

BeQuiet, a manufacturer of computer fans, is considering expanding its product line to include fans that may be louder but offered at a lower price point. The company aims to understand how consumers value different attributes of computer fans—specifically, noise level (measured in dBs), cooling ability (measured in RPM), and the presence of RGB lighting. This report presents an econometric analysis of consumer preferences for these features and provides recommendations on how BeQuiet should adjust its business strategy based on these findings.

Demand Estimation		
	<i>Coefficient Estimate</i>	<i>Standard Error</i>
Price	-0.213	0.123
RPM	0.0163	0.011
dBs	0.169	0.164
RGB	0.541	0.818
Budget*RPM	-0.00000668	0.00000526
Budget*dBs	-0.000482*	0.000139
Budget*RGB	-0.00138*	0.000646
Build*RPM	0.00561	0.00829
Build*dBs	0.187	0.155
Build*RGB	1.03	0.798

* = Significance

$$U = -0.213(\text{Price}) + 0.0163(\text{RPM}) + 0.169(\text{dBs}) + 0.5418(\text{RGB}) - 0.00000668(\text{Budget}*\text{RPM}) - 0.000482(\text{Budget}*\text{dBs}) - 0.00138(\text{Budget}*\text{RGB}) + 0.00561(\text{Build}*\text{RPM}) + 0.187(\text{Build}*\text{dBs}) + 1.032(\text{Build}*\text{RGB}) + \epsilon$$

It is important to note that due to the small sample size of the survey, most of the coefficient results are not statistically significant. However, intuitively, product characteristics such as price, RPM, and dBs are expected to have a significant impact on the purchasing likelihood (utility) of the consumer. The only two significant coefficients are Budget*dBs and Budget*RGB, illustrating the interacting effects of these characteristics.

Despite the limitations of the data, the coefficients collected from the regression can still provide valuable insights into overall trends and the effects of certain product and consumer characteristics.

Unsurprisingly, the negative coefficient for price (-0.213) is consistent with the general economic theory that as price increases, demand for a product decreases. This coefficient is also useful for calculating consumers' willingness to pay (WTP) for certain product characteristics, using the formula $WTP = - \frac{\text{coefficient of interest}}{\text{coefficient of price}}$.

However, the coefficients for two important yet closely related characteristics of a computer fan, RPM and dBs, present more complex interpretations. The positive coefficient for RPM (0.0163) suggests that consumers prefer fans with strong cooling ability for performance, which is the primary purpose of a computer fan. Specifically, consumers are willing to pay \$0.0764 for an additional unit of RPM. Interestingly, despite the general expectation that consumers would be averse to high noise levels, the coefficient for dBs (0.169) is also positive, indicating that consumers prefer higher noise levels. Consumers are willing to pay \$0.791 for a unit increase in dBs.

Two hypotheses warrant further research to explain the dBs results. One possibility is that consumers value computer performance so much that they view noise level as an additional performance measure. Alternatively, consumers may value both RPM and dBs, but since higher RPM typically results in higher noise levels, the coefficients may be insignificant with a larger sample size. Both hypotheses suggest that collinearity could impact this regression, where predictors are linearly dependent—higher RPM often indicates higher noise levels and improved performance.

The positive coefficient for RGB (0.541) indicates that it increases consumer preference for purchasing the product. Consumers are willing to pay \$2.54 for the presence of RGB lighting.

Understanding the interaction between consumer characteristics and product features is also crucial for tailoring products to better appeal to target consumers.

The interaction between budget and RPM (-0.00000668) suggests that changes in consumer budget do not significantly impact their preference for RPM. The interaction between budget and dBs (-0.000482) indicates that consumers with higher budgets prefer lower noise levels. The interaction between budget and RGB (-0.00138) indicates that as budget increases, consumers place less importance on the presence of RGB lighting.

The significant results for BudgetdBs and BudgetRGB suggest that consumers with higher budgets prefer lower noise levels and the presence of RGB lighting. These findings should be further explored with a larger sample to confirm whether there are strong dependencies between RPM and dBs that could lead to counterintuitive results.

The interaction between Build and RPM (0.00561) suggests that those who build their own PCs value higher RPM. The interaction between Build and dBs (0.187) indicates that those who build their own PCs may prefer higher noise levels, likely due to the association with performance. The interaction between Build and RGB (1.03) reflects a strong preference for RGB lighting among PC builders.

Overall, the trends indicated by these coefficients suggest that consumers who build their own PCs may prioritize performance and RGB lighting, even at the cost of higher noise levels. However, these results should be verified with larger sample sizes to ensure they are not due to chance.

Although most of the results and statistics in this regression are not significant—implying a higher likelihood that these predictions could be due to chance—we can still offer some strategic recommendations based on observed trends.

First, the consistent and positive preference for RGB lighting, whether among PC builders or not, indicates that consumers value and are willing to pay extra for this feature. Additionally, the positive coefficients for dBs, especially among PC builders, indicate that many consumers do not mind higher noise levels if it is associated with higher performance—especially for those who build their own PCs. However, as the budget continues to increase, we may observe that a certain subset of consumers values lower noise levels, possibly due to a greater emphasis on comfort when the cost of a quiet fan is not a concern.

Therefore, it may be wise for the company to create two different products: one for PC builders who prioritize fan performance over some disturbance from a louder fan, and another for higher-budget consumers who may prioritize a quieter fan for comfort. A louder, more functional fan, which requires less cost to produce and can therefore be sold at a lower price, could appeal more to PC builders with lower budgets, while a quieter fan, which is more expensive to build, could be sold at a higher price, attracting higher-budget consumers.

This analysis catalyzes future research that aims to gather a larger and more diverse sample of individuals with vastly different budgets and interests in acquiring a PC. This approach will not only produce estimates that are more likely to be statistically significant but also allow researchers to conduct within-group analyses, examining certain subsets of the population that may exhibit specific purchasing tendencies. For example, some consumers explicitly choose the cheaper option, while others explicitly choose the option with lower dB levels.

It is also important to note that in the survey, the creator did not specify the RPM or dB levels for the set of questions where these characteristics were held constant. Therefore, rather than omitting these inputs altogether, I included the average RPM or dB levels for a PC after conducting some research. This approach results in different coefficient estimates compared to completely omitting the variables for those sets of questions. Further research is needed to determine which method yields more accurate estimates.