight line (perfectly elastic curve) and the margin is the constant total net revenue divided by the number of units sold.

The retailer can obtain his constant net revenue while charging any price that is higher than the minimum retail price and lower than the maximum retail price. Which he will do will depend on whether he is a price maker or a price taker, whether he is trying to maximise the price to his supplier or minimise the price to the customer. He may of course charge a price outside this area, but if he does he will not obtain the desired net revenue.

If these curves are transferred to Figure 6 where retail price is plotted against wholesale price it will be seen that with an inelastic demand the points representing the wholesale/retail price relationship under the constant income criterion could be anywhere between the horizontal minimum curve and the upward sloping maximum curve. It is easy to postulate reasons why the regression curves of observed data might slope downwards here: for instance, the retailer may aim at maximum retail prices at low price levels and minimum retail prices at higher price levels.

The assumption of less elastic supply curves does not alter the analysis. This, again, proves that regression curves drawn through observed points do not indicate the price policy of an individual retailer.

The price elasticity of demand for a product may be very different if it is calculated on a daily, weekly or yearly basis. A housewife may choose the cheapest vegetables on display on any one shopping expedition, but over a week she will aim to serve her family a variety of produce, so her demand may be less elastic. Over a year she may have an even less elastic demand. For instance, once she knows that the Brussels sprout crop is short she will accept that a fairly high price, a price that she would not normally pay, is reasonable. Demand may be less elastic on Saturday when the housewife is buying for weekend meals than on Monday and Tuesday, when her family are taking some or all of their meals away from home and she can more easily postpone her purchases. It is certainly true, in western countries, that most vegetable sales are on Friday and Saturday and that Monday and Tuesday are slack days. Analysis of the demand for hogs in Chicago showed that the elasticity of demand was -5.8 on Saturdays, -2.8 on Wednesdays, -2.5 for weekly data and -1.0 on yearly data (14). As these are wholesale prices the very elastic demand on Saturday is largely because the hogs bought then will be sold retail on Monday and Tuesday, and the less elastic demand on Wednesday is for hogs that will be sold retail to weekend shoppers. After allowing for a retail margin, it is probable that the elasticity of demand at retail would be less elastic, covering a range from inelastic to elastic, so the appropriate margin would vary according to the time period under consideration.

A stallholder in a developing country seldom has more than a few pounds capital, so he cannot take less than the required income for more than one or two days without losing a substantial part of his capital. The normal period over which such a retailer would try to maintain a steady income would be one or two days. The English greengrocer is also limited in his resources: he may have two weeks' credit with his supplier and he may conceivably borrow from the bank. Under these circumstances, he must obtain the required income in each fortnightly period. In practice he is more likely to work on a weekly accounting period, accepting a small shortfall on Monday, Tuesday and Wednesday and making this up on Friday and Saturday. It is unlikely that the retailer with the extremely low turnover, the one who is particularly likely to follow a constant-income policy, will accept a shortfall for any longer period. However, as he is obtaining a constant income from a mix of products rather than from a single product he may even be willing to take a loss on one item for a considerable period of time, as long as he is making an overall profit. This may be part of a loss-leader policy or it may be due to indivisibilities, the jump from 2p to 3p a pound being too great to be acceptable, particularly if it is temporary. On occasion, it may be due to faulty accounting.

Is a retailer capable of calculating the prices required to maintain a constant income under these circumstances? The answer is Yes. He may not explicitly take price elasticity into account but he can give a good estimate of sales on any day of the week under given weather conditions with given prices. If he consistently underestimates sales he may lose business, and, in the long term, new rivals will enter the market. If he overestimates sales he will be left with an unmarketed and perhaps unmarketable surplus. If he is a poor judge of sales, in fact, he will not be a successful greengrocer and will soon go out of business. Some of the large chains I approached have wastage rates, including losses due to marking down produce at the end of the day, of less than one per cent, which shows how accurate such forecasts can be (7).

