

Impact of CCSP Assessment Fees on California Carpet Shipments

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I. Introduction

Minor Bell Neal, PC, retained Bates White on behalf of the Carpet and Rug Institute (CRI) to analyze the impact on California carpet shipments of certain assessment fees levied under the California Carpet Stewardship Program (CCSP) administered by the Carpet America Recovery Effort (CARE).

CARE, a nonprofit organization, operates under the stated mission “to advance market-based solutions that increase landfill diversion and recycling of post-consumer carpet, encourage design for recyclability and meet meaningful goals as approved by the CARE Board of Directors.”¹ CARE manages the CCSP, which is responsible for “meeting the requirements for carpet recycling set by California statute (AB 2398), signed into law by the governor of California on September 30, 2010.”² The California stewardship law is regulated by CalRecycle, a California state agency.³

Effective July 1, 2011, an assessment fee of \$0.05 per square yard was levied on all carpet shipped to California. As shown in Figure 1, the assessment fee doubled to \$0.10 per square yard effective April 1, 2015, and doubled again to \$0.20 per square yard effective April 1, 2016. Effective January 1, 2017, the assessment fee increased further to \$0.25 per square yard.

Figure 1: California Stewardship assessment fee schedule

Date	Assessment fee (dollars per sq. yard)
July 1, 2011 – March 31, 2015	\$0.05
April 1, 2015 – March 31, 2016	\$0.10
April 1, 2016 – December 31, 2016	\$0.20
January 1, 2017 – present	\$0.25

Source: CalRecycle, “Carpet Stewardship Program Overview,” accessed Mar.9, 2017, <http://calrecycle.ca.gov/Carpet/Program.htm>.

Our analysis demonstrates that the assessment fee has had a significant, negative impact on California carpet shipments. In particular, our analysis demonstrates that the assessment fee reduced carpet shipments to California by more than 4% from April 2015 to March 2016 and by more than 6% through year-end 2016. As we explain further below, those figures represent conservative estimates of

¹ CARE, “About CARE,” accessed Mar. 9, 2017, <https://carpetrecovery.org/about/about-care/>.

² CARE, “Carpet Stewardship Program,” accessed Mar. 9, 2017, <https://carpetrecovery.org/california/>.

³ *Id.*

the impact of the assessment fee because, due to a data limitation, it does not include any reductions in California carpet shipments associated with the initial implementation of the assessment fee from July 1, 2011, to March 31, 2015.

Our analysis also demonstrates that demand for carpet in California is highly sensitive to even small changes in price. In economic terms, the price elasticity of demand for carpet sold in California is approximately -3.5 to -3.8 , which is highly elastic. Consequently, additional increases in the assessment fee would further reduce California carpet shipments significantly. For example, our elasticity estimates predict that an increase in the assessment fee from \$0.20 to \$0.40 would further reduce California carpet shipments by an additional 8.1% to 8.9%.

In the remainder of this report, we explain our analytic methodology and discuss our results.

II. Methodology

Our methodology is a standard application of a difference-in-differences regression model that quantifies the impact of the assessment fee by comparing changes in California carpet shipments with carpet shipments to the rest of the United States, while controlling for other factors that could impact carpet demand (e.g., housing permits, population, etc.). The difference-in-differences methodology is the “gold-standard” for evaluating the impact of any scientific or “natural” experiment in which a subgroup of the population is exposed to a treatment (here, the implementation of the assessment fee), while the remainder of the population is not. In scientific terms, the impact of the treatment is quantified by comparing the response of the treatment group (here, California) to the response of the control group (here, the rest of the United States).

Due to a limitation of the available data, we do not observe California carpet shipments prior to the first implementation of the assessment fee on July 1, 2011. However, our approach uses the natural experiment of the increases in the assessment fee—from \$0.05 to \$0.10 per square yard effective April 1, 2015, and from \$0.10 to \$0.20 per square yard effective April 1, 2016—to quantify the impact on California carpet shipments and estimate the elasticity of demand. Our methodology, therefore, provides a conservative estimate of the impact of the assessment fee because it does not include any reductions in California carpet shipments associated with the initial implementation of the assessment fee in July 2011.

