ESTIMATING THE DEMAND FOR RECORD ALBUMS

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Because of the great importance of taste as a determinant of demand for phonograph records, little work has been done in the area of estimating their demand. This study introduces a way of measuring the taste for popular record albums, thus permitting an estimation of their demand by using multiple regression analysis. Taste was measured through the performance of singles taken from the album. Combined with this taste variable were the status of the artist, exposure by radio play and concerts, and submarket appeal. These were found to be statistically significant variables and provided an apparently valid model for estimating demand.

An attempt was also made to estimate the price elasticity of demand in order to judge whether recently instituted price increases can be justified. (A 1977 trade publication article[1] indicated a concern by the record industry regarding the importance of the price variable.) Price was found to be of minor importance and in the inelastic range.

The Sample. All of the data for this study came from *Billboard* magazine. The sample consisted of 141 record albums which appeared on the *Billboard* Top LPs chart in the first half of 1977. The sample consisted of all albums which fell off this chart between April 23 and July 9, 1977, except for the following, which were excluded: 1) all "greatest hits" albums, which are compilations of material previously released on other albums; 2) other reissues of previously released material; 3) all "live" albums, which are generally live concert performances of material previously released in studio-recorded versions; 4) all albums that returned to the charts after July 2; and 5) all albums which first entered the charts before 1976. The last group was excluded because data on one of the variables (radio play) were not available before late 1975 and because the list price on some of these albums was changed since their initial release.

The Variables. The dependent variable, QA, in our demand equation is an estimate of the quantity of records sold. Since actual sales data are not readily available, the chart performance of the albums on the *Billboard* Top LPs chart (which consists of 200 records per

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[1] "Dealers, Customers Gripe but Accept $1 LP Price Rise," *Billboard*, May 7, 1977, pp. 1, 10, 12, 14, 77, 85, 90.

week) was used instead. This performance was measured by taking 201 minus the chart position, summed over all weeks for which the album appeared on the chart.[2] (Thus the number 1 album gets a value of 200 and the number 200 album gets a value of 1, etc.) Although these charts are estimates of relative, not absolute, sales performance, a source in the industry[3] has estimated that the correlation between chart performance and actual sales is about .9, indicating that QA provides a reasonably good estimate of sales. The range of observed values of QA was from 2 to 7865, with a mean of 1199.

The independent explanatory variables in our model were chosen to estimate the following factors affecting demand: taste, artist status, exposure, submarket appeal, and price. All of these variables except price were expected to have a positive effect on sales. Price was expected to have a negative effect on sales, in accordance with a usual downward-sloping demand curve.

Taste was measured by QS, the performance on the *Billboard* Hot 100 singles chart of 45 rpm singles taken from the album. Performance on this chart (which consists of 100 records per week) was measured by taking 101 minus the chart position, summed over all weeks for which the single appeared on the chart. If more than one single was taken from the album, QS is the sum of the chart performances of all of the singles. Since these singles are excerpts from the album, their sales can be taken as an indication of the appeal of the music in the album to the public. Many of those who buy albums do so because they contain these popular singles. The range of observed values of QS was from 0 to 4023, with a mean of 346.

Artist status was measured by QP, the performance of the artist's most recent previous album (disregarding "greatest hits" albums) on the Top LPs chart. This was measured in the same way as QA.[4] It is taken as an indication of the popularity of the artist. Some of those who buy albums do so because they liked the artist's previous album. The range of observed values of QP was from 0 to 13813, with a mean of 1392.

[2] Because no issue of *Billboard* was published for the week of January 1, 1977, the chart positions for that week were assumed to be the same as for the previous week.

[3] Thomas F. Dunne, Capitol Records, Inc., private communication.

[4] In two cases where the previous album was still on the chart when the sample album fell off, the summing of the chart performance for QP was stopped at the time the sample album fell off the chart.

Exposure was measured by RC, the total number of mentions in the *Billboard* Album Radio Action regional listings under the categories "top add ons," "top request/airplay," and "breakouts," plus the number of live concert appearances listed in the *Billboard* Top Box Office charts during the weeks the album was on the charts. This is an indication of the extent of radio play the album received on the radio stations surveyed, which are mainly FM album-oriented rock stations, and the additional exposure of the artist in live concert appearances. Many of those who buy albums do so because they heard the album (or selections from it) on the radio or saw the artist in concert. The radio play and concert totals were originally included as separate variables, but since their coefficients were approximately equal and since there was some multicollinearity between the variables, it was decided to combine them into one variable. The range of observed values of RC was from 0 to 41, with a mean of 5.9.

