An Economic Analysis of Genuine Alaska Pollock Producers Marketing Programs

by

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Executive Summary

Genuine Alaska Pollock Producers (GAPP) is an organization of companies that catch and process Wild Alaska Pollock that promotes products made from the species in U.S. and overseas markets. Unlike federally-overseen mandatory checkoff programs used by much of the food and agricultural industries, this marketing program is funded through voluntary contributions by its members. In 2020, the GAPP Board commissioned an evaluation study by Professor Harry M. Kaiser of Cornell University to measure the overall return on investment (ROI) from GAPP marketing efforts. That study, which we now refer to as ROI 1.0, found a very high ROI on the overall GAPP marketing effort. To ascertain the effectiveness of GAPP since that study, a new economic study was commissioned in 2022 called ROI 2.0, to determine whether the GAPP marketing efforts continue to have a positive impact on the demand for Wild Alaska Pollock. Specifically, ROI 2.0 addressed five key research questions:

1. How have GAPP marketing expenditures over time and most recently impacted the demand for Wild Alaska Pollock?

2. What would Wild Alaska Pollock demand have been had there not been any GAPP marketing expenditures?

3. How does the gain in revenue due to GAPP marketing expenditures compare to the costs of the marketing?

4. What is the return on investment of the GAPP marketing programs?

5. What effect do other factors have on demand for Wild Alaska Pollock?

To answer these five questions, this study quantified the relationship between the GAPP marketing effort and the demand for Wild Alaska Pollock using the same econometric framework as was used in ROI 1.0. Econometrics is widely recognized as the best "science" available for evaluating demand impacts of commodity marketing expenditures. The following were the key findings of the study.

- The most important demand drivers for Wild Alaska Pollock fillet products are the U.S. dollar – Euro exchange rate, Consumer Price Index for all items, volume of catch of Wild Alaska Pollock, domestic volume of Tilapia imports sold in the U.S., Russian MSC certification, USDA purchases of Wild Alaska Pollock in the "Bonus Buy" program, and GAPP generic marketing expenditures.

- The results indicated that a 10% increase in GAPP marketing expenditures was associated with a 0.594% increase in fillet price, on average, since 2007. This means that

the statistical evidence supports the hypothesis that GAPP's marketing activities increase demand for Wild Alaska Pollock fillet.

- The most important demand drivers for Wild Alaska Pollock surimi products are the volume of surimi substitute exports to Japan, U.S. dollar – Yen exchange rate, Consumer Price Index, Itoyori imports from Japan, and GAPP generic marketing expenditures.

- The results indicated that a 10% increase in GAPP marketing expenditures was associated with a 0.32% increase in surimi price, on average, since 2007. This means that the statistical evidence supports the hypothesis that GAPP's marketing activities increase demand for Wild Alaska Pollock surimi.

- In the last 5-years, had there not been any GAPP marketing, the wholesale fillet price would have been 5.9% lower, on average, than it actually was during this period. Likewise, had there been no GAPP marketing over this period, the wholesale surimi price would have been 3.5% lower than it actually was over this period.

- From 2016-20, GAPP marketing resulted in an average increase in total wholesale fillet revenue of $22.6 million per year and wholesale surimi revenue by $17.7 million per year.

- Each dollar invested in GAPP marketing returned $15.75 in wholesale net revenue to the Wild Alaska Pollock industry.

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Introduction

Genuine Alaska Pollock Producers (GAPP) is an organization of companies that catch and process Wild Alaska Pollock that promotes products made from the species in U.S. and overseas markets. Unlike federally-overseen mandatory checkoff programs used by much of the food and agricultural industries, this marketing program is funded through voluntary contributions by its members. Through this voluntary checkoff program, GAPP has spent an average of $500,000 per year promoting Wild Alaska Pollock over the period 2003 through 2018. But beginning in 2019, GAPP members dramatically increased their contributions to GAPP to $3.65 million per year. This represents over a seven-fold increase in marketing spending by GAPP.

In 2020, the GAPP Board commissioned an evaluation study by Professor Harry M. Kaiser of Cornell University to measure the overall return on investment (ROI) from GAPP marketing efforts. That study, which we now refer to as ROI 1.0, found a very high ROI on the overall GAPP marketing effort. To ascertain the effectiveness of GAPP since that study, a new economic study was commissioned in 2022 called ROI 2.0, to determine whether the GAPP marketing efforts continue to have a positive impact on the demand for Wild Alaska Pollock. Accordingly, the purpose of the research reported here was to conduct an economic evaluation of the impacts of GAPP's marketing programs on the demand for Wild Alaska Pollock, and to compute an overall ROI for GAPP.