In a purely scientific experiment (such as a clinical trial for a new drug), the treatment and control groups are selected randomly, such that there is no inherent need to control for other differences between the treatment and control group populations that might confound measurement of the impact

of the treatment. However, in a natural experiment, the treatment and control groups are not selected randomly, so it can be important to control for any other differences that vary between the groups. Indeed, if one could control for all other potential differences between the treatment and control groups, then any remaining differences after the natural experiment must be associated with the treatment itself.

A major benefit of the difference-in-differences methodology is that one does not need to control for factors that are the same for both the treatment and control groups. In our case, for example, one does not need to control for trends in the manufacturing costs of carpet because that is a factor that would be the same for carpet shipped to California and the rest of the United States. The only factors that need to be controlled for are those that may differ between California and the rest of the United States.

We controlled for other potential differences between California and the rest of the United States using several different standard approaches. In our first approach, we directly incorporated variables into our regression analysis that might impact carpet demand differently in California than in the rest of the United States. Importantly, as explained further below, in our review of numerous data series, we found no evidence of any systematic differences in trends between California and the rest of the United States for factors that might impact carpet demand. Nevertheless, in an abundance of caution, we included such variables under one set of regression specifications.

In our second approach, we used standard “fixed effects” for California and for each year and quarter of observed data. Fixed effects (also known as “indicator” or “dummy” variables) control for any systematic differences (even unknown to us) between California and the rest of the United States and for each year and/or quarter of the observed data. For example, if carpet demand is systematically lower in California than in the rest of the United States, our fixed effect for California would control for that difference. Similarly, if carpet demand were systematically lower in the fourth quarter of 2015, our fixed effect for that time period would control for that difference. Indeed, the only factors that could conceivably confound our estimates of the impact of the assessment fee are those that change differentially over time between California and the rest of the United States. However, based upon our research to date, we are not aware of any such factors other than changes in the assessment fee.

For each regression specification, the dependent variable is the natural logarithm of carpet shipments. Consistent with standard practices, we also used the natural logarithms of the continuous independent variables (e.g., housing permits) so that the regression output could be interpreted as percentage changes, not as changes in level.

III. Difference-in-differences calculations

We begin our discussion of the results with a simple comparison of quarterly carpet shipments to California and the rest of the United States during periods with different assessment fees. As shown in Figure 2, from 2011 Q3 through 2015 Q1—when the assessment fee was \$0.05 per square yard—about 24.7 million square yards of carpet were shipped to California each quarter, compared to about 196.0 million square yards shipped to the rest of the United States. From 2015 Q2 through 2016 Q1—when the assessment fee doubled to \$0.10 per square yard—average quarterly shipments to California declined by approximately 700,000 square yards, or about 2.7%. During the same period, average quarterly shipments to the rest of the United States increased by about 3.5 million square yards, or 1.8%. Hence, while California carpet shipments declined by 2.7%, carpet shipments to the rest of the United States increased by 1.8%. Thus, California carpet shipments were reduced by 4.5% compared to carpet shipments to the rest of the United States during this period.

Similarly, from 2016 Q2 through 2016 Q4—when the assessment fee doubled again from \$0.10 to \$0.20 per square yard—average quarterly shipments to California were reduced by 3.1% compared to their pre-2015-Q1 levels, while average quarterly shipments to the rest of the United States increased by 3.3%. Thus, California carpet shipments were reduced by 6.5% compared to carpet shipments to the rest of the United States through year-end 2016.

Figure 2: Difference in average quarterly shipments of carpet, by fee period and region

Period	Average quarterly shipments (sq. yards)				Difference in percentages
	California		Rest of U.S.		
	Level	Percentage change from first period	Level	Percentage change from first period	
2011 Q3 – 2015 Q1	24,738,900	--	195,972,824	--	--
2015 Q2 – 2016 Q1	24,065,883	-2.7%	199,421,720	1.8%	-4.5%
2016 Q2 – 2016 Q4	23,960,471	-3.1%	202,463,196	3.3%	-6.5%

Source: FloorFocus' national carpet shipments and CARE's California carpet shipments data.