Submarket appeal was measured by SU, the number of submarkets for which the album appeared on the *Billboard* submarket album chart or for which singles from the album appeared on the submarket singles chart. The submarkets included in this variable are country, soul, jazz, easy listening, and disco. These submarkets are for different types of music than that primarily programmed by the radio stations included in the variable RC. No attempt was made to compute the performance on these submarket charts, because sales of the records in these submarkets constitute part of the total sales of the records, measured by QA and QS. Originally, separate "dummy" variables were tried for each of these five submarkets. However, the coefficients for the five submarket variables were of similar magnitude, and the overall fit was better when SU was used. Thus it was decided to combine the five categories into one variable. The range of observed values of SU was from 0 to 3, with a mean of 0.9.

Price was measured by PR, the list price of the album. Even though there normally is discounting at the retail level, the sales prices in any one location are generally approximately proportional to the list prices. Thus percentage variations in actual sales prices (used in computing elasticities) are generally about the same as percentage variations in list prices. The observed values of PR were 6.98 and 7.98, with a mean of 7.04.

The Estimates. The model which was estimated is: $QA = b_0 + b_1QS + b_2QP + b_3RC + b_4SU - b_5PR$. The estimated equation is:

$$\underset{(0.29)}{QA = 457.7} + \underset{(12.61)}{1.112\ QS} + \underset{(7.10)}{0.2043\ QP} + \underset{(8.46)}{65.32\ RC} + \underset{(5.19)}{344.2\ SU} - \underset{(0.40)}{88.30\ PR.}$$

The numbers in parentheses are the t-statistics for the coefficients. A t-value of greater than 1.65 indicates that the coefficient is significantly different from zero for a one-sided test at the .05 significance level. The coefficient of determination, $R^2 = .824$, indicates that most of the variation in QA has been explained by this regression. Nevertheless, the residual variation is still moderately large, as indicated by the standard error of estimate, $s = 618.02$. (This, though, is only about 8% of the range of observations for QA.) All the coefficients have the expected sign. However, since the coefficient of PR was not significantly different from zero, the equation was re-estimated, dropping that variable. The results are:

$$QA = \underset{(1.79)}{-166.3} + \underset{(12.70)}{1.115\ QS} + \underset{(7.20)}{.2019\ QP} + \underset{(8.51)}{65.45\ RC} + \underset{(5.34)}{348.4\ SU.}$$

$R^2 = .824$ and $s = 616.11$. The coefficients of all of the variables are similar in both regressions. The only noteworthy change is the shift in the intercept from positive to negative. The positive intercept in the first equation is an estimate of QA when a record's price is reduced to zero and all the other independent variables are also zero. The negative intercept in the second equation can be interpreted as being a result of the fact that a 0 value of QA does not necessarily correspond to zero sales. Thus the intercept can be thought of as an estimate of the degree of "backward extrapolation" of the charts needed to reach zero sales.

As expected, the variable introduced to measure taste, QS, proved to be the most significant one in the model, as is shown by its t-value. This also indicates the importance of the use of singles as a way of promoting the sales of an album. The second most significant variable was RC, revealing the importance of radio play and live concerts in giving exposure to a record. The third most significant variable was QP, taken as a measure of the artist's popularity. As might be expected, the coefficient of this variable is substantially less than one, suggesting that a follow-up album can be expected to sell only about one-fifth as well as the previous album in the absence of any other stimulus to sales. Next in significance was SU, indicating the importance of submarket appeal. This also reflects the importance of the "cross-over" effect of the appeal to more than one submarket, which is often discussed in the record industry. Price, PR, does not seem to be a significant detriment to sales, reinforcing the opinion of some in the industry that "the public will pay for what it wants, even though it may bitch about the higher cost."[5]

