AN ECONOMIC ANALYSIS OF GENUINE ALASKA POLLOCK PRODUCERS MARKETING PROGRAMS

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October 23, 2020

EXECUTIVE SUMMARY

The Association of Genuine Alaska Pollock Producers (GAPP) commissioned an independent economic evaluation of the impacts of GAPP's marketing programs on the demand for Wild Alaska Pollock. In order to distinguish the impact of GAPP marketing programs on the demand for Wild Alaska Pollock from the impacts of other factors, an econometric framework was adopted. Once the econometric model is estimated, the resulting demand models are used to compute an average return on investment (ROI) for GAPP marketing expenditures. An average ROI provides the dollar returns from each dollar invested in the organization. In order to compute the ROI, the estimated demand models are used to simulate the outcome of two scenarios for the period, one with and one without the existence of the marketing organization. The results of this study focus on the past 5-year period, from 2016 - 2020. The results of this study determined that during this period, the average ROI of GAPP to its members has been $28.59 in wholesale revenue to the Wild Alaska Pollock industry as measured by the price of Wild Alaska Pollock fillet and surimi block for every dollar invested in the organization. The quantitative evidence illustrates that GAPP marketing expenditures have been positively impactful for the Wild Alaska Pollock industry.

INTRODUCTION

The Association of Genuine Alaska Pollock Producers (GAPP) is an organization of companies that catch and process Wild Alaska Pollock as well as others who have ownership of the fishery resource. GAPP also has an associate membership program that invites companies that have an interest either in the profitability of those who catch or process Wild Alaska Pollock or those who work to market the products of Wild Alaska Pollock. GAPP also seeks out other dollars including Federal grants to further its marketing efforts. GAPP promotes products made from the species caught in U.S. waters that are marketed in U.S. and overseas markets. Unlike federally-overseen mandatory checkoff programs used by much of the food and agricultural industries (https://www.ams.usda.gov/rules-regulations/research-promotion), this marketing program is funded through voluntary contributions by its members and associate members and the Federal grant dollars GAPP is awarded. Through this voluntary promotion program, GAPP has spent an average of $500,000 per year promoting Wild Alaska Pollock over the period between 2003 through 2018 (ranging from just over $200,000 per year to over $1,000,000 per year during the timeframe). Beginning in 2019, however, GAPP members dramatically increased their contributions to GAPP to an average of $3.65 million per year. This represents a more than seven-fold increase in average marketing spending by GAPP.

Because of the significant increase in marketing spending, the GAPP Board of Directors and members are interested in determining the impact of their financial investment on the demand for Wild Alaska Pollock. Specifically, they commissioned an independent economic study to determine whether the GAPP marketing efforts are having a positive impact on the value of wholesale products produced from 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 as measured by the effect on the wholesale price of Wild Alaska Pollock fillet and surimi block.

OBJECTIVES AND SCOPE OF WORK

This study quantitatively measures the overall impact of GAPP's marketing expendatures on enhancing the demand for two of the primary products made from Wild Alaska Pollock - fillet and surimi block. In order to assess the effectiveness of GAPP's marketing activities, an econometric modeling approach was adopted. 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, and imported Pollock), consumer income, other key 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 the 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 (fillet and surimi block).

This study answers 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 the demand for Wild Alaska Pollock?

To carry out this independent evaluation, GAPP contracted with Professor Harry M. Kaiser of Cornell University to perform the evaluation. 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 referenced 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 presents the following:

1. The types of marketing programs GAPP offers;
2. A conceptual overview of how economists evaluate the economic impacts of generic marketing programs;
3. The economic methodology used in this study to measure the effects of GAPP's marketing on Wild Alaska Pollock demand;
4. The econometric (statistical) estimation results;
5. 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; and
6. 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 products 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 product. 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. Specifically, GAPP put forward a strategic plan in 2019, that was approved by the Board of Directors, that focused the organization's resources in three key areas: (1) research into consumer perceptions of Wild Alaska Pollock; (2) building a brand for the fish based on consistent communications; and (3) partnership programs with companies that produce products for the consumers.

Over the last two years, GAPP has invested significantly into understanding Wild Alaska Pollock's attributes that are most motivational to entice consumers to buy the fish and try it. This research became the basis for the communications strategy implemented industry-wide to ensure that Wild Alaska Pollock is talked about the same way to build a consistent brand for the species (https://www.alaskapollock.org/about-us/news/gapp-launches-wild-alaska-pollock-messaging-toolkits-for-members-partners). In 2020, GAPP further invested in similar research in key European markets and also into research around Surimi and Roe (https://www.alaskapollock.org/about-us/news/wild-alaska-pollock-is-beloved-in-europe-but-not-everyone-knows-its-name). This research will be utilized not only by GAPP to guide its future marketing campaigns, but also will be utilized by all GAPP partners.