The results shown in Figure 2 illustrate how carpet shipments to California were depressed relative to the rest of the United States at the same time that the assessment fee doubled from \$0.05 to \$0.10 and again from \$0.10 to \$0.20 per square yard. However, because these calculations do not control for other potential causes of depressed carpet demand in California, they do not, by themselves, establish a link between the assessment fee and the depressed demand. For example, it could be the case that

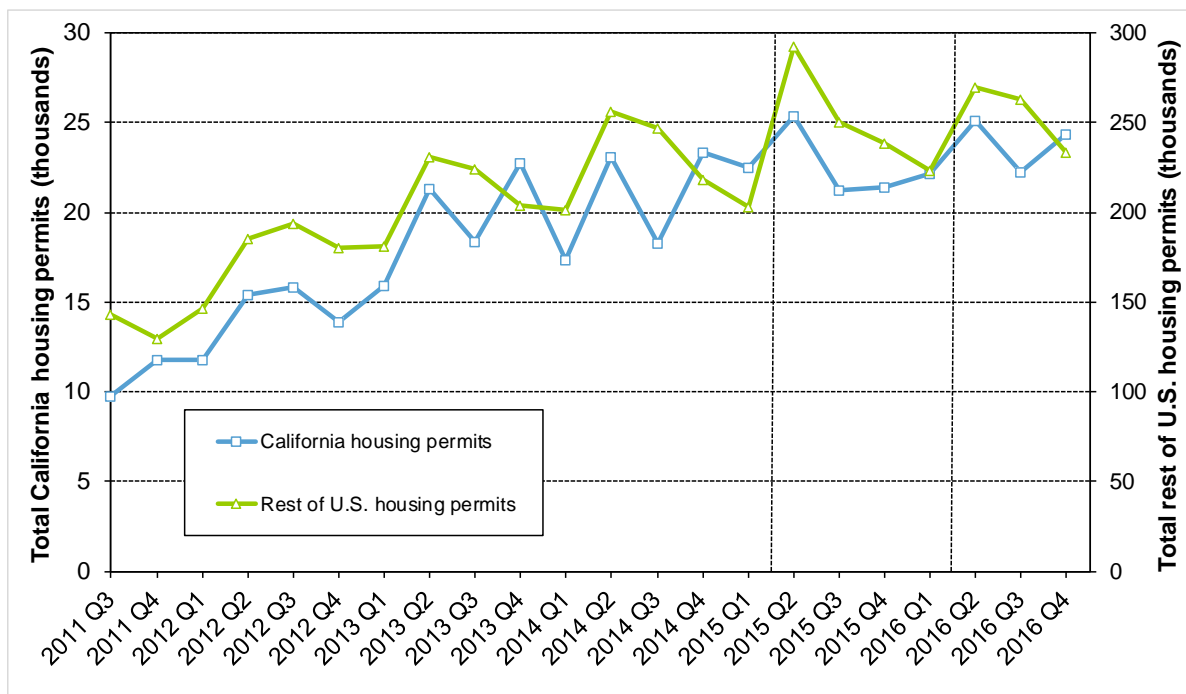
carpet demand in California was depressed because of a relative slowdown in residential housing construction compared to the rest of the United States.

To assess the likelihood that factors other than the assessment fee caused the depressed carpet demand in California, we analyzed numerous publicly available data series for both California and the rest of the United States. These data series included residential housing permits, personal income, population, and employment. However, none of those factors illustrated a pattern that would explain the depressed carpet demand in California compared to the rest of the United States during the relevant time period.

For example, as shown in Figure 3, residential housing permits in California and the rest of the United States continued an existing upward trend throughout the relevant time period. In fact, from 2015 Q2 through 2016 Q1—when the assessment fee was \$0.10 per square yard—residential housing permits in California were approximately 29% higher than from 2011 Q3 through 2015 Q1—when the assessment fee was \$0.05 per square yard. During the same time periods, residential housing permits in the rest of the United States increased by only 28%. Similarly, from 2016 Q2 to 2016 Q4—when the assessment fee was \$0.20 per square yard—residential housing permits in California were approximately 37% higher than from 2011 Q3 through 2015 Q1. During the same time periods, residential housing permits in the rest of the United States increased by only 30%.

Thus, during the relevant time period, residential housing permits increased more quickly in California than in the rest of the United States. Hence, residential housing permits do not provide a plausible explanation for the reduced California carpet shipments.

