The Impact of Alternative Assessment Levels by the U.S. Highbush Blueberry Council on the Grower Blueberry Price

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Introduction

The U.S. Highbush Blueberry Council (USHBC) is a national research and promotion organization that began operation in October 2001. The USHBC uses a variety of promotion techniques to increase the demand (sales) for blueberries. In the domestic market, these activities include health research, technical assistance and promotion to foodservice and food manufacturers, consumer public relations, advertising, and promotion.

The USHBC is authorized under the Commodity Promotion, Research, and Information Act of 1996, and was approved in the spring of 2000 by a majority (67.8%) of blueberry producers and importers in a special referendum. Under the original program, domestic blueberry producers and importers were assessed at a rate of $12.00 per ton, and the collected revenue was used to fund promotion, research, and information projects. However, in October 2012, the USHBC unanimously agreed to increase the assessment rate to $18 per ton "to more aggressively promote highbush blueberries and take advantage of the growing scientific knowledge of the healthfulness of our product." This report examines how future alternative assessment levels by the USHBC would impact the grower price for blueberries.

Objective and Scope

Since it has been over 10 years since the assessment rate was changed, price inflation has eroded the assessment level the USHBC has to promote blueberry sales. Accordingly, the purpose of this research is to develop an "econometric" model to simulate the impact of alternative USHBC promotion levels, blueberry supply volume, and several other demand drivers on the grower price. The use of an econometric model is advantageous since it measures the net effect of each of these factors on price. This enables us to directly quantify the net impact of each demand driver on the blueberry price in isolation of the other drivers. Of particular interest is how increasing the promotion budget by the USHBC can offset the negative effect of increasing blueberry volume (domestic supply plus imports) on the blueberry price. The purpose of this report is to present the results of this analysis, as well as to document the model and data used to produce the results. This analysis serves to inform the discussion by the blueberry producers and importers in considering increasing the assessment rate for the USHBC.

Methodology

The econometric model developed in this study uses national annual time series data for the blueberry industry since 2000 on various demand drivers to measure how each of these drivers impact the grower price. Blueberry "demand" is measured as the price growers receive for blueberries. Specifically, the final model selected includes the volume of blueberry supply to measure how increases in volume decrease the blueberry price. The model also includes

consumer income levels to see how changes in income impact the blueberry price. Finally, and most relevant to this study, the model includes annual USHBC promotion spending to see how alternative expenditure levels impact the grower price for blueberries. The data and its sources can be found in the Appendix of this report.

More specifically, the following demand drivers are included in the specification of the econometric model to ascertain the extent, if any, of their impact on the grower price. Each driver is tracked annually, so that the degree of correlation, if any, it has with changes in the real inflation-adjusted blueberry price over this time period can be measured.

1. Total volume of blueberries in the U.S. market, including domestic blueberry supply and imports from other countries. The volume of blueberries in the market should be negatively related to blueberry prices. As volume increases, the price of blueberries should decrease, reflecting the "Law of Demand." The source of data for this variable is the USHBC office.

2. USHBC public relations and promotion inflation-adjusted expenditures in the domestic market. This is the key factor that is statistically tested to see whether it has a positive and significant impact on blueberry prices. If it has a positive and statistically significant impact on price, this means that the marketing activities of the USHBC have a positive impact on blueberry prices. The source of data for this variable is the USHBC office.

3. Inflation-adjusted personal disposable income. Consumer income should be positively related to blueberry prices, i.e., as consumers' incomes increase, blueberry demand should increase, which should cause the price for blueberries to increase. The source of figures for this variable is the Economic Report of the President.

4. Inflation-adjusted blueberry price in the previous year. It is well known that prices from year to year are positively correlated. Thus, one major determinant of the current year's price is the price in the previous year. The national weighted average annual grower price for fresh and processed blueberries from the USDA's annual Fruit and Tree Nuts Situation and Outlook Report is used in this study.

5. Consumer Price Index for all Items (CPI). The CPI is a measure of overall price inflation for all goods and services in the economy. The CPI is used here to deflate all monetary measures to adjust for inflationary impacts on the blueberry price. The source of this data is the Bureau of Labor Statistics, Consumer Price Index series.