Another significant component of GAPP's marketing strategy has been to put more Wild Alaska Pollock in front of more consumers. To help accomplish this, GAPP has worked to start a Partnership Program which funds projects that puts Wild Alaska Pollock products into new channels or new categories, or helps raise Wild Alaska Pollock's profile with new consumers through popular influencers (https://www.alaskapollock.org/about-us/programs). 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 (https://www.alaskapollock.org/about-us/news/wild-alaska-pollock-consumer-awareness-familiarity-continues-to-grow-say-experts).

CONCEPTUAL OVERVIEW OF ECONOMIC EVALUATION

In an economic evaluation of generic (not brand-specific) marketing programs, two basic questions must be answered. First, does the program result in a higher price or value for the commodity? To be effective, the program must produce higher demand (measured as an increase in price) in the marketplace. Second, do the industry-wide benefits exceed the total cost of the marketing program? This is the bottom-line, and most important, effectiveness criterion to the industry funding the program.

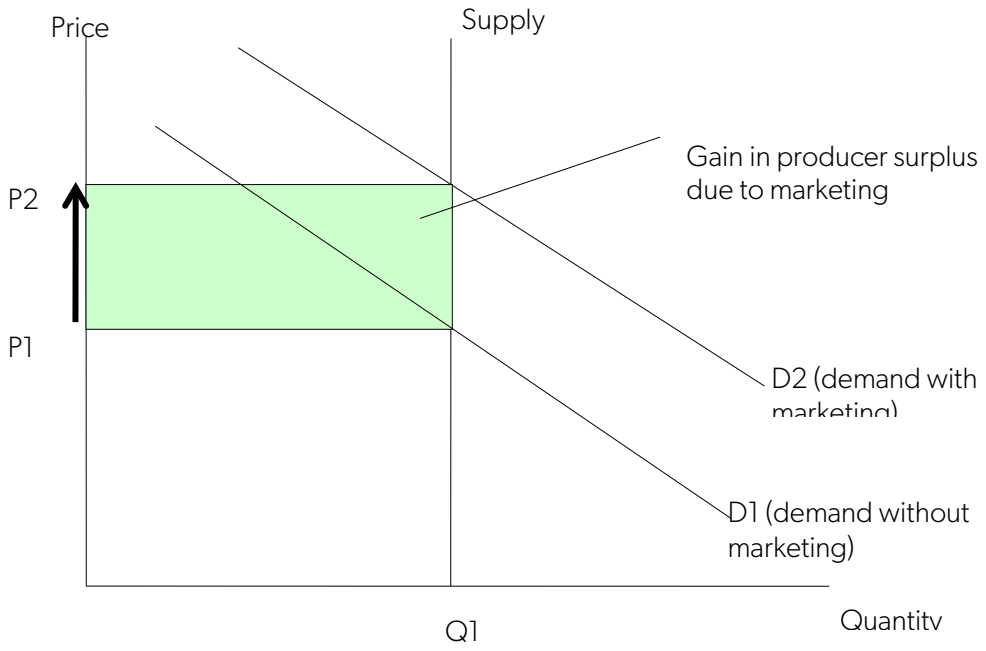
To evaluate the economic impacts of marketing programs on price and revenues, the most widely accepted method by economists is a market supply-demand framework. Obviously, other factors besides quantity affect the market price (i.e., demand drivers--see economic methodology section for detail), and these factors affect the position of the demand curve. Consequently, all these factors must be accounted

for in any quantitative analysis of market demand so that the impact of marketing activities can be accurately isolated.

Price determination in a market is based on the interaction of market demand and supply. The market supply curve measures how quantity supplied in the market responds to increases and decreases in price. For a commodity like wild-caught fish, the overall supply is generally fixed (by the catch) regardless of price level. Such a situation is most likely to happen in the short-run, when fishermen do not have time to make adjustments in production in response to a price change.

The goal of generic marketing programs is to increase the market demand for the commodity. Figure 1 illustrates the case of no supply response, which is an accurate reflection of the Wild Alaska Pollock market. The initial market "equilibrium" without a GAPP marketing program occurs where market supply and demand are equal, resulting in a market price and quantity of P1 and Q1, respectively. Suppose that the successful marketing program causes the market demand curve to increase from D1 to D2.[1] This marketing-induced increase in demand means that consumers now place greater value on the commodity, as reflected by the fact that they are willing to pay more for each quantity relative to the previous demand curve.

Figure 1. Impact of marketing when there is no supply response



[1] Checkoff programs also have an impact on market supply, one similar to the impact of a tax. The checkoff assessment would therefore cause the supply curve to decrease (i.e., shift back to the left). For simplicity, this shift is not drawn here.