Figure 3: Total housing permits in California and the rest of the United States



Source: Census Bureau's Building Permits Survey, via the SOCDS Building permits database, accessed at <https://socds.huduser.gov/permits/index.html> on February 16, 2017.

As shown in Figures 5–7 in the appendix, none of the other factors we analyzed provided any explanation for the reduced California carpet shipments. Indeed, personal income, population, and employment all followed a steadily increasing trend throughout the relevant time period for both California and the rest of the United States.

IV. Difference-in-differences regression results

As described in Section II, we estimated a standard difference-in-differences regression model to quantify the impact of the assessment fee by comparing changes in California carpet shipments with carpet shipments to the rest of the United States, while controlling for other factors that potentially impact carpet demand. We controlled for other factors using two different standard approaches. In our first approach, we directly incorporated variables addressing those factors into our regression analysis. In our second approach, we used standard “fixed effects” for California and for each year and quarter of our observed data. Fixed effects control for any systematic differences (even unknown

to us) between California and the rest of the United States and for each year and/or quarter of the observed data.

For each regression specification, the dependent variable is the natural logarithm of carpet shipments. Consistent with standard practices, we also used the natural logarithms of the continuous independent variables (e.g., housing permits) so that the regression output can be interpreted as percentage changes.

Figure 4 summarizes the results of our regression analysis. Specifications I and III implement the fixed-effects controls for potential differences between California and the rest of the United States, while Specifications II and IV incorporate data on residential housing permits and population directly.⁴ Specifications I and II implement year-specific (e.g., 2015) and quarter-specific (e.g., Q4) fixed effects, while Specifications III and IV implement unique fixed effects for every quarter (e.g., 2015 Q1).

For each regression specification, the variables of interest are the estimated coefficients on the indicator variables for California carpet shipments during the two treatment periods. These coefficients measure the impact of the carpet assessment fee relative to the benchmark period (i.e., 2011 Q3 through 2015 Q1) and are interpreted as the percentage change in California carpet shipments relative to the rest of the United States, controlling for all other factors in the regression model. For example, the estimated coefficient of -0.039 for the first treatment variable in regression 1 means that California carpet shipments declined by 3.9% during the period 2015 Q2–2016 Q1, relative to carpet shipments to the rest of the United States, controlling for all other factors in the regression model. Similarly, the estimated coefficient of -0.062 for the second treatment variable in regression 1 means that California carpet shipments declined by 6.2% by the end of 2016, relative to carpet shipments to the rest of the United States, controlling for all other factors in the regression model.

⁴ Personal income and employment are nearly perfectly collinear with population. As a result, they could not be included in the regression model due to multicollinearity.

Figure 4: Regression results for the effect of assessment fee changes on California carpet shipments

Variable	Specification I		Specification II		Specification III		Specification IV	
	Coefficient estimate	Robust SE	Coefficient estimate	Robust SE	Coefficient estimate	Robust SE	Coefficient estimate	Robust SE
Effect of fee change from \$0.05 to \$0.10	-0.039**	-0.015	-0.042***	-0.015	-0.046***	-0.012	-0.048***	-0.010
Cumulative effect of fee change from \$0.05 to \$0.20	-0.062***	-0.015	-0.060***	-0.015	-0.066***	-0.012	-0.061***	-0.008
Dummy variable for CA	-2.071***	-0.008			-2.069***	-0.008		
Log of housing permits			-0.077	-0.050			-0.102*	-0.056
Log of population			1.141***	-0.061			1.171***	-0.068
Constant	19.021***	-0.014	-2.247***	-0.616	19.146***	-0.026	-2.401***	-0.662
Time effects	Year and Quarter		Year and Quarter		Period fixed effects		Period fixed effects	
No. of observations	44		42		44		42	
Adjusted R-squared	1		1		1		1	
Implied Elasticity	-3.59		-3.48		-3.82		-3.53	

Notes: *** p<0.01, ** p<0.05, * p<0.1. Source: Bates White analysis.