To compare the relative importance of each factor on the blueberry price, the results from the statistical ("econometric") model are measured as demand "price flexibility coefficients." A price flexibility coefficient measures the percentage change in blueberry price given a 1% change in a specific demand driver, holding all other factors constant. For example, the computed price flexibility coefficients for blueberry volume measures the percentage change in blueberry price given a 1% change in blueberry volume. The computed promotion price flexibility coefficient measures the percentage change in blueberry price given a 1% change in

USHBC promotion expenditures, and so on. Since price flexibility coefficients are calculated for each demand driver listed above, one can compare them to determine which factors have the largest percentage impact on blueberry prices.

Econometric Results

The estimated blueberry price equation is specified using a logarithmic functional form using annual data from 2000 to 2021. Two other functional forms are estimated, linear and semi-logarithmic, but the double logarithmic specification has the best statistical results and is therefore used here. A convenient feature of the logarithmic specification (LOG) is that the estimated regression coefficients are the price flexibility coefficient for the variable in question. Two versions of the model are estimated. The first includes an intercept (or constant) term (Table 1), however, the intercept is found to be statistically insignificant. The second model omits the intercept term (Table 2). Both models have very similar results.

The estimated models fit the data reasonably well; for instance, the R-square indicates that about 55% of the variation in the grower blueberry price is explained by the demand drivers in the price equation. The equation has elasticity signs that are consistent with economic theory, and, in the no-intercept model, the estimated coefficients are all statistically significantly different from zero at the 10% significance level or better. In the model that includes the intercept, both the intercept and the real income variable are not statistically significant at better than the 10% level. Several econometric diagnostic tests are conducted on the residuals in the regression, and no autocorrelation or heteroscedasticity problems are detected. The estimated price model is deemed appropriate for this simulation analysis.

The estimated blueberry price flexibility coefficients are reported in Table 1 (Model 1) and 2 (Model 2). Not surprisingly, total volume of domestic supply and imports is highly statistically significant and negative. A 1% increase in market volume, holding all other demand drivers constant, is associated with a 0.69% (Model 1) or 0.68% (Model 2) decrease in the grower price. This is the second most important demand driver behind blueberry price in the previous year, discussed later.

Promotion expenditures by the USHBC have a positive and statistically significant impact on the blueberry price. A 1% increase in USHBC promotion expenditures is associated with a 0.28% (Model 1) and 0.3% (Model 2) increase in the blueberry price, holding all other demand drivers constant. This indicates that USHBC promotions are benefiting producers and importers by increasing the price they receive for blueberries. This finding is consistent with the 2024 evaluation of the USHBC (Kaiser, 2024).

Real personal income is positively correlated with the blueberry price. Specifically, a 1% increase in real personal income is associated with a 0.5% (Model 1) and 0.32% (Model 2) increase in the blueberry price. As real income increases, consumers demand more blueberries, which increases the price. Economists refer to this as a "normal good."

Table 1. Regression results for grower blueberry price (Model 1 with constant term).

Dependent Variable: LOG(PRICE/CPI)
Sample (adjusted): 2001 2021
Included observations: 21 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	-5.235011	16.44311	-0.318371	0.7543
LOG(VOLUME)	-0.689953	0.289918	-2.379824	0.0301
LOG(PROMO/CPI)	0.275978	0.156754	1.760583	0.0974
LOG(REALINCOME)	0.506597	0.662401	0.764789	0.4555
LOG(PRICE(-1)/CPI(-1))	0.717444	0.149162	4.809838	0.0002

R-squared	0.547525	Mean dependent var	-5.165062
Adjusted R-squared	0.434406	S.D. dependent var	0.177868
S.E. of regression	0.133767	Akaike info criterion	-0.981174
Sum squared resid	0.286299	Schwarz criterion	-0.732478
Log likelihood	15.30233	Hannan-Quinn criter.	-0.927201
F-statistic	4.840264	Durbin-Watson stat	1.769277
Prob(F-statistic)	0.009453	Wald F-statistic	10.67929
Prob(Wald F-statistic)	0.000207		

Where: PRICE is the weighted average grower price for fresh and processed blueberries, CPI is the Consumer Price Index for All Items (2023=1), volume is the quantity of domestically produced and imported blueberries available, PROM is USHBC promotion expenditures in $1,000, REALINCOME is real personal income (in chained 2017 billion dollars), and PRICE(-1)/CPI(-1) is the real grower price in the previous year.