How important is it that the statistics used should refer to the same time period as the 'short-run' over which retailers maintain a constant income? If the retailers think of one day, and the statistics refer to a week, then the weekly figure could be the sum of several different percentage margins, or the sum of absolute and percentage margins, or the sum of different absolute margins on each day of the week, and it would not be clear to the user which of these he was measuring. Certainly, such a calculation should be based on weighted data. In practice, it is more likely to be based on modal mid-week prices, that is, on the prices on low-turnover days. It is, in any case, true that the means of such a variable will have a lower variance than the individual observations and that the relationship of the retail price to the wholesale price will appear to be more stable than it actually is. There is also the point made above, that the wholesale price on any day of the week may not refer to produce retailed on that day. Thus the appropriate margin will depend on the time period over which the retailer is attempting to keep a constant income. If the analysis of the demand facing retailers is based on the wrong time period, or even the wrong days of the week, the policy on margins may appear to be irrational or inconsistent. The analysis of market demand will certainly produce such results unless all retailers in the market have a price strategy relating to the same period and this is the time period to which the statistical analysis relates.

From the premise that retailers attempt to maintain a steady income in the short run, AlIen draws the conclusion that retailers will charge a higher margin per unit when prices are low if the price elasticity of demand is elastic, and he uses this to derive the elasticity of demand at wholesale for individual commodities. Implicit in this is the assumption that each retailer sells only one commodity and tries to maintain a steady income from this one commodity. In fact, most retailers sell a range of fruits and vegetables, some of which are in season at any time of the year, and the retailers are more likely to attempt to maintain a steady income from the combined revenue than they are to maintain a steady income from each individual commodity.

If the retailer has the same turnover in each month he can achieve this aim by taking a constant percentage margin, even when he sells different products in each season, cauliflower in summer, sprouts in winter, for instance. In so far as the turnover fluctuates, a variable margin is necessary to maintain the income, but the fluctuation in turnover must be lower than the fluctuation of price or quantity of anyone good, both because of the high price when supplies are short and because of the increased sales of one good when another is not available.

Only in a developing country is it common to find retailers selling a single product who would attempt to maintain a steady income in the short term. Retailers of this sort have only a small share of the market. In a developed country the single-commodity retailers, the dairymen, the bakers, the shoe shops tend to have fixed prices and variable incomes.

Clearly, then, the basic pricing policy, Points 2,3,4 of the thesis, would be confined to the developing countries, and even there to one sector of the retailing trade, the small market traders, a sector for which is particularly difficult to get data. The nearest one could get to applying it to a developed country would be to say that small retailers, in particular, may aim at keeping a constant short-term income, which they might do by several means, including charging a fixed percentage margin. MacArthur and Rashid (5) on the other hand, conclude: "This explanation seems very plausible for fruit and vegetables retailing in developed countries, although it may be less appropriate for developing countries."

Thus, the relationship between wholesale and retail prices at market level, a relationship which is important for some analytical purposes, cannot be derived from the behaviour of individual firms, unless an enormous amount of data-sales and price data for a year, or period of years, for a representative sample of firms-is available. It would be a lot easier to obtain the necessary information from market statistics. The first point, that the pricing policy of individual retailers explains the relationship between consumers' demand and the market demand facing farmers, is refuted.

THE INDIVIDUAL RETAILER

It has been shown so far that it is impossible to derive an individual retailer's pricing policy from his buying price and his selling price alone. Firstly, the regression curves drawn through empirically derived data could very easily be confused (Figure 1) even when the demand curve is of constant elasticity. Secondly, the confusion is worse if the curves are not of constant elasticity. Thirdly, even if the elasticity of demand, and the quantities sold, are known, it is the imagined demand curve that the retailer bases his price on. Discrepancies between the time period over which a retailer balances his income and the time period over which the data are collected invalidate such a comparison. Finally, a retailer attempting to maintain a steady income in the short run will do so by attempting to maintain his income from his total sales rather than by maintaining a steady income from the sales of each item.

RETAILER'S DEMAND OR MARKET DEMAND

Even if the existence of the imagined demand curve is ignored, the differences between the objective statistical demand curve facing the retailer and the objective statistical market demand curve must be discussed.

Allen says: "I have argued in the previous *Farm Economist* article, and more particularly in my book, that retailers attempt as far as possible to maintain their own gross returns as stable as possible in the short run and that this motive provides a key to our understanding the short-term behaviour of retail margins on horticultural produce. If retailers are in a position to determine their mark-ups per unit of produce sold so as to give them stable gross returns in the short run, then the greater the price elasticity of demand for a particular commodity the more variable will the margin be" (1).