Across all four regression specifications, the estimated impact of the assessment fee on California carpet shipments from 2015 Q2 to 2016 Q1 ranged modestly from –3.9% to –4.8%. Similarly, the estimated cumulative impact of the assessment fee on California carpet shipments by year-end 2016 ranged modestly from –6.0% to –6.6%. As indicated by the asterisks, all of the estimated treatment coefficients were statistically significant (i.e., different from zero) at the standard 5% level of confidence or better. Indeed, all but one of the estimated treatment coefficients were statistically significant at the 1% level of confidence. This means that we can be quite confident that the assessment fee is depressing California carpet shipments.

The regression results can also be used to calculate an implied price elasticity of demand for carpet shipped to California.⁵ Price elasticity is an economic concept that quantifies the responsiveness of demand to changes in price. It is calculated as the percentage change in quantity demanded divided by the percentage change in price. Because price and quantity demanded are inversely related, price elasticities should be negative. Price elasticities between 0 and –1 are considered inelastic, meaning that quantity demanded is not particularly responsive to price. Price elasticities less than –1 (i.e.,

⁵ In economic terms, we are able to measure the slope of the demand curve for carpets shipped to California because the assessment fee shifts the supply curve without shifting the demand curve.

greater than 1 in absolute value) are considered elastic, meaning that quantity demanded is more responsive to changes in price.

As shown in Figure 4, California carpet shipments were reduced by 6.0%–6.6% when the assessment fee increased from \$0.05 to \$0.20. Using an average carpet price of \$8.69 per square yard, the corresponding increase in price was approximately 1.7% (i.e., $(0.20-0.05)/8.69$). Hence, the estimated price elasticity ranges from -3.5 to -3.8 (i.e., $-6.0/1.7$ to $-6.6/1.7$), which is highly elastic.

Because demand for carpet in California is highly elastic, additional increases in the assessment fee would further reduce California carpet shipments significantly. For example, as shown in Figure 5 below, our elasticity estimates predict that an increase in the assessment fee from \$0.20 to \$0.25 would further reduce California carpet shipments by an additional 2.0%–2.2%. Similarly, an increase in the assessment fee from \$0.20 to \$0.40 would further reduce California carpet shipments by an additional 8.1%–8.9%. Importantly, these predicted reductions in California carpet shipments are in addition to the 6.0%–6.6% reductions we estimate are associated with the historical increases in the assessment fee from \$0.05 to \$0.20.

Figure 5: Predicted impact of additional fee increases on California carpet shipments

Assessment fee	Cumulative change in assessment fee (above \$0.20)	Predicted cumulative change in CA carpet shipments	
		Low	High
\$0.20			
\$0.25	\$0.05	-2.0%	-2.2%
\$0.30	\$0.10	-4.0%	-4.4%
\$0.40	\$0.20	-8.1%	-8.9%
\$0.50	\$0.30	-12.1%	-13.3%
\$0.60	\$0.40	-16.2%	-17.7%

Note: Weighted average price input calculated over the 2015 Q2–2016 Q1 period. Source: Bates White analysis.