Finally, the price in the previous year is positively associated with the current year price. A 1% increase in the previous year's blueberry price is associated with a 0.72% (Model 1) and 0.7% (Model 2) increase in the current year price, holding all other demand drivers constant.

Simulation Scenarios for Alternative Assessment Levels

The econometric model is used to simulate the impact of three scenarios on future blueberry prices. The first is the *Baseline scenario,* where the assessment rate remains at $0.009 per pound. In this scenario, it is assumed that blueberry volume (domestic supply and imports) increases by 7% each year, which is based on recent increases in volume. It is also assumed that real disposable income increases by 2% per year and the CPI increases by 3.5% per year. Both econometric models have very similar results, so for the results that follow, Model 1 is used in the simulations.

The second scenario is the *Increased Assessment scenario (Level 1)*. In this case, everything is the same as in the Baseline scenario, except that the assessment rate is increased in 2027. Specifically, beginning in 2027, the assessment rate is increased to $0.015 per pound for processed blueberries and $0.025 per pound for fresh. In this scenario, it is assumed that 30% of

total volume continues to go into processed and 70% of volume goes into fresh blueberries. Because the only difference between scenarios is the assessment rate, the difference between scenarios provides a measure of the impact of increasing the assessment rate on the blueberry price.

The third scenario is the Increased Assessment scenario (Level 2). In this case, everything is the same as the Baseline scenario, except the assessment rate is increased in 2027 to $0.025 for all blueberries. This assessment level is approximately 17.65% higher than scenario 2.

Table 2. Regression results for grower blueberry price (Model 2 without constant term).

Dependent Variable: LOG(PRICE/CPI)
Sample (adjusted): 2001 2021
Included observations: 21 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(VOLUME)	-0.680536	0.268902	-2.530790	0.0215
LOG(PROMO/CPI)	0.302183	0.139774	2.161932	0.0452
LOG(REALINCOME)	0.318440	0.147593	2.157551	0.0456
LOG(PRICE(-1)/CPI(-1))	0.710430	0.137141	5.180285	0.0001

R-squared	0.545586	Mean dependent var	-5.165062
Adjusted R-squared	0.465395	S.D. dependent var	0.177868
S.E. of regression	0.130051	Akaike info criterion	-1.072136
Sum squared resid	0.287526	Schwarz criterion	-0.873180
Log likelihood	15.25743	Hannan-Quinn criter.	-1.028958
Durbin-Watson stat	1.778229		

Where: PRICE is the weighted average grower price for fresh and processed blueberries, CPI is the Consumer Price Index for All Items (2023=1), volume is the quantity of domestically produced and imported blueberries available, PROM is USHBC promotion expenditures in $1,000, REALINCOME is real personal income (in chained 2017 billion dollars), and PRICE(-1)/CPI(-1) is the real grower price in the previous year.

The simulation model is run for the time period 2027-2033 (it begins in 2027 since there is no assumed difference in assessment levels until the year 2027). Figure 1 shows the USHBC marketing budget in real 2023 dollars. In 2027, real promotion levels are $6.7 million for the Baseline scenario, $12.8 million for the Increased Assessment scenario (Level 1) and $15.1 million for the Increased Assessment scenario (Level 2). By 2033, real promotion levels are $8.2 for the Baseline, $28.8 for the second scenario, and $33.9 million for the third scenario. In other words, by 2033, total real USHBC promotion levels are 3.5 times higher for the second scenario relative to the Baseline scenario, and over four times higher for scenario 3 relative to the Baseline.

Figure 1. USHBC marketing expenditures in real 2023 dollars for baseline and two increased assessment scenarios, 2027-2033.

