BATES WHITE
ECONOMIC CONSULTING 1300 Eye Street NW, Suite 600, Washington, DC 20005 main 202.408.6110 fax 202.408.7838

August 31, 2017

Joe Yarbrough
President
Carpet and Rug Institute
100 S. Hamilton St.
Dalton, GA 30720

Re: CRI California Carpet Demand Study

Dear Joe:

At your request, we recently reviewed the August 22, 2017 comments offered by Eunomia Research & Consulting Ltd (Eunomia) to our June 29, 2017 report entitled "Impact of CCSP Assessment Fees on California Carpet Shipments." We investigated the concerns raised by Eunomia and prepared specific responses, which are contained in the attached annotated document.

In short, based upon our investigation, we determined that Eunomia's comments do not undermine our conclusions about the impact of the CCSP assessment fees on California carpet shipments. Most of Eunomia's comments fall into one or more of the following categories:

- Eunomia suggests that other economic variables including the price of carpets and the prices of substitute products (such as wood or stone) should have been included in our regression analysis. However, our fixed-effects regression specification controls for any factor that does not trend differently in California compared to the rest of the Unites States. Our understanding, at least with respect to carpet, is that pricing is done at a national level. Hence, there is no reason to believe that the price of carpet in California trended differently than the rest of the United States. It is also reasonable to believe that other floor covering is priced at a national level and, therefore, would not impact our results. In any case, we understand that such price data are not available on a state-by-state basis as would be required for our analysis.
- Based upon "typical" retail prices for various quality grades of carpet posted on a website, Eunomia assert that $72.00 per sq. yard is a representative (retail) price for carpet.[1] Using this purported representative (retail) price, they further assert that the recent increase in the assessment fee to $0.25 per sq. yard represents only 0.35% of the average (retail) price of carpet. However, based upon data from Market Insights, Eunomia has greatly overstated the average retail price of carpets by ignoring the fact that carpet sales are highly skewed toward the lowest

[1] See http://www.carpetpriceguides.com/.

quality grades. As shown in Attachment 1, the average retail price of carpet in the United States in 2016 was only $1.52 per sq. foot, which equates to $13.68 per sq. yard. Hence, Eunomia appears to have overstated the retail price of carpets by more than five times and correspondingly understated the assessment fees as a percentage of retail prices. Finally, we note that our analysis is based upon wholesale carpet shipments and prices, not retail.

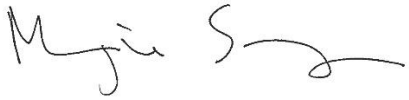
- Eunomia suggests an alternate regression specifications that would add "interaction variables" that multiply our indicator variable for California by our indicators for each time period. Eunomia asserts that these interactions would "account for possible differential changes in demand between California and the rest of the US over time." In the first instance, we note that it is not feasible to add interaction effects for every time period because doing so would expand the number of estimated parameters to equal the number of observations (an intractable scenario). However, if we take Eunomia's comment as a suggestion to add interaction effects only for each observation after the studied increases in assessment fees, that is at least a theoretically feasible suggestion. Recognizing that there are inherent tradeoffs between flexibility and structure in econometric models (i.e., more flexibility is not necessarily preferred), we nonetheless implemented a version of our regression specification that incorporated separate interaction effects for every quarter after the studied fee increases. As we discuss further in the attached annotated document, the results of these flexible specifications are entirely consistent with our baseline results. Hence, there is no material impact on our conclusions from Eunomia's suggestion.
- Eunomia also suggests an alternate regression specification that would combine our two regression specifications by including our explanatory variables (i.e., housing permits and population) and our fixed-effects variables into a single regression. While this is theoretically sensible, the population variables for California and the rest of the United States are so highly correlated that the fixed-effects variables are redundant (i.e., nearly perfect multi-collinearity). Nevertheless, we were able to estimate a model where we added housing permits to our fixed-effects regression model. Adding housing permits slightly reduces our estimate of the impact of the assessment fees from -6.6% to -5.9%. Hence, in practice, there is no material impact on our conclusions from Eunomia's suggestion.
- Finally, Eunomia criticizes our calculation of an implied elasticity by asserting that (1) demand may have shifted such that we would not be measuring only a movement along the demand curve, (2) our calculations assume a linear demand curve, which contradicts our log-linear regression model, and (3) the price of carpet could have changed to a larger or smaller degree than the change in the assessment fee. Below, we summarize our responses to these assertions, but first remind you that the elasticity estimate is merely a by-product of our analysis and is not used to measure the impact of the assessment fee on California carpet shipments.