However, since supply is fixed, the only way to bring the market back into equilibrium due to the increase in demand is for the market price to increase from P1 to P2. The benefit to producers from the marketing program is the gain in industry-wide "producer surplus" given by the shaded area in the figure. This gain in producer surplus measures the marketing program's revenue benefits to producers and should be compared to total marketing costs to determine the return on investment (ROI) of the program. Typically, economists use the following formula for computing the ROI:

ROI = (Gain in Revenue – Marketing Costs)/Marketing Costs

We will adopt a similar method in the economic methodology, discussed in the subsequent section.

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 2003-2020. 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 drivers have a statistically significant impact on the fillet price:

- GAPP marketing expenditures
- Volume of fillet in the U.S. market
- Quantity of fillet imports into the U.S. market
- U.S. fillet exports to the E.U.
- Quantity of Tilapia, Pangasius, and Cod imports into the U.S. market
- Personal income in the U.S.
- Gross Domestic Product (GDP) in the E.U.
- Marketing expenditures for Wild Alaska Pollock fillet products by private companies (confidentially obtained by GAPP from members and downstream partners who market Wild Alaska Pollock products)
- Exchange rate of the U.S. dollar to the Euro
- Indicator variable for U.S. Department of Agriculture "Bonus Buy(s)"
- Indicator variable for U.S. Marine Stewardship Council (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 fillet price:

- GAPP marketing expenditures
- Volume of surimi in the U.S. market
- GDP in the U.S. and Japan
- Wild Alaska Pollock surimi substitutes imported into Japan
- Exchange rate of the U.S. dollar to the Japanese Yen
- Indicator variable that only U.S.-caught Pollock can be called Alaska Pollock in the U.S.
- Indicator variable for Chinese tariffs

*Note: all data and their sources are listed in the Appendix of this report.

Price Flexibility Coefficients. 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 (ROI) 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, 2003-2020. 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 basis 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 (2003-2020) price flexibility coefficients for the fillet demand model and Table 2 presents those for the surimi demand model.

Table 1. Price Flexibility Coefficients (Average 2003-2020) for Fillet Demand Model Version.

Wholesale surimi price with respect to:	Coefficient
Domestic fillet volume	- 0.077
Domestic Tilapia volume	0.139
U.S. dollar – Euro exchange rate	- 0.343
Brand fillet marketing expenditures	0.043
GAPP marketing expenditures	0.024

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

Wholesale surimi price with respect to:	Coefficient
Volume of surimi substitute imports into Japan	- 0.291
U.S. dollar – Yen exchange rate	- 0.478
GDP in Japan	- 0.860
GAPP marketing expenditures	0.032

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 0.88 indicating that the demand drivers in the model explained 88% of the variation in the fillet price over time. Domestic volume of fillets 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 0.77% decrease in fillet price. This is consistent with the well-known "Law of Demand" which says that price goes down when volume goes up.

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 1.39% increase in fillet price. This somewhat surprising result reflects the fact that Tilapia and Wild Alaska Pollock are (complimentary) products and their prices move together in the same direction over time. However, it can be hypothesized that they are both affordable seafood products that benefit when consumers are seeking out such products to meet their seafood needs.

The most important demand driver for fillet is the exchange rate between the U.S. dollar and the Euro. A 10% increase in the dollar relative to the Euro is associated with a 3.43% decrease in fillet price. This demonstrates that the international market for fillet is extremely important. When the value of the 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.

Brand fillet marketing expenditures by the largest fish companies has had a positive and statistically significant impact on the fillet price. A 10% increase in brand marketing expenditures is associated with a 0.43% increase in fillet price. Therefore, in addition to GAPP marketing, brand marketing has been an effective way of increasing demand for Wild Alaska Pollock.

In addition to these demand drivers, two of the indicator variables are positive and statistically significant. First, the indicator variables for U.S. Marine Stewardship Council (MSC) certification indicates an average increase in the wholesale fillet price of 3.4% which is attributed to receiving MSC certification. It should be noted that this indicator variable was constructed to take into account the impact of Russian MSC that occurred in the second half of 2013, which was reflected by setting the U.S. certification variable equal to 0 from the first six months of 2014 (2014.1) to the first six months of 2020 (2020.1). Hence, it is assumed that the countervailing impact of certification from the two countries offset each other for the first half of 2014 through the first half of 2020 (2014.1-2020.1). Second, the USDA purchases of Wild Alaska Pollock in 2019-20 increased the wholesale fillet price by 4.8%. 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 one-period lagged promotion expenditures have a significant impact on the fillet price. Specifically, a 10% increase in GAPP marketing expenditures is associated with a 0.24% 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. Thus, 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 90% confidence interval is computed for the GAPP marketing effect. 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 90% of the time. The 90% confidence interval for the GAPP marketing price flexibility coefficient is (0.003, 0.045). 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 a statistical fit as the fillet model. The surimi model has an R^2 of 0.52 (fillet was 0.88) indicating that the demand drivers in the model explained 52% 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.