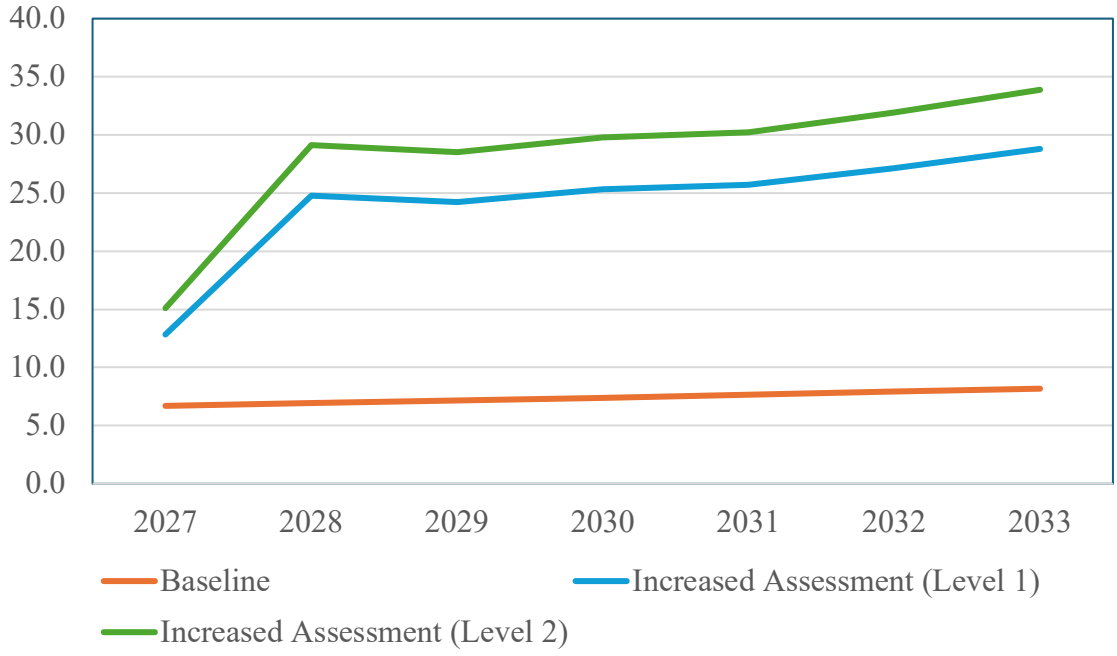
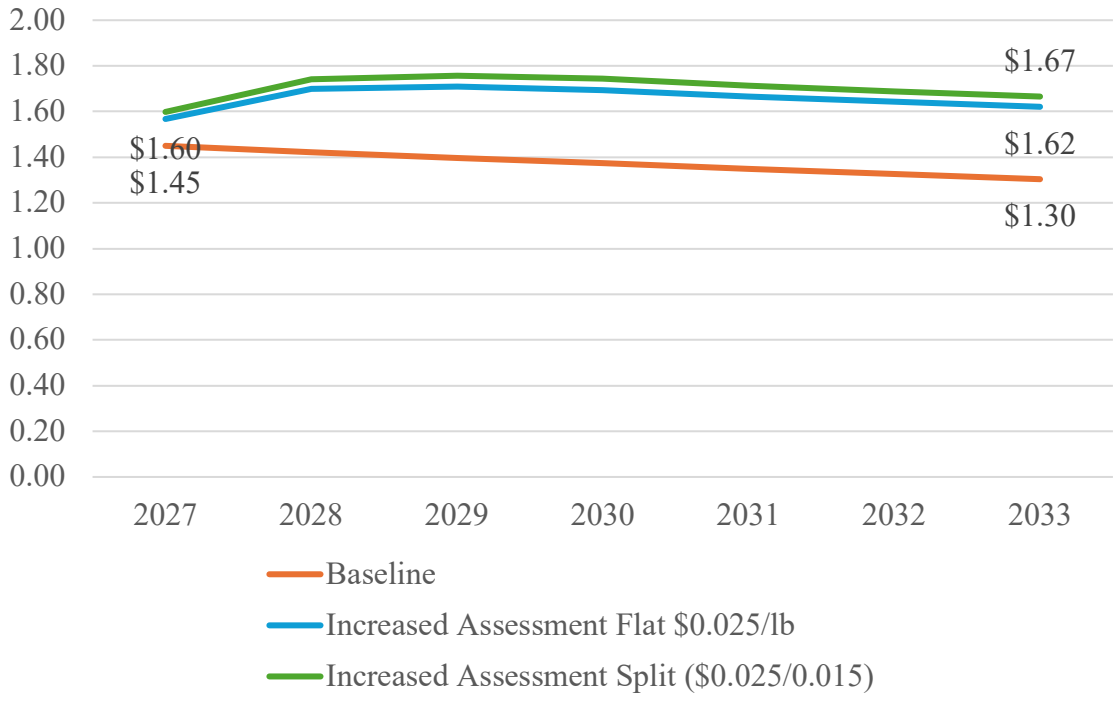