- With respect to Eunomia's first comment, the purpose of our econometric model is to measure changes in California carpet shipments controlling for factors that might otherwise shift demand (e.g., housing permits). Hence, our elasticity estimate does not assume that demand is constant, but rather that our model adequately controls for potential shifts in demand. Thus, because we have confidence that our model has controlled for potential shifts in demand, we have confidence in our elasticity estimate.
- Contrary to Eunomia's second assertion, our elasticity calculations do not assume a linear demand curve. We use a log-linear reduced-form specification to estimate the percentage change in carpet shipment resulting from changes in the assessment fee. This approach does not require any assumptions about the shape of the demand curve. We then use two points on the demand curve to estimate the price elasticity. Many different curves could connect those two points including linear, log-linear, etc., but the same elasticity estimate would result from each.
- We agree that carpet prices in California could have changed by more or less than the assessment fee. However, that concern is not relevant as long as pricing in California and the rest of the United States follows a similar trend over time. That is, because of the DID structure of our regression model, we have already controlled for any factor (including prices) that trends similarly in California compared to the rest of the United States. Based upon our understanding that carpet prices are set at a national level, we have no reason to believe that carpet prices are not properly controlled for in our regression model. Hence, our estimate of the change in carpet shipments should isolate the impact of the assessment fees.

In the attached annotated responses, we provide more detailed explanations of these and other points. In addition, as we explained in our initial report, our estimate of the impact of the assessment fees is conservative because it does not include the impact of the initial $0.05 assessment fee.

We hope that you find these responses helpful. Please let us know if you have any questions or would like to discuss any topic further.

Best regards,



Eric M. Gaier, PhD
Partner

Minjae Song, PhD
Principal

The following issues have been identified:

- Exclusion of the price of carpets, or changes in the price of carpets, from the analysis:
  - The analysis considers the impact of the assessment fee on the demand for carpets, where demand will primarily depend on the price of carpets (including the assessment fee). The price of carpets could be different in California compared to the rest of the US, and/or the price could have changed differently in California compared to the rest of the US (by more than the assessment fee) over the period of analysis. However, no account is taken of the price of carpets.

  [BW comments] By design, our fixed-effects difference-in-differences (DID) regression methodology controls for any factor that trends similarly in California compared to the rest of the United States. Hence, this comment would only be relevant if there was some reason to believe that carpet prices in California trended differently than carpet prices in the rest of the United States. To the contrary, we understand that carpet prices would trend similarly because manufacturers set prices at the national level. Discounts may be provided based upon customer purchasing volumes, but there is no reason to believe that prices would trend differently in California compared to the rest of the United States. Nevertheless, we are willing to consider such pricing data if a source can be identified.

  - A US price comparison website for carpets notes the following typical prices per square foot:[1]
    - Good quality - $1.00 to $5.00
    - Better quality - $4.00 to $8.50
    - Best quality - $7.70 to $17+

  [BW comments] Note that these prices correspond to retail carpet prices, whereas our analysis is based on wholesale carpet shipments and wholesale prices.

  - Taking $8 as a representative amount, on a square yard basis this equates to $72. Accordingly with the most recent increase in the assessment, to $0.25 per square yard, it adds 0.35% to the price of an average carpet. This proportion of overall price would be higher for cheaper, poor quality carpets, and lower for the best quality carpets.

  [BW comments] Although the above cited retail prices for different quality grades of carpet may (or may not) be accurate, the reality is that carpet sales are highly skewed toward the lowest quality grade. For example, according to data from Market Insights, LLC (provided in Attachment 1), 76% of retail carpet sales in 2016 were priced at less than $2.00 per sq. foot and 92% were priced at less than $3.00 per sq. foot. Indeed, the average retail carpet price was $1.52 per sq. foot, which equates to only $13.68 per sq. yard. Hence, Eunomia appears to overstate the average retail price of carpets by more than five

[1] See http://www.carpetpriceguides.com/ accessed 22nd August 2017

times. Consequently, the $0.25 assessment fee represents about 1.8% of the average retail carpet price, a material amount.