Objectives and Scope of Work

This study quantitatively measures the overall impact of GAPP's marketing on enhancing the demand for two of the primary products made from Wild Alaska Pollock - fillets and surimi. In order to assess the effectiveness of GAPP's marketing activities, an econometric modeling approach is adopted. Econometrics is widely recognized as the best "science" available for evaluating demand impacts of commodity marketing expenditures. The econometric approach quantifies economic relationships using economic theory and statistical procedures with data, which in this case is time series observations on important market variables on a semi-annual basis. This framework enables us to simultaneously account for the impact of a variety of factors that influence Wild Alaska Pollock demand over time, including the volume of Wild Alaska Pollock sold in the market, the quantity of substitute products for Wild Alaska Pollock (e.g., Cod, Tilapia, Pangasius, imported Pollock), consumer income, other demand drivers, and GAPP marketing expenditures. By casting the evaluation in this type of framework, we can filter out the effect of other demand factors and, hence, quantify directly the net impact of GAPP marketing activities on Wild Alaska Pollock demand. Since Wild Alaska Pollock quantity is often fixed by the harvest and/or by quotas, a price inverse demand equation is used as the demand model. That is, the demand for Wild Alaska Pollock is measured as the price or unit value for specific wholesale products (fillets and surimi).

This study answers five key research questions:

1. How have GAPP marketing expenditures over time and most recently impacted the demand (measured as the wholesale block price for fillets and for surimi) for Wild Alaska Pollock?

2. What would Wild Alaska Pollock demand have been had there not been any GAPP marketing expenditures?
3. How does the gain in revenue due to GAPP marketing expenditures compare to the costs of the marketing?
4. What is the return on investment of the GAPP marketing programs?
5. What effect do other factors have on demand for Wild Alaska Pollock?

To carry out this independent evaluation, GAPP contracted with Professor Harry M. Kaiser of Cornell University to conduct the economic. Dr. Kaiser is the Gellert Family Professor of Applied Economics and Management at Cornell University, and director of the Cornell Commodity Marketing Research Program. Dr. Kaiser has extensive experience in conducting economic evaluation studies of domestic and international checkoff programs. Dr. Kaiser has written 150 refereed journal articles, five books, 17 book chapters, over 150 research bulletins, and received $8 million in research grants in the area of agricultural marketing with an emphasis on marketing programs. He has conducted over 120 economic evaluation studies of domestic and international checkoff programs in the United States, Canada, and Europe on such commodities as fluid milk, cheese, butter, salmon, red meat, pork, raisins, walnuts, cotton, blueberries, potatoes, beef, peanuts, wheat, watermelons, high-valued-agricultural commodities, and bulk agricultural commodities. In 2005, Kaiser was the lead author of a book on all commodity checkoff programs in California.

This report is organized as follows. First, the types of marketing programs GAPP offers is discussed. Next, the economic methodology used in this study to measure the effects of GAPP's marketing on Wild Alaska Pollock demand is presented. This is followed by a presentation of the econometric (statistical) estimation results. Then, the econometric results are

used in conjunction with a simulation model to simulate market conditions with and without the existence of the GAPP marketing so that the impact (return on investment) of its marketing activities can be estimated. The report concludes with a summary and a discussion of the implications of the main findings.

GAPP's Marketing Programs

Between 2003 and 2018, GAPP worked to represent the Wild Alaska Pollock industry by investing in marketing programs to get more Wild Alaska Pollock products into school cafeterias across the U.S. and in promoting Wild Alaska Pollock surimi and roe at various trade shows in Japan, a significant market for both products. During that period GAPP also invested in marketing campaigns in Germany to differentiate Wild Alaska Pollock from Russian-caught pollock products. GAPP also activated on social media and served as a resource for media inquiries on behalf of the entire industry. Furthermore, the organization closely collaborated with the Alaska Seafood Marketing Institute (ASMI) on promotional campaigns for Wild Alaska Pollock both in the U.S. and abroad.

With the increase in investment into GAPP and the formalization of the organization in 2018, the goals and workstreams of GAPP also became more concrete and less ad hoc. Specifically, GAPP put forward a strategic plan in 2019, that was approved by the new Board of Directors, that focused the resources in three key areas: research into consumer perceptions of Wild Alaska Pollock, building a brand for the fish based on consistent communications and partnership programs.

GAPP now invests significantly into understanding which of Wild Alaska Pollock's attributes are most motivational to entice consumers to try and buy the fish. This research became the basis for the communications strategy which has been implemented industry-wide to ensure that Wild Alaska Pollock is talked about the same way, to build a consistent brand for Wild Alaska Pollock. This year, GAPP has further invested in similar research in key European markets and also into research around surimi and roe. This research will be utilized not only by GAPP to guide its future marketing campaigns, but also will be utilized by GAPP's partners.

Another significant component of GAPP's marketing strategy has been to put more Wild Alaska Pollock in front of more consumers every day. To help accomplish this, GAPP has worked to start a Partnership Program which funds projects that either put Wild Alaska Pollock products into new channels, into new categories, or associated with influencers that can help raise the fish's profile with new consumers. Since the start of the program in 2019, GAPP has funded more than 40 projects in the U.S. and across Europe that have put Wild Alaska Pollock into new product innovations, targeted new categories—like the popular snacking category—and associated products with influencers including Martha Stewart and Antoni Porowski. This program has resulted in more than 28 products coming to market utilizing Wild Alaska Pollock and millions of new consumers becoming aware of the fish.

