

Daylight and Retail Sales



Technical Report Executive Summary

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EXECUTIVE SUMMARY

This study presents evidence that a major retailer is experiencing higher sales in daylit stores than in similar non-daylit stores. Statistical models were used to examine the relationship between average monthly sales levels and the presence of daylight in the stores, while simultaneously controlling for more traditional explanatory variables such as size and age of the store, amount of parking, local neighborhood demographics, number of competitors, and other store characteristics. The retailer, who will remain anonymous, allowed us to study 73 store locations in California from 1999 to 2001. Of these, 24 stores had a significant amount of daylight illumination, provided primarily by diffusing skylights.

This study was performed as a follow-on to a similar study completed for Pacific Gas and Electric in 1999¹, which found that for a certain retail chain, all other things being equal, stores with skylights experienced 40% higher sales than those without skylights. This study, on behalf of the California Energy Commission, examined a second retail chain, in an entirely different retail sector, to see if the original findings would hold in a new situation, and if we could learn more about any daylight effect that might exist.

As a first step in this process, a simple model with daylight as a yes/no variable, and using basically the same format and inputs as the previous study, did not find a significant correlation between the presence of daylight, and increased sales. We then pursued the study in greater detail, adding more information to the model and describing daylight on a continuous scale by the number of daylit hours per year in each store.

The retailer in this study had a less aggressive daylighting design strategy and also more variation in both the range of daylight conditions and the range of store designs than the retailer in the first study. For this study, we collected much more detailed information about the characteristics of each store, and verified all information on site. Neighborhood demographics and retail competition were described using detailed, site-specific GIS analysis. Store managers were interviewed and employees were surveyed about their observations and preferences. For the final analysis, the amount of daylight in each store was described as the number of hours per year that daylight illumination levels exceeded the design electric illumination level.

Statistical regression models of average sales for the stores, using up to 50 explanatory variables, and both linear and natural log descriptions of the variables, found that increased hours of daylight per store were strongly associated with increased sales, but at a much smaller magnitude than the previous study. In addition, for this chain, the daylight effect on sales was found to be constrained by the amount of parking available at the store site. Sites with parking lots smaller than the norm experienced decreased sales associated with daylight, while stores with average and ample parking experienced increased sales as both the amount of daylight and parking increased. The statistical models were also more comprehensive, explaining about 75% of the variation in the data (model $R^2=0.75$), compared to 58% in the previous study.

¹ Hescong Mahone Group (1999). Skylighting and Retail Sales. An investigation into the relationship between daylight and human performance. Detailed Report for Pacific Gas and Electric Company. Fair Oaks, CA.

Specifically, this study found that:

- Average effect of daylighting on sales for all daylit stores in this chain was variously calculated from 0% to 6%, depending on the type of model and time period considered.
- A dose/response relationship was found, whereby more hours of useful daylight per year in a store are associated with a greater daylight effect on sales.
- No seasonal patterns to this daylight effect were observed.
- A bound of an empirical daylight effect for this chain was detailed, with a maximum effect found in the most favorable stores of about a 40% increase in sales. This upper bound is consistent with our previous finding.
- Daylight was found to have as much explanatory power in predicting sales (as indicated by the variable's partial R^2) as other more traditional measures of retail potential, such as parking area, number of local competitors, and neighborhood demographics.
- Along with an increase in average monthly sales, the daylit stores were also found to have slightly smaller increase in the number of transactions per month.
- ***The retailer reported that the primary motivation for the inclusion of daylight was to save on energy costs by having photocontrols turn off electric lights when sufficient daylight was detected. The retailer has been very pleased with the resulting reduction in operating costs. Based on current energy prices we estimated average whole building energy savings for the daylit stores at \$0.24/sf for the current design, with a potential for up to \$0.66/sf with a state-of-the art design.***
- ***The value of the energy savings from the daylighting is far overshadowed by the value of the predicted increase in sales due to daylighting. By the most conservative estimate, the profit from increased sales associated with daylight is worth at least 19 times more than the energy savings, and more likely, may be worth 45-100 times more than the energy savings.***
- During the California power crisis of 2001, when almost all retailers in the state were operating their stores at half lighting power, the stores in this chain with daylight were found to benefit the most, with an average 5.5% increase in sales relative to the other non-daylit stores within the chain (even while all stores in this chain increased their sales compared to the previous period).
- Employees of the daylit stores reported slightly higher satisfaction with the lighting quality conditions overall than those in the non-daylit stores. Most strikingly, they perceived the daylit stores to have more uniform lighting than the non-daylit stores, even though direct measurements showed both horizontal and vertical illuminance levels in the daylight stores to be substantially less uniform.
- Store managers did not report any increase in maintenance attributable to the skylights.
- The chain studied was found to be saving about \$0.24/sf per year (2003 energy prices) due to use of photocontrols, which could potentially increase up to \$0.66/sf per year with an optimized daylighting system.