Clearly the price elasticity of demand referred to must be the demand facing the individual retailer. He cannot know, let alone be directly influenced by, the market demand. One might expect that a single small retailer, one of hundreds, and particularly a single small retailer in a retail market, would face a perfectly elastic demand curve, as in perfect competition. This would, of course, make nonsense of the whole thesis: all or nearly all retailers would charge variable margins, whatever the country in which they operate, as all would face perfectly elastic demand curves.

However, even a cursory glance at a retail market in England shows that there can be a wide range of prices over a very small area, with two neighbouring stalls having different prices. This variation can only exist because of monopolistic elements in the market, mainly due to consumer loyalty, the housewife believing that one retailer has better produce or is more honest, or gives better service or is more cheerful. The location is important even at this level: the retailers near the entrance to the market and on the main routes through the market can charge more than retailers in the backwaters where casual customers would not normally go. There is adequate empirical evidence to show that locational monopoly is important: all large retailers use pedestrian flow analysis when choosing a site for a shop and take into account the availability of public transport and the location of other shops which attract the general public (9). On a smaller scale, it is possible to determine the optimum location of the different departments of a supermarket and even the optimum layout of a display. Much of this work has been done by large manufacturers interested in obtaining locational advantages for their products. Anderson and Schaffer (10) have done a similar analysis for greengrocery.

Once it is accepted that the market is not an example of perfect competition but of imperfect competition, and that retailers do not face a perfectly elastic demand in the short run, other variations, essentially variations in market demand, become relevant. There are substantial differences in the demand for fruits and vegetables in different regions; different income groups have distinct consumption levels for the individual vegetable items, so the characteristics of the demand facing a retailer who sells mainly to the AB income group is atypical in many ways, not least of these being elasticity of demand. Thus a wide variety of elasticities of demand exist at anyone time and there is a variety of appropriate mark-ups even on the Allen thesis.

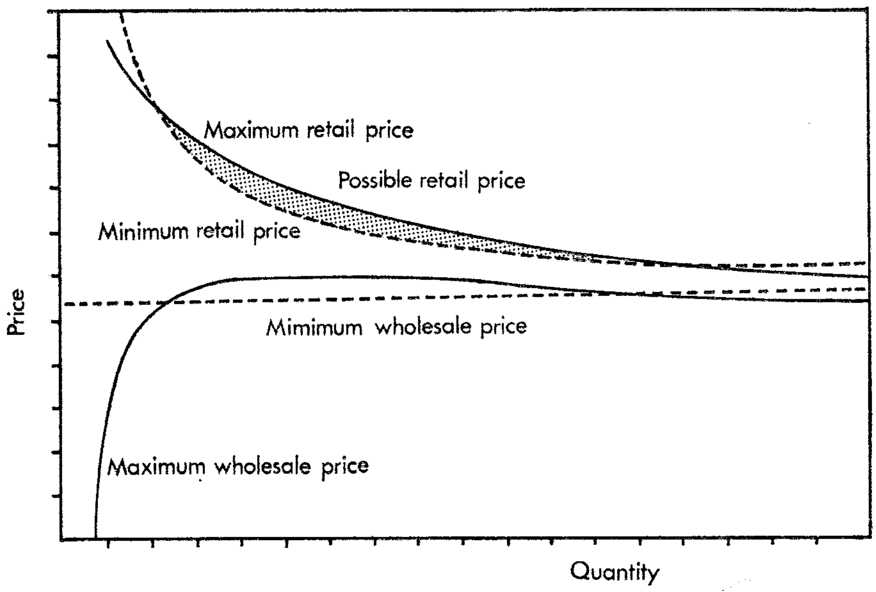

Figure 5: Range of prices that will secure a constant income at any level of sales. Perfectly elastic supply curve