V. Conclusion

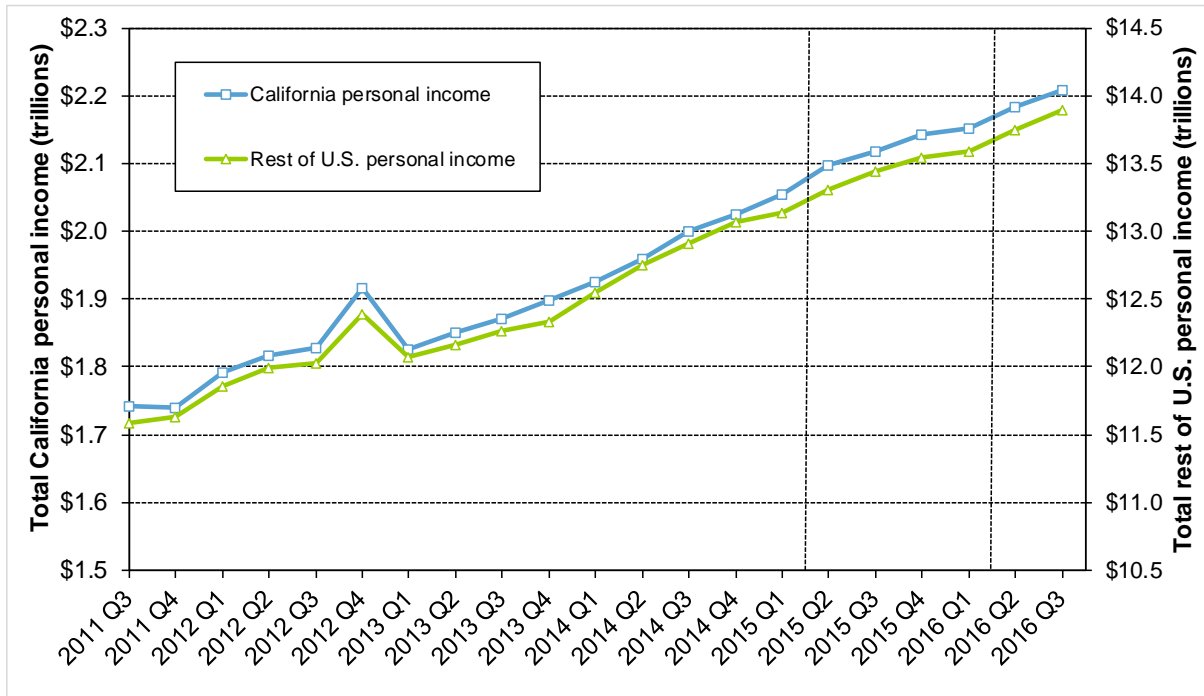
Our analysis demonstrates that the assessment fee has had a significant, negative impact on California carpet shipments. Our results using different regression specifications demonstrate a remarkable consistency of the estimated impact of the assessment fee program. For example, across all four regression specifications, the estimated impact of the assessment fee on California carpet shipments from 2015 Q2 through 2016 Q1 varied within a narrow range from -3.9% to -4.8%. Similarly, the

estimated cumulative impact of the assessment fee on California carpet shipments by year-end 2016 varied within a narrow range from -6.0% to -6.6%. These estimates are conservative and likely understate the true impact of the assessment fee because they do not incorporate any reductions in California carpet shipments associated with the initial implementation of the assessment fee in July 2011.

Our analysis also demonstrates that the demand for carpet shipped to California is highly sensitive to even small changes in price. In economic terms, the price elasticity of demand for carpet shipped to California is approximately -3.5 to -3.8, which is highly elastic. Consequently, additional increases in the assessment fee would further reduce California carpet shipments significantly.