Lastly, GAPP has worked to build a brand for Wild Alaska Pollock using consistent messaging and marketing. Based on the research conducted in 2019, GAPP was able to identify the most motivational attributes for consumers to try and buy Wild Alaska Pollock. Based on that research, GAPP has created a messaging "Toolkit" that tells the Wild Alaska Pollock story in the most compelling way and has trained the industry and GAPP partners on how to use the messaging—on websites, on product packaging, and in sell-sheets and at restaurants and retailers. This new, compelling and consistent messaging has resulted in more than 10 million people knowing about Wild Alaska Pollock (in the U.S.) in 2020 vs 2019 based on independent research funded by GAPP and conducted by Ketchum, Inc. These marketing messages will continue to be updated as new research results are collected and analyzed to ensure that GAPP's communications strategy can continue to evolve and meet consumers where they are.

Economic Methodology

Econometric Model. To answer the five questions posed previously, this study quantifies the relationship between the GAPP marketing effort and the demand for Wild Alaska Pollock. The model developed is based on the economic theory of consumer demand. In theory, one expects that GAPP's marketing activities are beneficial to the Wild Alaska Pollock producers because such marketing should increase the demand for Wild Alaska Pollock, which results in higher revenue for the industry. However, there are also other factors that affect demand. In order to distinguish the impact of GAPP marketing programs on demand for Wild Alaska Pollock from the impacts of other factors, an econometric framework is adopted. Econometric models are widely recognized as the best "science" available for evaluating demand impacts of commodity marketing expenditures.

The Wild Alaska Pollock demand model developed in this study uses bi-annual time series data for the national market for the period of 2007-2022 (first half). The models can be used to assess how strongly various Wild Alaska Pollock demand drivers are correlated with demand. For example, with the model we are able to determine how important a change in market volume is relative to a change in GAPP marketing expenditures regarding their impacts on the Wild Alaska Pollock price. An individual demand model is estimated separately for fillets and surimi.

The following demand drivers are included in the initial fillet model to determine which have a statistically significant impact on the fillet price:

- GAPP marketing expenditures
- Volume of catches of Wild Alaska Pollock
- Consumer Price Index for all items
- Volume of fillet in U.S. market

- Quantity of fillet imports into the U.S. market
- US fillet exports to EU
- Quantity of Tilapia, Pangasius, and Cod imports into the U.S. market
- Personal income in U.S.
- Exchange rate of U.S. dollar to Euro
- Indicator variable for USDA Bonus Buy
- Indicator variable for U.S. MSC certification
- Indicator variable for Russian MSC certification
- Indicator variable that only U.S.-caught Pollock can be called Alaska Pollock in the U.S.
- Indicator variable for McDonalds Fish McBites promotion
- Indicator variable for Chinese tariffs

The following demand drivers are included in the initial surimi model to determine which have a statistically significant impact on the surimi price:

- GAPP marketing expenditures
- Volume of catches of Wild Alaska Pollock
- Volume of Tilapia imports in the U.S.
- Volume of Itoyori imports in the U.S.
- Exchange rate of U.S. dollar to Euro
- Consumer Price Index for all items
- Indicator variable for Russian MSC certification
- Indicator variable for USDA Bonus Buy

All data and their sources are listed in the Appendix of this report.

To compare the relative importance of each factor on Wild Alaska Pollock demand, the results from the statistical (econometric) model are converted into "price flexibility coefficients." A price flexibility coefficient measures the percentage change in the fillet (or surimi) price given a one-percent change in a specific demand driver, holding all other factors constant. For example, the computed price flexibility for market volume measures the percentage change in the fillet (or surimi) price given a one-percent change in market volume. The computed GAPP marketing price flexibility coefficient measures the percentage change in the fillet (or surimi) price given a one-percent change in GAPP marketing expenditures, and so on. Since price flexibility coefficients are calculated for each demand factor listed above, one can compare them to determine which factors have the largest impact on fillet (or surimi) price.

Market Simulation Analysis. Once the econometric model is estimated, the resulting demand models are used to compute a return on investment for GAPP marketing expenditures. An average ROI provides the dollar returns from each dollar invested in GAPP marketing.

In order to compute the ROI, the estimated demand models are used to simulate the outcome of two scenarios for the period, 2017-2022. In the first scenario, which is the baseline or historical scenario, all demand drivers in the models are set to their semi-annual historical levels and the fillet (or surimi) price is simulated over time. This scenario provides a base to compare the counterfactual scenario results with. In the second scenario, which is the counterfactual no GAPP marketing scenario, all demand drivers except for GAPP marketing expenditures, are again set to their semi-annual historical values. However, unlike the first scenario, GAPP marketing expenditures are set to zero in the second scenario. Since the only thing different between the two scenarios is GAPP expenditures, the difference in simulated

prices between the two scenarios provides a quantitative measure of the impact of GAPP marketing on the fillet or surimi price.

