The Determinants of Plant-Based Meat Alternative Purchases in the U.S.

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Abstract: Plant-Based Meat Alternative (PBMA) products, as an alternative protein source, are designed to mimic the test and texture of conventional meat and claim to remove the detrimental health effects associated with consuming animal meat. PBMA is still not a substitute for red meat although the U.S. market is experiencing substantial growth in PBMA products. In this study, we combine multi-layer socioeconomic and demographic characteristics using household-level consumer panel data covering the entire United States to determine the factors influencing PBMA consumption. We find a small increase in price results in a substantial reduction in both probabilities of consumption and quantity demand for PBMA. However, household income does not play a significant role in consumption decisions. Young and educated females are more likely to consume PBMA products while age, employment, and education do not have any significant effect on male-headed household consumption decisions. Asian and African American consumers purchase more PBMA than Caucasians. Hence, there is a need for more investment in research and development focusing on the PBMA industry so that consumers can decide for themselves if PBMA could be a staple on their plate.

Keywords: Plant-Based Meat, Panel-Double Hurdle, Demand, Elasticity, Meat

1. Introduction:

Animal agriculture derives worldwide criticism from environmental, animal welfare, and public health perspective. It is a major concern as around 14.5% of global greenhouse gas emissions originated from livestock production and even in the U.S, this sector is responsible for almost half of the total greenhouse gas emissions from agricultural activities. The U.S. is one of the heaviest beef-consuming countries (57.2 lb. per capita in 2018), although many consumers reported a desire to reduce their consumption (Neff et al., 2018) and try new alternative protein options (Van Loo et al., 2020). The growing demand and consumption of red and processed meat also exacerbate detrimental health outcomes forcing many national and international food-based dietary guidelines to advise reduction of meat consumption (USDA, 2020).

The demand for plant-based protein sources such as soy chunks, tofu, tempeh, and such like other plant products is substantially lower than animal meat products, especially in Western countries like the United States. Plant-Based Meat Alternative (PBMA) can be a good option, as argued by the proponents of PBMA, that is designed not only to replicate the test and texture of conventional meat but also to avoid the detrimental health effects (e.g., cholesterol, saturated fat content) as it is fully plant-based (Lacy-Nichols et al., 2021). The raw ingredients of PBMA are originated from soy, pea, and wheat protein and the production process has advantages over the animal meat industry by generating lower greenhouse gas emissions and minimal use of water and land (Heller & Keoleian, 2018; Tilman & Clark, 2014; Zhao et al., 2022).

However, there are some concerns regarding the PBMA being a substitute for animal meat as the cultural identity is deeply bonded with conventional meat and some concern of nutritional loss during the ultra-processing of PBMA still exists (Hu et al., 2019; Slade, 2018; Zhao et al., 2022). We do not have a clear understanding of the long-run health effects of PBMA as it is a relatively new product. Although the nutritional positioning of PBMA is a matter of debate, if producers promote it as an ‘ultra-processed’ food then there is a concern regarding some adverse health effects including obesity, CVD, cancer, and type 2 diabetes (Lacy-Nichols et al., 2021). Hence, meat proponents and some nutrition experts are expressing doubts regarding the potential health benefits the product claims due to its ultra-processing nature (Bohrer, 2019; Khandpur et al., 2021; Santo et al., 2020).

The recent growth of the PBMA industry creates a dire need to identify whether PBMA is only attracting the meat reducers-flexitarians and nonmeat consumers or the majority of the PBMA demand is originated from conventional meat consumers (Zhao et al., 2022). To become a mainstream product and a perfect substitute for animal meat, PBMA price needs to be very competitive with conventional meat products. However, due to the lack of research and development, technological advancement, and expensive processing methods make the PBMA price higher than some of the conventional meat products (e.g., ground meats). Hence, a majority of the consumers may be reluctant to shift from animal meat apart from testing the PBMA once or twice. According to the market demand study of PBMA by Zhao et al. (2022), the demand and market share of PBMA in the United States is substantially lower compared to conventional meat. The authors found that consumers consider PBMA as a substitute for chicken, turkey, and fish but a complement for beef and pork.