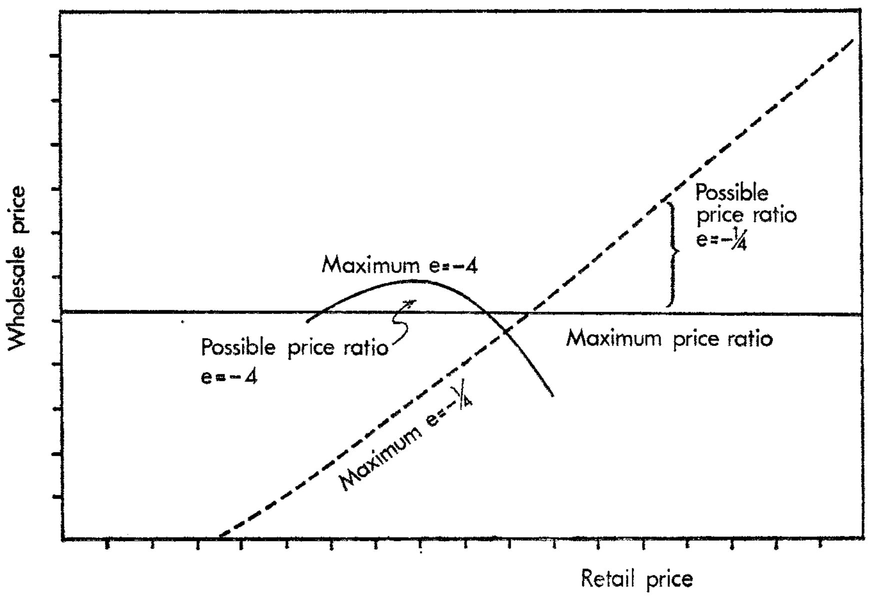

Figure 6: Relationship between retail and wholesale prices when a retailer is free to charge a range of prices: constant revenue criterion, perfectly elastic supply curve

This invalidates Point 6, that countries with elastic market demands for food are more likely to have percentage margins, for it has been shown that an elastic market demand for food can exist simultaneously with inelastic demands facing each individual retailer. Further, it has been shown that individual retailers normally face demand curves with different elasticities. There remains the possibility that where market elasticities are low the elasticities facing most individual retailers will also be low. There is no particular reason to expect that this will be the case and some reasons for expecting the opposite to be the case will be presented below.

So far the discussion has been mainly about the use of this analysis on the behaviour of individual firms. The data used by AlIen and MacArthur, however, referred to prices reported in markets. The question now arises, how far can the behaviour of market margins be derived from the behaviour of individuals in that market?

It has been shown above that even firms operating the same constant-income policy with the same elastic price elasticity of demand may appear to have very different policies if their wholesale-price retail-price relationship is plotted on a graph. When market prices are quoted they are usually some sort of a mode of the wholesale price and of the retail price. The assumption of the thesis is that in some way these market prices reflect the true price. In fact the mean market price will be

$$R = \frac{\Sigma(x_i\, p_i\, (1+m_i))}{\Sigma(x_i)}$$

Where R = average retail price in the market as a whole,
x_i = the quantity sold by the ith firm,
p_i = the price paid by the ith firm,
m_i = the mark-up of the ith firm divided by its wholesale price.

What is argued in the thesis under discussion on the other hand is that

$$R = \frac{\overline{X}\overline{P}(1+\overline{M})}{\overline{X}} = \overline{P}(1+\overline{M}) = \frac{\Sigma(x_i\, p_i\, (1+m_i))}{\Sigma(x_i)}$$

Where $\overline{X}$ is the mean sales,
$\overline{P}$ is the mean (or modal) price at wholesale,
$\overline{M}$ is the mean mark-up.

If x_i, p_i and m_i were independent it is possible that $\overline{P}(1+\overline{M})$ would be an acceptable approximation to $\frac{\Sigma(x_i\, p_i\, (1+m_i))}{\Sigma(x_i)}$ but this is clearly not so. It has been shown that there is no reason to expect a consistent relationship between the retail price and the wholesale price of individual retailers even if they face identical demand curves and have identical pricing strategies. In fact the margin is related to the price and to the turnover of the individual retailer; the retailer with a large turnover will have a lower margin than the small retailer (if, indeed, he does not adopt a different pricing strategy). If the price is high the margin will tend to be high. If the price is high, sales will tend to be low. As a result $\overline{P}(1+\overline{M})$ would give a seriously biased estimate of R, because of incorrect weighting.

If allowance is made for the fact that the market prices reported are often median prices or modal prices, X could be interpreted as the mean sales, P as the median or modal price and M as the median or modal margin. This would emphasise the difficulty in aggregation.

Where asymmetric demand curves exist, and it is suggested that these are common, the problem is more difficult, even if it is assumed that all retailers face the same demand curve.

If allowance is now made for the fact that each firm is likely to face very different demand curves the solution is even less likely.

Account must also be taken of the fact that different firms have different policies.