While domestic volume of surimi was not found to significantly influence the wholesale surimi price, the volume of Wild Alaska Pollock surimi substitutes in Japan had a significant and negative impact on the surimi price. Specifically, holding all other demand drivers constant, the results indicate that a 10% increase in the volume of Wild Alaska Pollock surimi substitutes in Japan decreased the wholesale surimi price by 2.9%. Japan is the most important export market for U.S. surimi, which is clearly reflected by this result.

Similar to the fillet demand model, the U.S. exchange rate relative to other country currencies is a significant demand driver for surimi. Specifically, a 10% increase in the dollar relative to the Yen is associated with a 4.8% decrease in surimi price.

The most important demand driver for surimi is Gross Domestic Product (GDP) in Japan. Specifically, a 10% increase in GDP in Japan is associated with an 8.6% decrease in the surimi price, holding all other demand drivers constant. This result reflects that as economic conditions worsen, Japanese consumers switch to lower-cost fish products such as surimi, but when economic conditions strengthen, they switch to higher-priced fish.

The price flexibility coefficient associated with GAPP marketing is positive and statistically different from zero. The results are remarkably similar to the fillet demand model even though much of GAPP's marketing programs are used for the marketing of fillet products. This indicates that GAPP's fillet marketing has a "halo" impact on other Wild Alaska Pollock products such as surimi. Both current and one-year lagged promotion expenditures have a significant impact on the surimi price. Specifically, a 10%

increase in GAPP marketing expenditures is associated with a 0.3% increase the surimi price, holding all other demand drivers constant. This result is not statistically different from GAPP's impact on the fillet price. The 90% confidence interval on the GAPP marketing price flexibility coefficient for surimi is (0.008, 0.040). Hence, again 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*.

AVERAGE 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 2003 – 2020: (1) baseline scenario, where the wholesale fillet and surimi prices are simulated based on all explanatory variables sets to their historical levels, and (2) a 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. Here we focus on the past 5-year period, from 2016 - 2020.

Figures 2 and 3 present the estimated impact of GAPP marketing expenditures on the wholesale fillet and surimi price, respectively, for 2016 through 2020. Between 2016- 2020, had there not been any GAPP marketing, the wholesale fillet price would had been 5.3% lower on average than it actually was during this period (Figure 2). Likewise, had there been no GAPP marketing over this period, the wholesale surimi price would have been 5.9% lower than it actually was over this period.

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. Over the five-year period, the results indicate that GAPP marketing efforts resulted in an increase in total wholesale fillet revenue of $121.6 million and wholesale surimi revenue by $132.9 million. Based on this increased wholesale revenue and the total budget of GAPP over this 5-year period ($8.6 million), the rate of return on investment (ROI) from the NWPB promotion is equal to:

ROI = (121.6 + 132.9 - 8.6) /8.6 = 28.59

In other words, each dollar invested in GAPP marketing returned $28.59 in wholesale revenue to the Wild Alaska Pollock industry. The lower bound of a 90% confidence interval for this ROI estimate is 4.66, which is still much 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.*

Figure 2. Wholesale fillet price with and without GAPP marketing, 2016-20.