Figure 2. Blueberry growers' price in real 2023 dollars for baseline and increased assessment scenarios, 2027-2033.



The real inflation-adjusted blueberry price for the three scenarios for 2027-2033 is displayed in Figure 2. For the Baseline scenario, where there is no increase in the assessment rate, the real grower price decreases from $1.45 per pound to $1.30 from 2027-2033, representing a 10.1% decrease. In the Increased Assessment scenario (Level 1), the price starts out at $1.57 per pound in 2027, which is 8.1% higher than the 2027 Baseline price due to higher promotion levels. By 2033, the grower price is $1.62 per pound, which is 3.4% higher than its 2027 price level. In the Increased Assessment scenario (Level 2), the price starts out at $1.60 per pound in 2027, which is 10.2% higher than the 2027 Baseline price due to higher promotion levels. By 2033, the grower price is $1.67 per pound, which is 4.3% higher than its 2027 price level.

Figure 2 shows that the price consistently declines each year in the Baseline scenario, which is mainly due to increasing market volume each year and a decrease in the real assessment level. Both Increased Assessment scenarios show that an effective way to combat the negative impact of increasing volume on price is raising the assessment rate.

Another way to compare the economic impacts of the two scenarios is to compare the difference in the average real assessments from 2027-2033 for the two scenarios with the difference in the average real price for the two scenarios. For instance, consider the first Increased Assessment scenario (Level 1). The average difference (2027-2033) in real prices between the Baseline and first Increased Assessment scenarios is $0.28 per pound, i.e., the average price for the Baseline scenario is $1.37 per pound vs. the average price for Scenario 2 is $1.66 per pound. On the cost side, the average real assessment rate for the Baseline scenario from 2027-2033 is $0.0071 per pound, whereas the average real assessment rate for the Increased Assessment scenario (Level 1) is $0.0173 per pound. In other words, on average from 2027-2033, blueberry growers would have their assessment rate increased by $0.0102 per pound. Comparing the increase in cost of $0.0102 with the increase in price of $0.28, it is clear that growers and importers would be substantially better off with the Increased Assessment scenario (Level 1). The implied return-on-investment (ROI) based on price difference is equal to:

$$ROI = (0.28 – 0.0102) / 0.0102 = 26.45.$$

In other words, for every additional $1 raised by the Increased Assessment scenario (Level 1), blueberry growers and importers would receive $26.45 in additional revenue.

Similarly, the average difference (2027-2033) in real prices between the Baseline and second Increased Assessment scenarios is $0.33 per pound, while the average difference in real assessment rates is $0.0126 per pound. The ROI based on comparing Scenario 3 to the baseline is $25.20.

Summary and Conclusions

This report examined the impact of three different assessment levels by the USHBC on the blueberry price received by growers. The Baseline scenario was a continuation of the current assessment rate of $0.009 per pound, while the first Increased Assessment scenario increased the assessment rates to $0.0125 for processed blueberries and $0.025 for fresh blueberries. The

second Increased Assessment scenario increased the assessment rate to $0.025 per pound for all blueberries. The impacts of the three scenarios were simulated using an econometric model of demand drivers impacting the blueberry price. The model explanatory variables included market volume (domestic supply plus imports), real disposable income, CPI, blueberry price in previous year, and USHBC promotion expenditures.