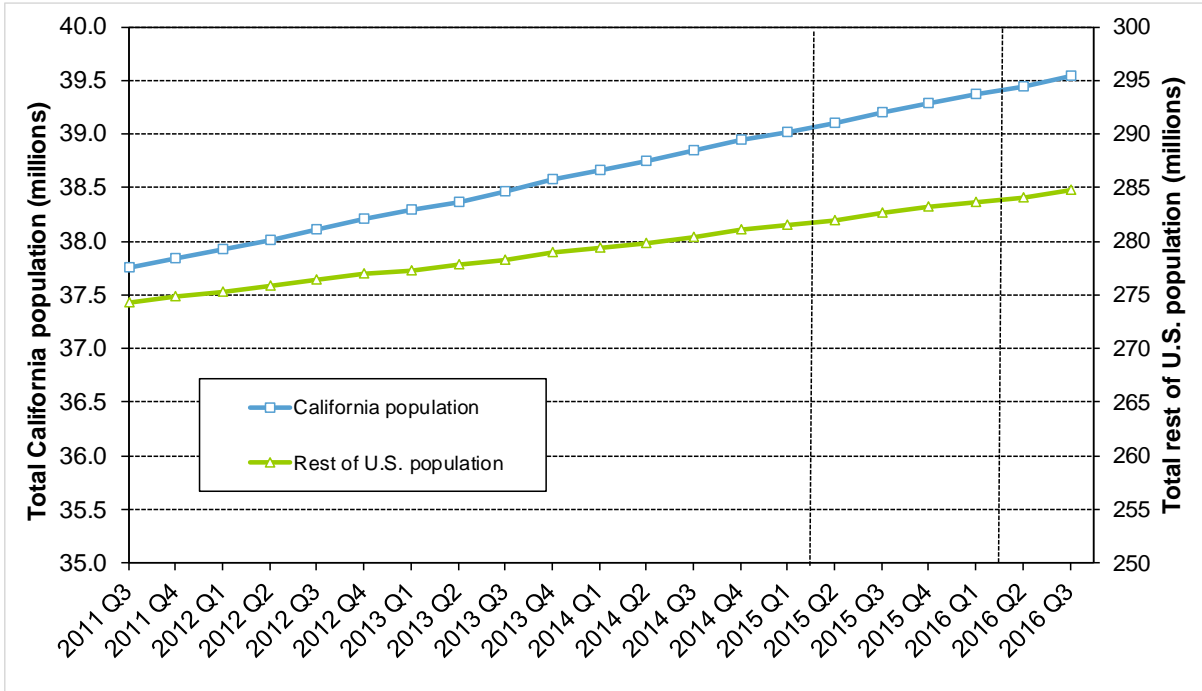
VI. Appendix

Figure 6: Total personal income in California and the rest of the United States



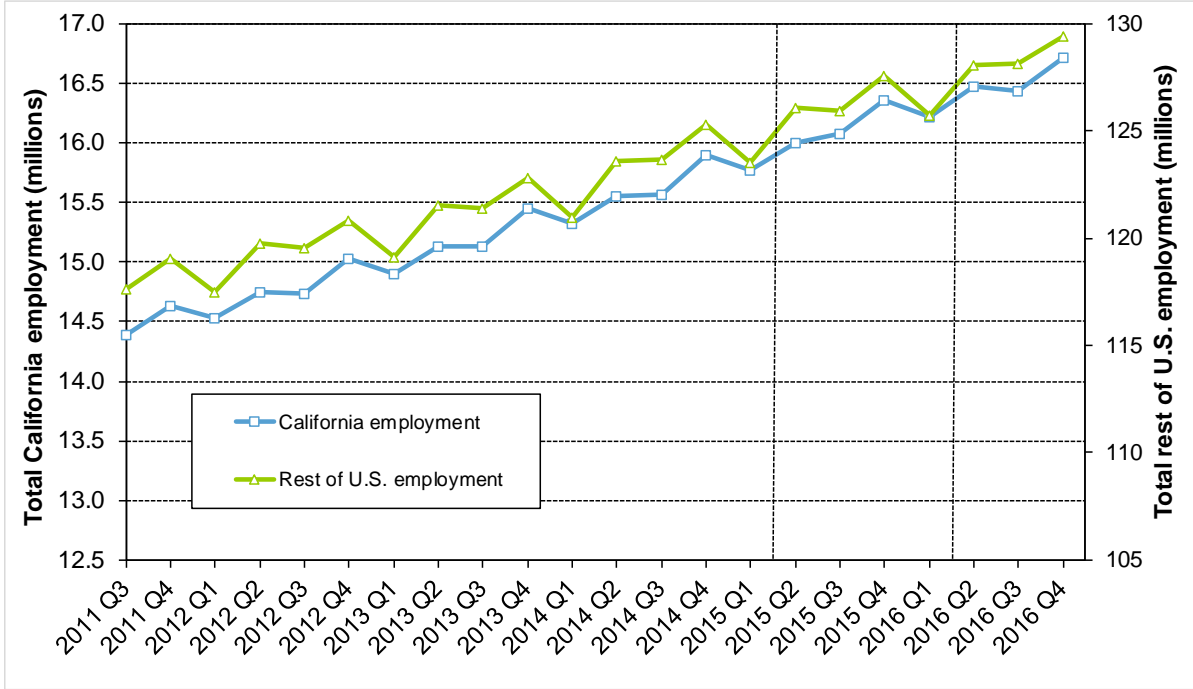
Source: BEA's GDP & Personal Income database, accessed at https://www.bea.gov/iTable/index_regional.cfm on February 16, 2017.

Figure 7: Total population in California and the rest of the United States



Source: BEA's GDP & Personal Income database, accessed at https://www.bea.gov/iTable/index_regional.cfm on February 16, 2017.

Figure 8: Total employment in California and the rest of the United States



Source: Non-farm, seasonally adjusted employment, via BLS's Employment, Hours, and Earnings database, accessed at <https://www.bls.gov/sae/#tables> on February 16, 2017.