- All regressions and elasticity calculations should include the price of carpets.

[BW comments] See previous comments.

- Exclusion of substitute products and other relevant factors that might affect demand:
  - The price of substitute products (i.e. alternative flooring types such as wood or stone) can change demand for carpet. This has not been included (or even mentioned) in the analysis.

  [BW comments] As we explained above, our DID regression methodology is designed to control for any factor that trends similarly in California compared to the rest of the United States. Hence, this comment would only be relevant if there was some reason to believe that prices for substitute products in California trended differently than prices in the rest of the United States. While we have no specific information one way or the other, it is reasonable to believe that manufacturers of other flooring materials would set prices in a similar fashion compared to carpet manufacturers (i.e., at a national level). Nevertheless, we are willing to consider such pricing data if a source can be identified.
  - People in California could prefer other flooring materials over carpet, which could negatively affect the demand for carpet.

  [BW comments] Again, to the extent that consumers' preferences in California are not trending differently compared to the rest of the United States during our study period, this comment would not be relevant. That is, our DID fixed-effects model controls for potential systematic differences in consumer preferences between California and the rest of the United States that do not trend differently over time. Given the relatively short time period of our study, there is no reason to believe that consumers' preferences are trending differently in California.
  - Weather can affect the choice of flooring products, and the hot and humid weather in California could have a negative impact on demand for carpets

  [BW comments] Again, to the extent that California's climate is not trending differently compared to the rest of the United States, during our study period, this comment would not be relevant. That is, our DID fixed-effects model controls for potential systematic differences in climate between California and the rest of the United States that do not trend differently over time. Given the relatively short time period of our study, there is no reason to believe that California's climate is trending differently from the rest of the United States.
- DID Regression Model:
  - For the Difference-in-differences (DID) estimation, if the price of carpets in California is different from, or changed to a greater or lesser extent than, the rest of the US, the entire analysis would be

redundant. Even if the price levels and changes were the same between the regions, this should have been mentioned in the analysis.

[BW comments] Again, the only potentially valid concern regarding prices in the DID methodology is if carpet prices in California trended differently than those in the rest of the United States (apart from the assessment fee). Mere differences in pricing levels would be controlled for appropriately through the fixed effects indicator variables. Because we understand that carpet prices are set at a national level, there is no reason to believe that carpet prices trended differently in California.

- Fixed effect dummy variables for California (designed to capture the differential impact on demand for California compared to the rest of the US), and fixed effect dummy variables for time-periods (designed to capture the differential impact on demand over different periods of time) were included. However, the model should have also included 'interaction dummy variables' (dummy for California multiplied by dummy for time- periods) to account for possible differential changes in demand between California and the rest of the US) over time.

[BW comments] In the first instance, we note that it is not feasible to add interaction effects for every time period because doing so would expand the number of estimated parameters to equal the number of observations (an intractable econometric scenario). However, if we take Eunomia's comment as a suggestion to add interaction effects only for each observation after the studied increases in assessment fees, that is at least theoretically feasible. Under this interpretation, Eunomia essentially suggests that we specify a more flexible regression that would allow the estimated impact of the assessment fees to vary for each quarter.

Recognizing that there are inherent tradeoffs between flexibility and structure in econometric models (i.e., more flexibility is not necessarily preferred), we nonetheless implemented a version of our regression specification that incorporated separate interaction effects for every quarter after the studied fee increases. The estimated quarterly impacts ranged from approximately -2.9% to approximately -8.5%. All estimated coefficients were negative and statistically significant at the 1% level of confidence. Hence, we conclude that the results of these more flexible specifications are entirely consistent with our baseline results. Thus, there is no material impact on our conclusions from Eunomia's suggestion.

- Adjusted R-squared values are reported to be 1 (which is the maximum possible value) – suggesting that the regression is a perfect fit for each variable for all data. This is not possible, and suggests that these R-squared values have been rounded up to 1, meaning that the relative explanatory power of different model specifications cannot be compared by the reader.

[BW comments] Eunomia correctly points out a clerical error in our report. We inadvertently rounded the adjusted R-squared values. The unrounded values range from 0.9996 to 0.9997, meaning that our models explains virtually all of the variation in carpet shipments. A revised Final Report has been provided to counsel.