Econometric Results

The complete set of econometric results is presented in the Appendix of this report. Here, we focus mainly on the estimated price flexibility coefficients. Table 1 presents the average (2007-2022) price flexibility coefficients for the fillet demand model and Table 2 presents those for the surimi demand model.

Table 1. Price Flexibility Coefficients (Average 2007-2022) for Fillet Demand Model Version.

Wholesale fillet price with respect to:	Coefficient
Volume of catch of Wild Alaska Pollock	-0.130
Volume of tilapia imports into U.S.	0.184
U.S. dollar – Euro exchange rate	-0.635
Consumer Price Index for all items	0.619
GAPP marketing expenditures	0.059

Each model was originally estimated with all the demand drivers discussed in the previous section. Then, a "step-down" regression method was used, where each variable that was not statistically significant was omitted one by one, and the regression was re-run. This procedure was followed until all remaining variables in the model were statistically significant.

The estimated fillet model has an excellent statistical fit with a coefficient of determination (R^2) of 0.84 indicating that the demand drivers in the model explained 84% of the variation in the fillet price over time. Volume of catch of Wild Alaska Pollock has a negative impact on the wholesale fillet price. Specifically, holding all other demand drivers constant a 10% increase in domestic fillet volume is associated with a 1.3% decrease in fillet price. This is

consistent with the well-known "Law of Demand" which says that price goes down when volume goes up and vice versa.

The volume of tilapia in the domestic market is positively associated with fillet price. Holding all other demand drivers constant, a 10% increase in tilapia volume is associated with a 1.84% increase in fillet price. This somewhat surprising result reflects the fact that yilapia and Wild Alaska Pollock are (complimentary) products and their prices move together in the same direction over time. A very similar result was found in the 2020 study.

The most important demand driver for fillet is the U.S. dollar – Euro exchange rate. A 10% increase in the dollar relative to the Euro is associated with a 6.35% decrease in fillet price. This reflects that the international market for fillet is extremely important. When the value U.S. dollar appreciates (or depreciates) relative to the Euro, this is akin to a price increase (or decrease) to foreign buyers and has a substantial impact on the demand for Wild Alaska Pollock.

Not surprisingly, the wholesale fillet price is positively associated with the overall inflation rate, which is measured as the Consumer Price Index for all items. A 10% increase in the Consumer Price Index is associated with a 6.19% increase in fillet price. This factor is almost as important as the U.S.-Euro exchange rate in influencing the fillet price.

In addition to these demand drivers, two of the indicator variables are statistically significant. First, the indicator variables for Russian MSC certification indicates an average decrease in the wholesale fillet price of 1% which is attributed to Russia receiving MSC certification. Second, the USDA purchases of Wild Alaska Pollock in 2019-20 increased the wholesale fillet price by 1.1%. Thus, these government purchases of Wild Alaska Pollock were quite beneficial to the industry.

The price flexibility coefficient associated with GAPP marketing is positive and statistically different from zero. Both current and four-periods of lagged promotion expenditures have a significant impact on the fillet price. Specifically, a 10% increase in GAPP marketing expenditures is associated with a 0.595% increase the fillet price, holding all other demand drivers constant. This means that the statistical evidence supports the hypothesis that GAPP's marketing activities increase demand for Wild Alaska Pollock fillet. So the answer to the first question posed in this research is that GAPP marketing does have a significant and positive impact on the fillet price.

Because there is error inherent in any statistical model, a 95% confidence interval is computed for the GAPP marketing. This interval can be interpreted as the range of possible values where one can be confident that the true population elasticity could be expected to fall 95% of the time. The 95% confidence interval for the GAPP marketing price flexibility coefficient is (0.005, 0.117). Because the lower bound estimate is positive, this provides statistical confidence that GAPP's marketing activities have a positive and statistically significant impact on the fillet price.

The estimated surimi model did not have as good of statistical fit as the fillet model. The surimi model has an R^2 of 0.66 (fillet was 0.84) indicating that the demand drivers in the model explained 66% of the variation in the surimi price over time. It is possible that there is an important demand driver for surimi that we have not captured in this model. While future refinement to this model will be useful, we still find some statistically significant demand drivers that impact the surimi wholesale price.

Volume of catch has a negative impact on the wholesale surimi price. Specifically, holding all other demand drivers constant a 10% increase in volume of Wild Alaska Pollock

catch is associated with a 0.70% decrease in surimi price. This is consistent with the well-known "Law of Demand" which says that price goes down when volume goes up and vice versa. This variable is found to be statistically significant at the 9% level based on a one-tailed p-value.

Table 2. Price Flexibility Coefficients (Average 2003-2020) for surimi Demand Model Version.