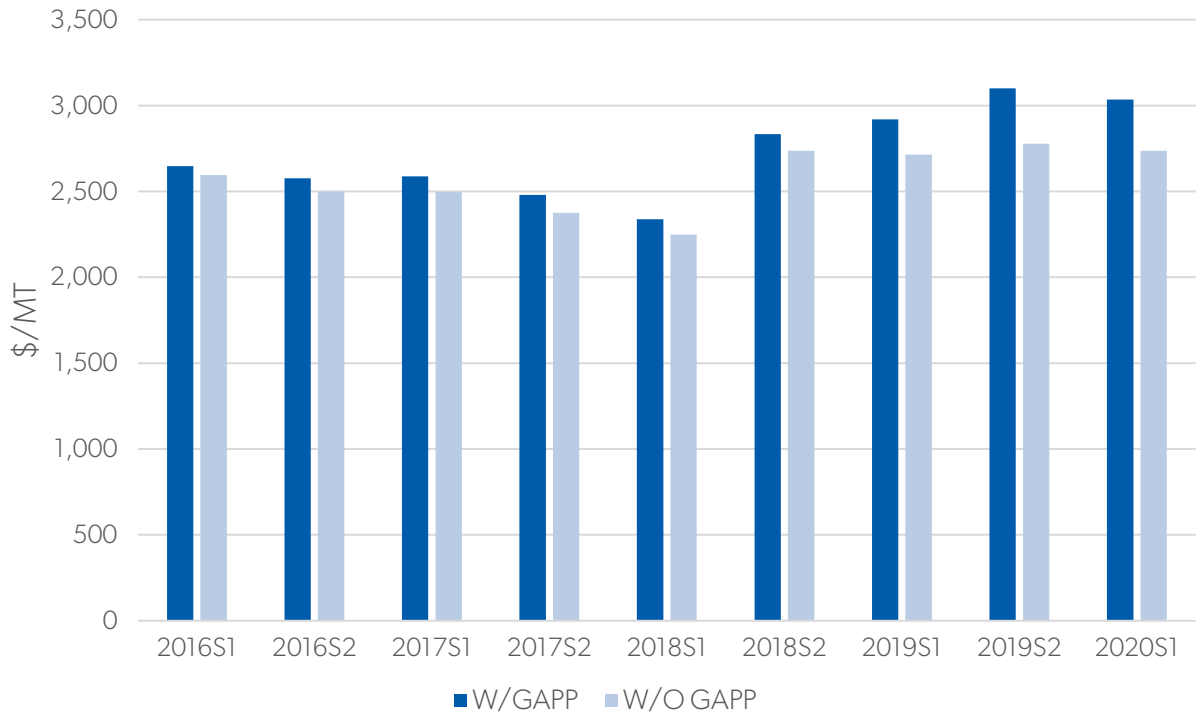
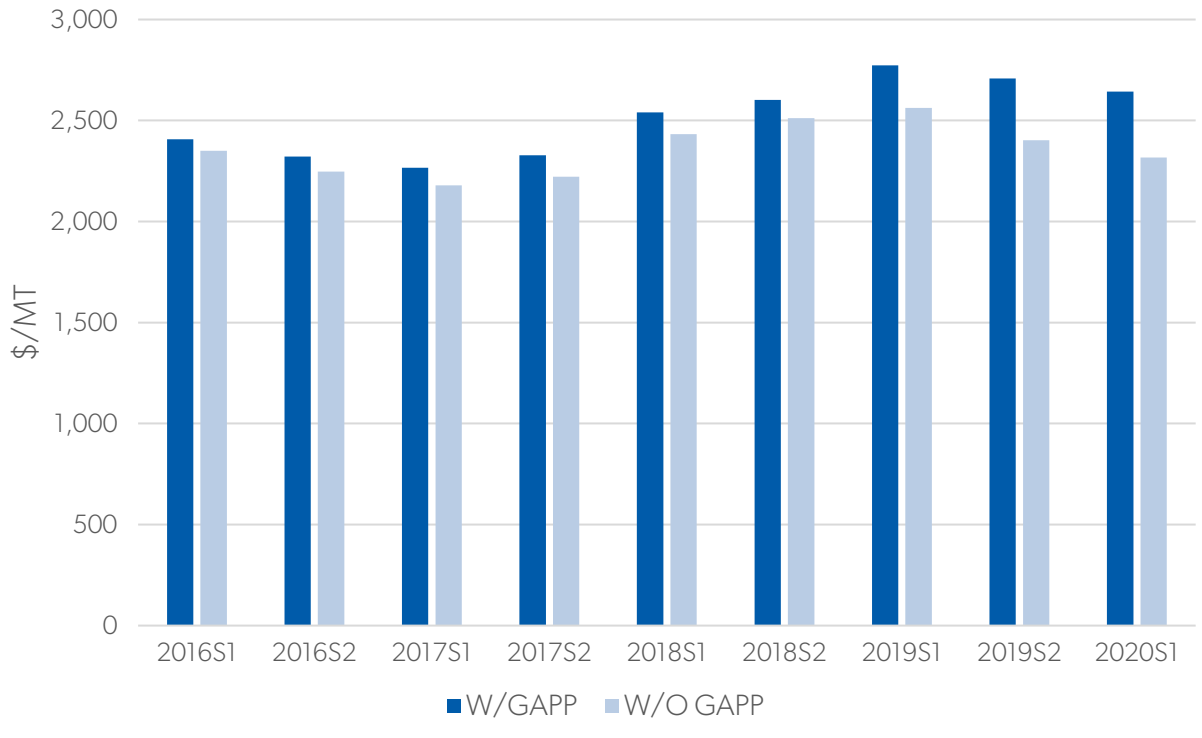


Figure 3. Whoelsale Surimi price with and without GAPP marketing, 2016-2020.