At best only perhaps three-quarters of all retailers will adopt a fixed income policy and even these will have the fixed income policy for, say, their greengrocery items, adopting different policies for different items.

It has been shown previously that it is impossible to derive the policy of an individual firm from details of its retail price and its wholesale price unless the quantities sold are known and one has some idea of the imagined demand curves. It is shown here that it is no easier to derive the wholesale/retail price relationships of individual retailers from the wholesale/retail price relationships of the market.

SUMMARY

The logical basis of the thesis is incorrect. It is impossible to identify an individual retailer's pricing policy from his buying price and his selling price alone. Firstly, the regression curves drawn through empirically-derived data could very easily be confused, even when the demand curve is of constant elasticity. Secondly, if the demand is not of constant elasticity there is even more room for confusion. Thirdly, the retailer's pricing policy is based on his imagined demand rather than on a statistical demand curve, so the policy could not be derived even if one had access to the most detailed figures of purchase prices, selling prices and quantities sold.

Even if it were possible to derive such a relationship, the criteria proposed by Allen and by MacArthur and Rashid would not classify the relationships correctly.

There may be a range of appropriate prices with a given supply, demand and pricing policy.

Comparisons are pointless if the time over which the data are collected and the time over which the retailer aims to steady his income are not the same.

A retailer attempting to maintain a steady income in the short-run will do so by attempting to maintain his income from his total sales rather than by maintaining a steady income from the sales of each item.

An elastic demand can exist simultaneously with inelastic market demands facing each retailer, so it cannot be assumed that, because the market margins would provide the market as a whole with a constant revenue, the margins of individual retailers would provide them with a constant revenue.

It is impossible to aggregate the margin policy of individual retailers in the way suggested.

Any of these points is sufficient to invalidate the thesis.

DISCUSSION

There does not seem to be any possibility of developing a general approach to the problem of deriving a wholesale demand curve from the retail demand curve plus knowledge of the distributive margins. An analysis of an oligopolistic market might be feasible but the assumptions on pricing policy and imagined demand curves would prove very restrictive.

The alternative is one of finding the relationship between market prices at retail and at wholesale levels over a period of years and assuming that the relationship will remain constant over a short period. However, the combination of forces that goes to make up a market curve can change as discussed above, and the data problems described by MacArthur and Rashid are insuperable in many markets.

ACKNOWLEDGMENT

The author wishes to thank J. Connolly, P. Cox and P. J. Drudy for their comments on this paper. He is especially grateful to F. K. O'Neill for suggesting the line of argument followed in the section entitled *Range of possible retail prices.*

APPENDIX 1

APPENDIX

A constant elasticity demand curve has the function

$$x = aR^e$$

Where R is the retail price
a is a constant
x is the quantity sold
e is the elasticity of demand, which is normally negative.

$$\frac{x}{a} = R^e$$

$$\left(\frac{x}{a}\right)^{\frac{1}{e}} = R$$

The mark-up which will give the retailer a constant net revenue K will be $\frac{K}{x}$ so the wholesale price will be

$$W = \left(\frac{x}{a}\right)^{\frac{1}{e}} - \frac{K}{x}$$

$$= R - \frac{K}{x}$$

$$= R - \frac{K}{aR^e}$$

Where $e = -1$, unit elasticity, $W = R\left(1 - \frac{K}{a}\right)$

Thus, the curve for $e = -1$ on the wholesale/retail price graph (Figure 1) will be a straight line passing through the origin and W will be a constant proportion of R.
Where $e = 0$, $W = R - \frac{K}{a}$

Demand is perfectly inelastic so x is constant. Thus the curve for $e = 0$ on the wholesale/retail price graph is a straight line of 45° slope cutting the R axis at $\frac{K}{a}$

Where e is infinity the demand curve is perfectly elastic. There is only one value of R so all observations of W fall in a vertical straight line at this value of R on the wholesale/retail price graph. The highest point on this curve is $W < R$. Algebraically—

$e \rightarrow -\infty$

$W \rightarrow R$	$R < 1$
$W = 1 - \frac{K}{a}$	$R = 1$
$W \rightarrow -\infty$	$R > 1$

(That is to say that when the price charged is greater than the appropriate price R=1, the retailer will sell nothing at all and no margin can give him any revenue.)