Wholesale surimi price with respect to:	Coefficient
Volume of catch of Wild Alaska Pollock	-0.070
Volume of Itoyori imports into U.S.	-0.191
U.S. dollar – Yen exchange rate	-0.670
Consumer Price Index for all items	0.540
GAPP marketing expenditures	0.035

The volume of Japanese Itoyori imports in the domestic market is negatively associated with surimi price. Holding all other demand drivers constant, a 10% increase in Itoyori import volume is associated with a 1.91% decrease in surimi price.

Like the fillet model results, the most important demand driver for surimi is the U.S. dollar – Yen exchange rate. A 10% increase in the dollar relative to the Yen is associated with a 6.7% decrease in surimi price. This reflects that the international market for surimi is extremely important. When the value U.S. dollar appreciates (or depreciates) relative to the Yen, this is akin to a price increase (or decrease) to foreign buyers and has a substantial impact on the demand for Wild Alaska Pollock surimi.

Not surprisingly, the wholesale surimi price is positively associated with the overall inflation rate, which is measured as the Consumer Price Index for all items. A 10% increase in

the Consumer Price Index is associated with a 5.4% increase in surimi price. This factor is almost as important as the U.S.-Yen exchange rate in influencing the surimi price.

In addition to these demand drivers, the indicator variable for the U.S. – China tariffs is statistically significant and positive, which indicates that the tariffs increased the wholesale surimi price.

The price flexibility coefficient associated with GAPP marketing is positive and statistically different from zero. Current (but not lagged) promotion expenditures have a significant impact on the surimi price. Specifically, a 10% increase in GAPP marketing expenditures is associated with a 0.35% increase the surimi price, holding all other demand drivers constant. This means that the statistical evidence supports the hypothesis that GAPP's marketing activities increase demand for Wild Alaska Pollock surimi. So the answer to the first question posed in this research is that GAPP marketing does have a significant and positive impact on the surimi price.

Because there is error inherent in any statistical model, a 95% confidence interval is computed for the GAPP marketing. This interval can be interpreted as the range of possible values where one can be confident that the true population elasticity could be expected to fall 95% of the time. The 95% confidence interval for the GAPP marketing price flexibility coefficient is (0.003, 0.067). Because the lower bound estimate is positive, this provides statistical confidence that GAPP's marketing activities have a positive and statistically significant impact on the surimi price.

Return on Investment

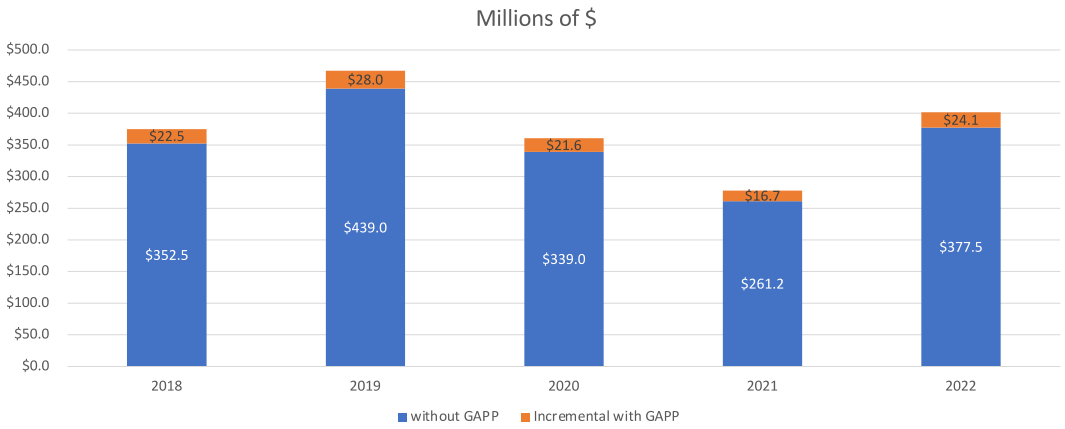
Both estimated wholesale demand models are used to simulate market conditions with and without the GAPP marketing. Specifically, two scenarios are simulated over the time period 2018 - 2022: (1) baseline scenario, where the wholesale fillet and surimi prices are simulated based on all explanatory variables sets to their historical levels, and (2) no-GAPP marketing scenario, which is the same as the baseline except GAPP marketing expenditures are set to zero. A comparison of the simulated wholesale fillet and surimi prices between these two scenarios provides a measure of the impact GAPP marketing on wholesale prices.

The results indicate that GAPP increased the wholesale fillet price by 5.9% and the wholesale surimi price by 3.5% relative to what it would have been in the absence of GAPP marketing. That is, in the past 5-years, without GAPP, the wholesale fillet and surimi prices would have averaged 5.9% and 3.5% less than what they actually were.

We can multiply the increase in the wholesale fillet and surimi prices due to GAPP marketing by fillet and surimi production to derive the gain in total wholesale revenue. The results are presented in Figure 1 below. Over the five-year period, the results indicate that GAPP marketing resulted in an average increase in total wholesale fillet revenue of $22.6 million per year, and wholesale surimi revenue by an average of $17.7 million per year. In other words, had there not been GAPP marketing over the past five years, net revenue would have been, on average, $40.3 million per year lower than it actually was.