- Explanatory variables (population, housing permits, etc.) and fixed effect dummy variables were used in separate specifications. Including these in the same regression model would be desirable and would better explain the variations in the demand curve.

  [BW comments] In theory, Eunomia's suggestion is sensible. However, because of the high degree of correlation between population in California and the rest of the United States, the population variable becomes redundant with the fixed effects for California (i.e., nearly perfect multi-collinearity) and cannot reliably be added. However, when the log of housing permits is added to the fixed-effects regression specification (i.e., Specification III of Figure 4 in our Final Report), the estimated impact of the assessment fee reduces slightly from -6.6% to -5.9%.[2] Thus, there is no material impact on our conclusions from Eunomia's suggestion.

- Elasticity:
  - The implied elasticity calculation assumes that there is no shift in the demand curve between the start and end point of the elasticity calculation. However, the demand curve could have shifted because of a change in consumer preference, price and availability of substitutes (wood, tiles, laminated floors, etc.).

    [BW comments] The purpose of our econometric model is to measure changes in California carpet shipments controlling for factors that might otherwise shift demand (e.g., housing permits). Hence, our elasticity estimate does not assume that demand is constant, but rather that our model adequately controls for potential shifts in demand. Thus, because we have confidence that our model has controlled for potential shifts in demand, we have confidence in our elasticity estimate.
  - For the elasticity calculation to hold true, demand would have to be linear, meaning that the relationship between changes in price and quantity demanded varies at the same proportion for each level of price. However, it is more realistic to assume a non-linear demand function, i.e. quantity demanded changes disproportionately at different levels of price. In fact by using logarithmic transformation on their dependent and independent variables in the DID regression they have implicitly assumed the demand function to be non-linear. Therefore their elasticity calculation cannot possibly hold true.

    [BW comments] Our elasticity calculations do not assume a linear demand curve. We use a log-linear reduced-form specification to estimate the percentage change in carpet shipment resulting from

[2] The effect of fee change from $0.05 to $0.10 changes from -4.6% to -4.3% and the cumulative effect of fee change from $0.05 to $0.20 changes from -6.6% to -5.9%.

changes in the assessment fee. This approach does not require any assumptions about the shape of the demand curve. We then use two points on the demand curve to estimate the price elasticity. Many different curves could connect those two points including linear, log-linear, etc., but the same elasticity estimate would result from each.

- For the implied elasticity calculation, the change in price between the start and end point was assumed to be just the change in assessment fee level, whereas the actual change in overall price could have been greater than the change in the assessment fee, making the implied elasticity calculation invalid.

  [BW comments] We agree that carpet prices in California could have changed by more or less than the assessment fee. However, that concern is not relevant as long as pricing in California and the rest of the United States follows a similar trend over time. That is, because of the DID structure of our regression model, we have already controlled for any factor (including prices) that trends similarly in California compared to the rest of the United States. Based upon our understanding that carpet prices are set on a national basis, we have no reason to believe that prices are not properly controlled for in our regression model. Hence, our estimate of the change in carpet shipments should isolate the impact of the assessment fees.

Attachment 1

U.S. Residential Replacement Market by Flooring Type- 2016

Retail Price Points	Total Flooring	Resilient Flooring	Laminate Floors	Wood Floors	Ceramic Fl. Tile	Carpet
Under $2.00/SF	57%	49%	39%	0%	38%	76%
$2.00 to $2.99/SF	18%	18%	39%	4%	23%	16%
$3.00 to $3.99/SF	10%	15%	17%	18%	19%	4%
$4.00 to $4.99/SF	8%	12%	5%	32%	13%	2%
$5.00 to $5.99/SF	5%	6%	0%	28%	7%	1%
$6.00/SF or more	2%	0%	0%	18%	0%	1%
Total-	100%	100%	100%	100%	100%	100%
Avg. Retail Price ($/SF)	$2.13	$2.34	$2.19	$5.15	$2.59	$1.52
Avg. Retail Gross Margin	38%	35%	35%	36%	39%	40%
Avg. Wholesale Gross Margin	22%	22%	22%	21%	24%	21%
Avg. Mill Price ($/SF)	$1.03	$1.18	$1.11	$2.60	$1.20	$0.72
Residential Quantity Sales (SF, MM)	9,293	1,423	781	764	1,257	5,067

Source: Market Insights LLC