APPENDIX. ECONOMETRIC MODELS

Wholesale Fillet Demand Model

The wholesale fillet demand model is estimated with semi-annual data from 2003-2020, and has the following econometric results:

Dependent Variable: FILLETP

Method: Least Squares

Sample (adjusted): 2003S2 2020S1

Included observations: 34 after adjustments

HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	1986.735	499.2585	3.979372	0.0005
FILLETQ-FILLETEUX+FILLETM	-0.004487	0.001936	-2.317668	0.0289
US-EU EXCH RATE	-8.823065	4.750000	-1.857488	0.0751
TILQ	0.006803	0.002304	2.953150	0.0068
FILLETP(-1)	0.451773	0.117413	3.847709	0.0007
BRAND(-1)/CPI(-1)	0.023416	0.013183	1.776187	0.0879
GAPP/CPI+GAPP(-1)/CPI(-1)	0.023732	0.012164	1.951028	0.0623
USCERT	200.3205	74.90402	2.674362	0.0130
BONUSBUY	145.0837	125.7080	1.154133	0.2594

R-squared	0.880247	Mean dependent var	2781.627
Adjust R-squared	0.841926	S.D. dependent var	399.6586
S.E. of regression	158.8985	Akaike info criterion	13.19634
Sum squared resid	631218.3	Schwarz criterion	13.60037
Log likelihood	-215.3377	Hannan-Quinn criter	13.33412
F-statistic	22.97033	Durbin-Watson stat	2.325903
Prob(F-statistic)	0.000000	Wald F-statistic	64.32973
Prob(Wald F-statistic)	0.000000		

In this table, FILLETP is the wholesale export price for Wild Alaska Pollock fillets, FILLETQ is U.S. fillet production, FILLETEUX is U.S. fillet exports to the EU, FILLETM is the volume of U.S. imports of fillet, US-EU EXCH RATE is the real agricultural trade adjusted exchange rate between the U.S. and the EU, TILQ is the volume of tilapia imports into the U.S., FILLETP(-1) is the U.S. wholesale fillet price lagged on period, BRAND is marketing expenditures by the largest fish companies for Wild Alaska Pollock fillets, CPI is the Consumer Price Index for all items in the U.S., GAPP is marketing expenditures by GAPP, GAPP(-1) is marketing expenditures by GAPP lagged one period, USCERT is an indicator variable for US MSC certification, and BONUSBUY is an indicator variable for the USDA Bonus Buy program. 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.

Dependent Variable: SURIMIP

Method: Least Squares

Sample (adjusted): 2007S1 2020S1

Included observations: 27 after adjustments

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	6137.125	1468.623	4.17883	0.0004
POLLOCKALT	0.013510	-0.004213	-3.206504	0.0042
US-YEN EXCH RATE	-10.58362	4.098382	-2.582389	0.0174
GDPJAPAN	-0.344502	0.274506	-1.254991	0.2233
GAPP/CPI+GAPP(-1)/CPI(-1)	0.024157	0.009367	2.578842	0.0175
TARIFF	296.0873	65.45474	4.523543	0.0002

R-squared	0.521931	Mean dependent var	2399.821
Adjust R-squared	0.408105	S.D. dependent var	264.2543
S.E. of regression	203.3033	Akaike info criterion	13.66041
Sum squared resid	867977.1	Schwarz criterion	13.94837
Log likelihood	-178.4155	Hannan-Quinn criter	13.74603
F-statistic	4.585337	Durbin-Watson stat	1.511263
Prob(F-statistic)	0.005532	Wald F-statistic	8.716981
Prob(Wald F-statistic)	0.000135		

In this table, SURIMIP is the wholesale export price for Wild Alaska Pollock surimi, POLLOCKALT is Wild Alaska Pollock surimi substitutes volume imported into Japan, US-YEN EXCH RATE is the real agricultural trade adjusted exchange rate between the U.S. and Japan, GDPJAPAN is Gross Domestic Product in Japan, CPI is the Consumer Price Index for all items in the U.S., GAPP is marketing expenditures by GAPP, GAPP(-1) is marketing expenditures by GAPP lagged one period, and TARIFF is an indicator variable for

the recent set of tariffs imposed by both China and the U.S. The data source for exchange rates and GDP in Japan 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.