The results indicated that without an increase in the assessment rate, the real grower price for blueberries would decrease by 10.1% from 2027 to 2033 averaging $1.37 per pound. In the Increased Assessment scenario (Level 1), the real grower price would increase by 3.4% from 2027 to 2033 and average $1.66 per pound. In the Increased Assessment scenario (Level 2), the real grower price would increase by 4.3% from 2027 to 2033 and average $1.70 per pound.

The increase in cost to blueberry growers and importers from the higher assessment scenario would be $0.0173 per pound for Level 1 and $0.0126 for Level 2. The estimated increase in price from the higher assessment scenario would be $0.28 per pound for Level 1 and $0.33 for Level 2. Therefore, while the assessment rate would be higher for both Increased Assessment scenarios, the positive impact on price was substantial with estimated ROIs of 26.45:1 for Level 1 and 25.2:1 for Level 2. In other words, each additional dollar raised by increasing the assessment rates would return $26.45 (or $25.20) in additional revenue to blueberry growers and importers.

References

Kaiser, Harry M. *An Economic Analysis of Domestic Market Impacts of the U.S. Highbush Blueberry Council*. Report Prepared for the U.S. Highbush Blueberry Council, 2024.

Appendix. Annual Data, 2000-2021 Used to Estimate Price Models.

Year	Consumer Price Index 1980-82=100	Real Personal Disposable Income 2017 $	Domestic Blueberry Production Pounds
2000	172.2	11,677,540,200,000	293,880,000
2001	177.1	11,942,774,900,000	263,950,000
2002	179.9	11,993,402,900,000	251,050,000
2003	184.0	12,172,098,300,000	268,300,000
2004	188.9	12,545,784,600,000	273,610,000
2005	195.3	12,840,118,500,000	298,360,000
2006	201.6	13,384,211,900,000	358,250,000
2007	207.3	13,777,007,300,000	364,030,000
2008	215.3	13,934,991,100,000	438,610,000
2009	214.5	13,569,493,300,000	453,000,000
2010	218.1	13,872,110,900,000	493,830,000
2011	224.9	14,341,423,700,000	516,900,000
2012	229.6	14,721,863,800,000	546,900,000
2013	233.0	14,688,321,600,000	625,700,000
2014	236.7	15,221,847,200,000	670,040,000
2015	237.0	15,903,045,600,000	656,320,000
2016	240.0	16,164,609,800,000	690,430,000
2017	245.1	16,661,997,000,000	580,390,000
2018	251.1	17,175,824,800,000	605,920,000
2019	255.7	17,732,850,900,000	748,380,000
2020	258.8	18,760,399,600,000	684,810,000
2021	271.0	19,649,086,600,000	765,040,000

Appendix. Annual Data, 2000-2021 Used to Estimate Price Models.

Year	Blueberry Imports Pounds	Total Market Volume Pounds	Average Blueberry Price $/pound	USHBC Promotion Expenditures $
2000	74,402,085	368,282,085	0.76	276,100
2001	101,810,282	365,760,282	0.71	425,200
2002	100,457,582	351,507,582	0.85	425,100
2003	133,062,885	401,362,885	0.92	672,800
2004	158,638,829	432,248,829	1.09	704,000
2005	143,544,563	441,904,563	1.28	866,700
2006	151,345,210	509,595,210	1.56	947,200
2007	165,469,886	529,499,886	1.69	1,262,900
2008	210,158,272	648,768,272	1.35	1,395,600
2009	220,073,048	673,073,048	1.14	1,431,400
2010	262,848,304	756,678,304	1.30	1,998,200
2011	306,382,523	823,282,523	1.70	2,295,900
2012	329,081,052	875,981,052	1.54	2,820,800
2013	357,589,192	983,289,192	1.30	2,679,300
2014	368,208,774	1,038,248,774	1.33	3,621,700
2015	423,478,558	1,079,798,558	1.32	4,788,700
2016	495,489,000	1,185,919,000	1.08	5,434,900
2017	457,169,036	1,037,559,036	1.44	5,995,300
2018	555,239,843	1,161,159,843	1.36	6,282,300
2019	684,261,203	1,432,641,203	1.26	7,090,000
2020	697,527,848	1,382,337,848	1.36	6,547,000
2021	763,641,776	1,528,681,776	1.44	7,198,400