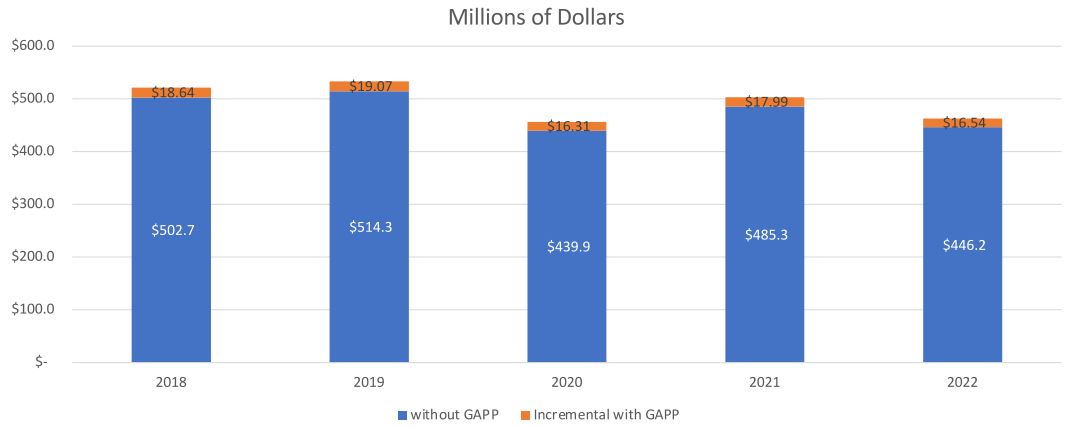
Based on this increased wholesale revenue and the total budget of GAPP over this 5-year period ($12.03 million), the rate of return on investment (ROI) from the NWPB promotion is equal to 15.75. In other words, each dollar invested in GAPP marketing returned $15.75 in

Impact of GAPP on industry-wide PBO fillet revenue (2018-2022)



Sources: NOAA and Undercurrent News Price Portal

Impact of GAPP on industry-wide surimi revenue (2018-2022)



Source: NOAA and US Census Bureau

Figure 1. Impact of GAPP on Fillet and Surimi Revenue.

wholesale revenue to the Wild Alaska Pollock industry. The lower bound of a 95% confidence interval for this ROI estimate is 1.35, which is still larger than 1.0 indicating positive net benefits

of GAPP marketing programs. Clearly, the quantitative evidence presented here illustrates that GAPP marketing has been impactful for the Wild Alaska Pollock industry.

Appendix. Econometric Models

Wholesale Fillet Demand Model

The wholesale fillet demand model is estimated with semi-annual data from 2007-2022, and has the following econometric results:

Dependent Variable: LOG(FILLETP)
Sample: 2007S1 2022S1
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.381381	1.372506	4.649437	0.0001
LOG(CATCHES)	-0.130442	0.043955	-2.967631	0.0069
LOG(TILAPIA)	0.183503	0.066963	2.740367	0.0117
LOG(USEUER)	-0.634770	0.159031	-3.991477	0.0006
LOG(CPI)	0.618538	0.210557	2.937634	0.0074
BONUSBUY	0.141977	0.040474	3.507885	0.0019
RUSCERT	-0.078889	0.035772	-2.205359	0.0377
PDL01	0.010205	0.004550	2.242812	0.0348

R-squared	0.843143	Mean dependent var	7.995360
Adjusted R-squared	0.795404	S.D. dependent var	0.101825
S.E. of regression	0.046058	Akaike info criterion	-3.100197
Sum squared resid	0.048791	Schwarz criterion	-2.730136
Log likelihood	56.05306	Hannan-Quinn criter.	-2.979567
F-statistic	17.66147	Durbin-Watson stat	2.146756
Prob(F-statistic)	0.000000		

Lag Distribution of LOG(GAPP)	i	Coefficient	Std. Error	t-Statistic
. * |	0	0.00850	0.00379	2.24281
. * |	1	0.01361	0.00607	2.24281
. * |	2	0.01531	0.00683	2.24281
. * |	3	0.01361	0.00607	2.24281
. * |	4	0.00850	0.00379	2.24281
	Sum of Lags	0.05953	0.02654	2.24281

In the table above, FILLETP is the wholesale export price for Wild Alaska Pollock fillets, CATCHES is U.S. volume of catches of Wild Alaska Pollock, TILAPIA is the volume of tilapia imports into the U.S., USEUER is the real agricultural trade adjusted exchange rate between the U.S. and the EU, CPI is the Consumer Price Index for all items, BONUSBUY is an indicator

variable for the USDA Bonus Buy program, RUSCERT is an indicator variable for Russian MSC certification, GAPP is marketing expenditures by GAPP, and LOG is the natural logarithm operator. The data source for exchange rates are from the USDA/ERS international macroeconomic data set, the CPI is from the Bureau of Labor Statistics, and all other data came from GAPP officials.