The Price Elasticity. Although the coefficient of price in the first equation above is not very reliable (as indicated by its low t-value), it is of some interest to consider the implications of this coefficient. First, the price elasticity of demand at the means can be estimated by multiplying the coefficient by the ratio of the mean values of PR and QA.[6] In this case, the elasticity estimate is $b_5 \frac{\overline{PR}}{\overline{QA}} = 88.30 \frac{(7.04)}{(1199)} = .52$. Of course, the price elasticity for a linear demand curve (as we have here) is not constant. Since the estimated elasticity is less than one at the means, this indicates that revenues (and profits) could be increased by raising the price of albums of at least average demand to the point where the price elasticity is one. This point can be determined by finding the demand equation that corresponds to the average values of the other variables, solving for the equation with the slope b_5 which goes through the point whose coordinates are the mean values of PR and QA or, alternatively, substituting the mean values of QS, QP, RC, and SU into the first of the above estimated equations. In either case, the estimated equation is $QA = 1821 - 88.30PR$, or, solving for PR, $PR = 20.62 - .01133QA$. The point where elasticity is one is the midpoint, where $PR = 10.31$ and $QA = 911$. However, since our estimate of b_5 is not very reliable and since $10.31 is well above the highest price observed in our sample, it would probably be unwise to immediately raise prices to that level. But the recent introduction of several albums of expected high demand at a list price of $7.98 instead of the previously prevailing list price of $6.98 seems justified in view of the goal of profit maximization. (Some of these higher priced albums were included in our sample.) This justification is reinforced by the relative insignificance of the coefficient of price in the estimated demand equation.

[5] *Billboard, op. cit.*

[6] Since b_5 is the estimate of the change in QA caused by a one-unit change in PR, i.e., $\Delta QA/\Delta PR$.

However, the regression results do not justify an across-the-board list price increase on all albums. Although the price coefficient is not significant, it is still negative, indicating that price may well have at least some detrimental effect on sales, which could be important for albums of less than average demand. Specifically, the formula for the price elasticity, $b_4 \frac{PR}{QA}$, can be set equal to one and solved for $QA = b_4 PR$ to find the demand level (resulting from different values of the other variables QS, QP, RC, and SU) which would result in revenue maximization for any given price. For a list price of \$7.98, this is $QA = 88.30\ (7.98) = 705$. Thus, for albums with an anticipated demand of less than $QA = 705$, a list price of \$7.98 could result in some revenue loss. (Since profit maximization generally occurs at a slightly higher price and lower quantity than revenue maximization, a slightly lower anticipated demand could be consistent with profit maximization at a list price of \$7.98). More widespread use of variable pricing, instead of the historical practice of a uniform list price, seems justified.

It is also of some interest to compare the above estimate of average price elasticity with an industry estimate[7] made when there was an across-the-board list price increase from \$5.98 to \$6.98. This 16.7% price increase resulted in an estimated loss of unit sales of 14%, corresponding to an elasticity of about .84, which is .32 larger than the above estimate.[8] All of the discrepancy could be attributable to the unrealiability of the estimated price coefficient in the regression. However, there are also other reasons to expect a difference between the two estimates. Probably the most important is that the measure of sales used in this study is a measure of relative sales, while absolute sales were used in the industry estimate. Thus, the regression estimate can be expected to reflect only the substitution effect of the price increase on demand, and not the income effect. The loss of "real" income resulting from the higher price would tend to depress total unit sales of all records, in addition to the estimated impact on relative sales. On the other hand, the industry estimate takes both effects into account by the use of actual unit sales. Another possible factor is that there may be some simultaneous equations bias in the regression estimate due to the interaction between supply and demand. However, since the list prices generally remain fixed in the face of fluctuating demand, and since the simple correlation between PR and QA or QP is not significantly different from zero, the magnitude of this bias is probably minor.

[7] Dunne, *op. cit.*

[8] A minor difference is that the above regression estimate is a point elasticity, while the industry estimate is an arc elasticity.

Conclusions. The model introduced above seems to be useful in the study of demand in this industry. The following policy implications seem warranted: In view of the signifiance of QS and RC, the emphasis currently prevailing in the industry towards promoting records through quality rather than price seems justified. Specifically, the promotion of albums through the release of singles from the album, attempts to get radio play, and encouraging artists to tour when their albums are released are important ways of increasing the sales of the album. Thus, for example, record company subsidies of artists' tours that coincide with album releases can be expected to pay off in increased sales. Since price does not appear to be a significant detriment to sales, selected price increases for high demand albums should increase profits. A variable pricing policy (charging different prices for different albums) is recommended.

Although the regression estimates seem reasonably satisfactory, there are ways the results could have been improved through the use of more or better data. These include the following:

(1) The use of actual sales data (instead of chart performance) would make the results more trustworthy.

(2) A more comprehensive survey of radio stations with a wider variety of formats would probably make radio play an even more significant variable and might well eliminate the need for the submarket variable. Ideally, the reports of the radio stations should be weighted by the size of their listening audience The kind of information used by the performing rights organizations (ASCAP and BMI) to determine royalty payments might be useful.

(3) A substantially larger sample would be needed to get more reliable estimates of the true impact of price change on sales.