Real US

	USDA Bonus Buy	Frozen Cod Fillet Imports	Consumer Price Index All Items	Euro Exchange Rate Index	US Fillet Exports to EU	US Surimi Exports to EU	Fillet Imports to US	Fillet Export Price	US Fillet Production	US Fillet Exports	EU Gross Domestic Product
Year	0,1	MT	1980 – 82 =100	2010 =100	MT	MT	MT	$/MT	MT	MT	Bil $
2003S1	0	22,972	202.1	109.9	19,961	7,166	13,843	2,029.41	46100	20,801	15,515
2003S2	0	19,873	203.5	109.9	48,117	9,499	14,615	1,825.08	97100	49,564	15,515
2004S1	0	24,225	205.3	100.4	25,128	8,965	11,561	2,048.08	56200	33,605	15,913
2004S2	0	20,005	206.8	100.4	65,610	12,320	13,701	2,034.95	101300	70,478	15,913
2005S1	0	19,158	208.8	101.3	27,533	12,448	13,034	2,038.08	48600	31,086	16,249
2005S2	0	23,290	209.1	101.3	47,631	18,760	12,959	2,386.57	105400	49,662	16,249
2006S1	0	22,779	211.2	101.4	25,591	7,044	10,055	2,528.09	60800	28,738	16,793
2006S2	0	20,279	214.5	101.4	55,159	10,635	8,493	2,727.04	104300	59,097	16,793
2007S1	0	18,459	219.6	93.4	34,049	4,274	14,808	2,702.94	66800	43,828	17,310
2007S2	0	19,707	224.6	93.4	52,009	7,824	15,271	2,846.42	102600	60,823	17,310
2008S1	0	16,296	238.0	90.1	28,774	7,033	13,087	3,214.04	47300	33,731	17,394
2008S2	0	16,784	251.7	90.1	40,269	9,939	14,402	3,580.02	73300	54,443	17,394
2009S1	0	15,451	253.5	96.5	21,098	3,023	19,669	3,187.40	46200	31,265	16,638
009S2	0	15,291	251.7	96.5	32,594	5,160	14,339	3,102.19	69500	47,419	16,638
2010S1	0	15,896	250.8	100.0	24,250	5,655	14,500	3,081.80	42900	40,436	17,010
2010S2	0	18,415	250.1	100.0	35,284	5,337	14,204	3,304.86	68600	41,128	17,010
2011S1	0	19,344	256.5	95.6	45,812	11,711	14,669	3,074.24	68700	56,167	17,308
2011S2	0	20,350	264.2	95.6	50,546	17,046	15,908	3,034.47	95900	57,896	17,308
2012S1	0	16,783	267.6	101.8	27,442	14,510	11,375	3,159.98	61400	32,660	17,240
2012S2	0	17,995	267.8	101.8	38,605	19,168	11,899	2,991.23	89700	47,696	17,240
2013S1	0	19,924	270.3	99.1	46,041	15,714	12,370	2,981.21	70577	51,733	17,284
2013S2	0	22,097	270.5	99.1	57,746	19,851	13,402	2,892.27	106340	63,119	17,284
2014S1	0	24,884	270.9	99.2	46,476	12,004	12,980	3,017.69	72166	52,453	17,592
2014S2	0	23,475	271.2	99.2	73,496	13,254	10,839	2,789.04	110331	79,366	17,592
2015S1	0	23,350	273.6	116.6	40,096	8,204	8,475	2,766.04	63896	45,928	18,005
2015S2	0	24,692	274.5	116.6	69,370	14,471	10,253	2,742.41	112300	78,224	18,005
2016S1	0	25,158	273.8	120.7	36,620	13,491	4,933	2,648.02	55100	47,138	18,373
2016S2	0	26,712	272.4	120.7	70,831	14,295	4,754	2,576.80	118600	80,181	18,373
2017S1	0	26,050	272.3	120.4	38,925	10,972	3,454	2,587.74	64122	51,113	18,824
2017S2	0	29,120	271.1	120.4	58,972	15,338	3,765	2,479.78	107696	79,587	18,824
2018S1	0	24,320	272.2	116.2	38,358	12,142	2,411	2,338.73	69300	61,114	19,201
2018S2	0	28,754	273.4	116.2	63,288	17,794	3,913	2,834.08	109100	78,986	19,201
2019S1	1	23,948	276.6	121.9	43,380	13,132	5,408	2,919.00	78509	57,466	19,478

2019S2	1	25,637	276.5	121.9	63,309	15,951	7,344	3,100.00	116593	75,086	19,478
2020S1	1	23,426	280.2	121.8	40,097	17,004	2,783	3,035.00	73377	54,535	19,769