Wholesale Surimi Demand Model

The wholesale surimi demand model is estimated with semi-annual data from 2007-2022, and has the following econometric results:

Dependent Variable: LOG(SURIMIP)
Included observations: 31
Huber-White (HC0) heteroskedasticity consistent standard errors and covariance
No d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.15795	2.339000	4.342860	0.0002
LOG(CATCHES)	-0.069325	0.050595	-1.370203	0.1833
LOG(ITOY)	-0.190842	0.072330	-2.638478	0.0144
LOG(USJAER)	-0.670003	0.171688	-3.902434	0.0007
LOG(CPI)	0.539273	0.237651	2.269177	0.0325
TARIFF	0.056230	0.023837	2.358941	0.0268
LOG(GAPP)	0.034919	0.015560	2.244176	0.0343

R-squared	0.656357	Mean dependent var	7.793551
Adjusted R-squared	0.570446	S.D. dependent var	0.116334
S.E. of regression	0.076246	Akaike info criterion	-2.114023
Sum squared resid	0.139523	Schwarz criterion	-1.790220
Log likelihood	39.76736	Hannan-Quinn criter.	-2.008472
F-statistic	7.639972	Durbin-Watson stat	1.610807
Prob(F-statistic)	0.000115	Wald F-statistic	17.77193
Prob(Wald F-statistic)	0.000000		

In the table above, SURIMIP is the wholesale export price for Wild Alaska Pollock surimi, CATCHES is U.S. volume of catches of Wild Alaska Pollock, ITOY is the volume of Itoyori imports into the U.S., USJAER is the real agricultural trade adjusted exchange rate between the U.S. and Japan, CPI is the Consumer Price Index for all items, TARIFF is an indicator variable for the period of time that the U.S. and China imposed tariffs on each other's imports, and GAPP is marketing expenditures by GAPP. The data source for exchange rates are from the USDA/ERS international macroeconomic data set, the CPI is from the Bureau of Labor Statistics, and all other data came from GAPP officials.

Data Used in the Fillet and Surimi Models

Year.Season	Bonus Buy Dummy Variable	Wild Alaska Pollock Catch	Covid-19 Dummy Variable	Consumer Price Index all items 1982-84=100	Price of diesil fuel $/gal
2007S1	0	505,857	0	219.64	2.86
2007S2	0	689,557	0	224.58	3.22
2008S1	0	367,992	0	238.05	4.06
2008S2	0	525,092	0	251.66	3.68
2009S1	0	304,824	0	253.46	2.34
2009S2	0	410,924	0	251.67	2.78
2010S1	0	308,172	0	250.83	3.04
2010S2	0	441,482	0	250.07	3.19
2011S1	0	518,343	0	256.45	4.00
2011S2	0	707,343	0	264.17	4.02
2012S1	0	509,085	0	267.60	4.20
2012S2	0	739,485	0	267.77	4.14
2013S1	0	520,382	0	270.34	4.07
2013S2	0	756,282	0	270.46	4.03
2014S1	0	554,117	0	270.94	4.02
2014S2	0	812,517	0	271.18	3.86
2015S1	0	574,176	0	273.65	3.05
2015S2	0	849,676	0	274.46	2.75
2016S1	0	599,267	0	273.82	2.42
2016S2	0	872,567	0	272.40	2.70
2017S1	0	648,378	0	272.26	2.84
2017S2	0	843,878	0	271.10	3.09
2018S1	0	652,048	0	272.20	3.55
2018S2	0	825,548	0	273.36	3.74
2019S1	1	628,725	0	276.61	3.59
2019S2	1	818,125	0	276.51	3.64
2020S1	1	667,556	1	281.07	3.20
2020S2	1	699,644	1	284.22	2.98
2021S1	1	637,842	1	285.09	3.54
2021S2	1	792,669	1	293.07	4.15
2022S1	1	528,890	1	313.52	5.19