$e \rightarrow +\infty$

$$W \rightarrow -\infty \qquad R < 1$$

$$W = 1 - \frac{K}{a} \qquad R = 1$$

$$W = R \qquad R > 1$$

APPENDIX TABLE 1: Derivation of wholesale/retail price relationship for a constant elasticity curve $e=\frac{1}{3}$

x	$R = \left(\frac{a}{x}\right)^{\frac{1}{e}}$	Margin $= \frac{K}{x}$	$W = R - \frac{K}{x}$
2	125.000	2.500	122.500
4	15.625	1.250	14.375
6	4.633	0.833	3.800
8	1.954	0.625	1.329
10	1.000	0.500	0.500
12	0.578	0.417	0.161
14	0.364	0.357	0.007
16	0.244	0.313	—
18	0.172	0.278	—
20	0.125	0.250	—
40	0.016	0.125	—
60	0.005	0.083	—
80	0.002	0.063	—
100	0.001	0.050	—

APPENDIX TABLE 2: Derivation of wholesale/retail price relationship for a constant elasticity curve e=4

x	$R = \left(\frac{a}{x}\right)^{-\frac{1}{e}}$	$\text{Margin} = \frac{K}{x}$	$W = R - \frac{K}{x}$
2	1.495	2.500	—
4	1.257	1.250	0.007
6	1.136	0.833	0.303
8	1.057	0.625	0.432
10	1.000	0.500	0.500
12	0.955	0.417	0.538
14	0.919	0.357	0.562
16	0.889	0.313	0.576
18	0.864	0.278	0.586
20	0.841	0.250	0.591
40	0.707	0.125	0.582
60	0.639	0.083	0.556
80	0.595	0.063	0.532
100	0.562	0.050	0.512

APPENDIX TABLE 3: Derivation of wholesale/retail price relationship for a linear demand curve. Constant-income policy

x	$(100 - x - \frac{K}{x})$	R = (100 − x)	$\text{Margin}\ \frac{K}{x}$	Percent margin	Elasticity
0		100.00	—	—	
10	(−10.00)	90.00	—	—	9.00
20	30.00	80.00	50.00	62.5	4.00
30	36.67	70.00	33.33	47.6	2.33
40	35.00	60.00	25.00	41.5	1.50
50	30.00	50.00	20.00	40.0	1.00
60	23.33	40.00	16.66	41.5	0.66
70	15.71	30.00	14.29	47.5	0.43
80	7.50	20.00	12.50	62.5	0.25
90	(−1.11)	10.00	—	—	0.11
100	(−10.00)	0.00	—	—	0.00

N.B.—Q is the quantity supplied.
R is the retail price at various levels of Q, P = (100−Q).
W is the wholesale price corresponding to various levels of P.
This will ensure the retailer a constant revenue $(P^1 = P - \frac{K}{Q})$

REFERENCES

1. Allen, G. R., *Fm. Economist* 9: 259-266, 1959.
2. Allen, G. R., *Farm Economist* 9: 569-573, 1961.
3. Allen, G. R., 'Agricultural marketing policies,' Basil Blackwell, Oxford, 1959.
4. Allen, G. R., *Fm. Economist* 8: 1-16, 1956.
5. MacArthur, J. D. and Rashid, A., *Fm. Economist* 12: 90-106, 1971.
6. Hallett, G., 'The economics of agricultural policy,' Basil Blackwell, Oxford, 1968.
7. Bowbrick, P. and Hinton, W. L. 'The procurement, distribution and sale of fresh vegetables by large supermarket chains, variety-store chains and greengrocery chains,' Dept. of Land Economy, Cambridge University, 1971.
8. Gornall, *E.,J. ind. &on.* 207, Augnst 1954. National Economic Development Office, 'The future pattern of shopping,' HMSO, London, 1971.

9. Anderson, D. L. and Schatfer, P. F. 'Display location and customer service in retail produce departments,' USDA, Washington. 1961.
10. Sweezy. P. M., *J.political Econ.* 47: 468-573,1939.
11. 'African market vendors in Lusaka: with a note on the recent boycott.' Human problems in British Central Africa, No. 22, 1969.

12.Dean, Edwin R. 'Studies in price formation in African markets.' Human problems in British Central Africa, No. 31, 1962.

13. Shepherd, G. S., 'Agricultural price analysis.' Iowa State University Press, Ames, 5th edn., p. 64, 1966