Surimi

	Japan Gross Domestic Product	Personal Disposable US Income	McDonalds Fish McBites	Name Chg Alaska Pollock	Substitutes Imported to Japan	GAPP Marketing Expenditures	Russian MSC Certification	Surimi Export Price	US Surimi Production	US Surimi Exports
Year	Bil $	Bil $	0,1	0,1	MT	$	0,1	$/MT	MT	MT
2003S1	5,459	10,177	0	0		0	0	1,954.07	83,900	57,623
2003S2	5,459	10,426	0	0		0	0	1,773.62	113,000	81,136
2004S1	5,579	10,548	0	0		104,293	0	1,558.91	73,000	61,556
2004S2	5,579	10,744	0	0		104,293	0	1,531.56	111,300	100,415
2005S1	5,672	10,736	0	0		303,057	0	2,041.70	77,000	75,749
2005S2	5,672	10,888	0	0		303,057	0	2,088.05	123,400	110,982
2006S1	5,753	11,184	0	0		249,143	0	2,106.66	76,200	67,750
2006S2	5,753	11,300	0	0		249,143	0	1,972.15	101,900	95,862
2007S1	5,848	11,486	0	0	65,584	537,982	0	1,998.51	68,600	51,678
2007S2	5,848	11,515	0	0	79,198	537,982	0	2,085.09	93,000	74,100
2008S1	5,784	11,656	0	0	80,159	169,618	0	1,861.40	51,600	43,310
2008S2	5,784	11,565	0	0	69,823	169,618	0	1,826.05	74,100	54,158
2009S1	5,471	11,628	0	0	49,896	147,068	0	2,651.91	34,700	30,285
2009S2	5,471	11,556	0	0	69,181	147,068	0	2,425.44	52,200	42,254
2010S1	5,700	11,716	0	0	64,961	130,350	0	2,622.95	42,500	40,354
2010S2	5,700	11,929	0	0	69,388	130,350	0	2,907.04	61,000	53,290
2011S1	5,693	12,071	0	0	55,595	134,478	0	2,459.93	63,600	58,787
2011S2	5,693	12,129	0	0	68,527	134,478	0	2,298.08	84,470	74,029
2012S1	5,779	12,432	0	0	53,754	129,576	0	2,521.11	68,000	67,512
2012S2	5,779	12,570	1	0	52,053	129,576	0	2,690.04	99,000	83,472
2013S1	5,894	12,278	1	0	39,506	154,028	0	2,313.29	70,177	69,538
2013S2	5,894	12,401	0	0	41,311	154,028	1	2,203.18	100,100	91,369
2014S1	5,916	12,684	0	0	43,331	210,625	1	2,270.30	75,461	68,736
2014S2	5,916	13,004	0	0	45,444	210,625	1	2,329.13	108,100	92,170
2015S1	5,996	13,288	0	0	40,057	207,041	1	2,369.73	81,100	72,482
2015S2	5,996	13,457	0	0	42,431	207,041	1	2,372.01	121,200	99,031
2016S1	6,053	13,562	0	0	37,393	425,181	1	2,406.67	80,100	75,291
2016S2	6,053	13,656	0	1	40,434	425,181	1	2,322.11	124,100	102,545
2017S1	6,158	13,907	0	1	32,625	606,988	1	2,267.05	83,090	77,216
2017S2	6,158	14,099	0	1	37,028	606,988	1	2,328.68	124,200	108,084

2018S1	6,206	14,448	0	1	34,133	507,594	1	2,539.58	91,332	82,933
2018S2	6,206	14,664	0	1	37,851	507,594	1	2,601.75	114,900	102,867
2019S1	6,245	14,906	0	1	38,143	1,818,500	1	2,773.43	90,708	81,418
2019S2	6,245	15,043	0	1	36,748	1,818,500	1	2,707.72	108,444	92,709
2020S1	6,272	15,060	0	1	31,609	1,835,000	1	2,643.00	80,613	72,500

	Real US			
	Tilapia Imports to US	China-US Tariff	US MSC Certification	Euro Exchange Rate Index
Year	MT	0,1	0,1	2010=100
2003S1	10,743	0	0	97.1
2003S2	12,506	0	0	97.1
2004S1	16,706	0	0	93.1
2004S2	19,454	0	0	93.1
2005S1	22,646	0	0	98.3
2005S2	32,970	0	1	98.3
2006S1	33,396	0	1	106.8
2006S2	40,985	0	1	106.8
2007S1	48,070	0	1	111.2
2007S2	52,566	0	1	111.2
2008S1	44,339	0	1	99.9
2008S2	59,396	0	1	99.9
2009S1	51,371	0	1	91.4
2009S2	63,391	0	1	91.4
2010S1	64,542	0	1	87.8
2010S2	86,285	0	1	87.8
2011S1	57,866	0	1	82.5
2011S2	74,580	0	1	82.5
2012S1	80,772	0	1	84.3
2012S2	87,519	0	1	84.3
2013S1	63,937	0	1	104.2
2013S2	95,943	0	1	104.2
2014S1	72,451	0	0	111.9
2014S2	92,462	0	0	111.9
2015S1	78,140	0	0	127.0
2015S2	79,919	0	0	127.0
2016S1	67,809	0	0	115.7
2016S2	62,360	0	0	115.7
2017S1	58,127	0	0	121.3
2017S2	62,923	0	0	121.3
2018S1	51,378	0	0	121.1
2018S2	72,057	1	0	121.1
2019S1	46,707	1	0	122.0
2019S2	59,778	1	0	122.0
2020S1	55,593	1	0	122.3