Year.Season	Dummy Variable Season A	U.S.-Euro Exchange Rate	Fillet Wholesale Price	Fillet Sales Volume	Promotion Expenditures GAPP
2007S1	1	80.73	2,702.94	66,870	537,982
2007S2	0	80.73	2,846.42	103,834	537,982
2008S1	1	77.92	3,214.04	47,368	169,618
2008S2	0	77.92	3,580.02	74,462	169,618
2009S1	1	83.49	3,187.40	47,063	147,068
2009S2	0	83.49	3,102.19	70,783	147,068
2010S1	1	86.30	3,081.80	42,734	130,350
2010S2	0	86.30	3,304.86	68,696	130,350
2011S1	1	82.33	3,074.24	69,279	134,478
2011S2	0	82.33	3,034.47	96,998	134,478
2012S1	1	87.61	3,159.98	61,644	129,576
2012S2	0	87.61	2,991.23	90,641	129,576
2013S1	1	85.49	2,981.21	70,576	154,028
2013S2	0	85.49	2,892.27	105,760	154,028
2014S1	1	85.55	3,017.69	72,166	210,625
2014S2	0	85.55	2,789.04	111,107	210,625
2015S1	1	100.00	2,766.04	63,878	207,041
2015S2	0	100.00	2,742.41	112,181	207,041
2016S1	1	103.55	2,648.02	55,100	425,181
2016S2	0	103.55	2,576.80	118,698	425,181
2017S1	1	103.44	2,587.74	64,364	354,196
2017S2	0	103.44	2,479.78	108,314	859,781
2018S1	1	99.88	2,338.73	69,162	303,005
2018S2	0	99.88	2,834.08	110,069	712,181
2019S1	1	105.45	2,918.70	78,509	622,493
2019S2	0	105.45	3,099.69	116,593	1,531,991
2020S1	1	104.69	3,035.45	73,377	1,522,062
2020S2	0	104.69	3,325.18	83,000	1,880,934
2021S1	1	100.01	3,227.35	53,850	2,233,663
2021S2	0	100.01	3,241.18	91,300	1,336,564
2022S1	1	100.03	3,660.12	56,463	1,884,367

Year.Season	Japanese GDP $	Disposable Income U.S. $	Itoyori Imports from Japan	U.S.-Yen Exchange Rate	Dummy Variable Name change
2007S1	4,286	10,425	21,820	105.96	0
2007S2	4,286	10,633	21,820	105.96	0
2008S1	4,240	10,959	21,642	95.26	0
2008S2	4,240	10,982	21,642	95.26	0
2009S1	4,010	10,905	17,137	87.11	0
2009S2	4,010	10,951	17,137	87.11	0
2010S1	4,178	11,230	20,801	83.67	0
2010S2	4,178	11,483	19,552	83.67	0
2011S1	4,173	11,792	20,721	78.68	0
2011S2	4,173	11,979	24,694	78.68	0
2012S1	4,236	12,388	21,853	80.33	0
2012S2	4,236	12,622	15,804	80.33	0
2013S1	4,320	12,420	15,115	99.36	0
2013S2	4,320	12,615	16,619	99.36	0
2014S1	4,336	12,998	12,575	106.65	0
2014S2	4,336	13,386	14,160	106.65	0
2015S1	4,389	13,645	10,568	121.04	0
2015S2	4,389	13,846	9,974	121.04	0
2016S1	4,412	14,026	8,114	110.29	0
2016S2	4,412	14,251	8,981	110.29	0
2017S1	4,508	14,640	8,368	115.60	0
2017S2	4,508	14,963	11,568	115.60	1
2018S1	4,523	15,439	7,573	115.44	1
2018S2	4,523	15,820	8,687	115.44	1
2019S1	4,552	16,096	6,918	115.48	1
2019S2	4,552	16,342	7,114	115.48	1
2020S1	4,336	17,425	5,526	114.56	1
2020S2	4,336	17,439	8,584	114.56	1
2021S1	4,490	18,796	7,900	121.00	1
2021S2	4,490	18,219	9,515	121.00	1
2022S1	4,607	18,340	5,340	123.00	1

Year.Season	Dummy Variable Russian Certification	Surimi Wholesale Price	Dummy Variable Tariff	Talapia Imports	Dummy Variable U.S. Certification
2007S1	0	1,998.51	0	48070.004	1
2007S2	0	2,085.09	0	52566.298	1
2008S1	0	1,861.40	0	44339.404	1
2008S2	0	1,826.05	0	59395.668	1
2009S1	0	2,651.91	0	51371.087	1
2009S2	0	2,425.44	0	63391.375	1
2010S1	0	2,622.95	0	64542.476	1
2010S2	0	2,907.04	0	86285.283	1
2011S1	0	2,459.93	0	57866.256	1
2011S2	0	2,298.08	0	74579.513	1
2012S1	0	2,521.11	0	80771.557	1
2012S2	0	2,690.04	0	87519.494	1
2013S1	0	2,313.29	0	63936.571	1
2013S2	1	2,203.18	0	95943.045	1
2014S1	1	2,270.30	0	72451.33	0
2014S2	1	2,329.13	0	92462.395	0
2015S1	1	2,369.73	0	78139.558	0
2015S2	1	2,372.01	0	79919.016	0
2016S1	1	2,406.67	0	67808.786	0
2016S2	1	2,322.11	0	62360.235	0
2017S1	1	2,267.05	0	58126.908	0
2017S2	1	2,328.68	0	62922.755	0
2018S1	1	2,539.58	0	51378.06	0
2018S2	1	2,601.75	1	72056.998	0
2019S1	1	2,773.43	1	46707.055	0
2019S2	1	2,707.72	1	59777.506	0
2020S1	1	2,643.12	0	55778	0
2020S2	1	2,594.41	0	60454	0
2021S1	1	2,793.43	0	43146	0
2021S2	1	2,549.11	0	65498	0
2022S1	1	2,921.44	0	42354.353	0