Although some consumers were skeptical regarding plant-based meat products' taste, price, safety, and naturalness at the beginning, the uprising market demand shows a promising trajectory for plant-based meat to become viable alternatives to meat in the long term. Indeed, the market segment of plant-based meat was worth $939 million in 2019 and it is estimated that by 2025 the market value will be around $27.9 billion in the U.S (Choudhury et al., 2020). However, PBMA market may face issues related to sustainable growth in the future considering consumers' unfamiliarity with the processing nature and the nutritional aspects of the product. Several surveys have been conducted to determine the consumption pattern of plant-based meat among different countries and the results vary widely. The survey results are dependent on the questionnaire design and terminology that may not necessarily be a true reflection of consumers' purchasing behavior and thus the result varies significantly even within countries (Bryant et al., 2019).

In this study, we combine numerous socioeconomic and demographic characteristics of household-level data covering the entire United States, rather than focusing only on the own and cross price elasticity of PBMA. As of now, there is no study conducted in the United States utilizing microlevel household characteristics that determines PBMA consumption. Moreover, we use retail level consumer purchase data that accurately represent the market demand for PBMA instead of depending on surveys and questionnaires that creates a hypothetical market condition. We are also using instrumental variable and control function approach to depict the price elasticity more accurate which is first of its kind in a panel-double hurdle framework. Hence, this study will shed light on the determines of household PBMA consumption that will eventually help to implement suitable policies for the betterment of both consumers and PBMA industry.

2. Data and Preliminary Analysis:

Our primary source of data is the Nielsen Scantrack scanner panel data. The enriched dataset contains around 40,000 to 60,0000 active participant households and 35,000 to 55,000 grocery, drug, mass merchandise, and other stores representing the entire U.S (divided into 52 markets). We compiled plant-based meat price, quantity, household income, and other demographic variables of 9,321 participant households covering monthly observations of 2018 and 2019 for this study. PBMA consists of various categories of products whereas Beyond Meat and Impossible Meat brands contribute a substantial proportion of total sales. The household scanner data contains observations of repeated purchasing behavior including quantities and prices of each household for over two or more years. Hence, the enriched data source is widely used to analyze consumer demand and purchasing behavior (Zare & Zheng, 2021; Zhao et al., 2022; Zhen et al., 2011, Zheng et al., 2016). We select the households that agree to scan and transmit the store-bought items for every month of 2018 and 2019 totaling 24 observations for each household.

The unit price of PBMA can not be observed directly in the household scanner panel data. Hence, we derive the unit price of purchasing households by dividing the total PBMA expenditure by total quantity purchased. There is a substantial percentage of households that do not consume PBMA and hence we follow an alternative approach used by Dong & Kaiser (2008) to calculate unit price. The imputed unit price of non-purchased households is obtained by averaging the unit price of households that purchased PBMA.

One of the major limitations of formulating unit price following the above approach is the high possibility of price endogeneity that may cause bias in estimates. To remove the endogeneity problem, we are using instrumental variable (IV) as an identification strategy. This is the first study to deal with price endogeneity in a panel-double hurdle framework. Let us consider a bivariate model:

$$y = \alpha + \beta x + \varepsilon \tag{1}$$

Here, x as an endogenous variable where $cov(x, \varepsilon) \neq 0$. If we consider an instrumental variable z such that it is correlated with x but not correlated with ε. Hence, to remove price (p) endogeneity problem we need to use an IV where $cov(z, p) \neq 0$ but $cov(z, \varepsilon) = 0$. Although satisfying the first requirement $cov(z, p) \neq 0$ is not a concern, but in practice fulfilling the second requirement $cov(z, \varepsilon) = 0$ is the difficult part as ε is unobserved. Thus, we have to rely on the economic intuition to meet the assumption. In this study we are using the average unit price of all the counties within a state excluding the county the households purchased from as an IV to solve price endogeneity problem.

We implement two-stage residual inclusion approach as a solution for bias estimate of price. In this method we first regress the unit price of PBM with the price IV and extract the residual. If we include the residual as a regressor in the econometric model, then the estimators are called as two stage residual inclusion estimators (Palmer et al., 2017). This can be written as:

$$\text{Stage 1: } p = \alpha + \beta p_{iv} + \varepsilon, \qquad \varepsilon \sim N[0, \sigma^2]$$
$$\text{Stage 2: } h(E|y) = \beta_0 + \beta_1 p + \beta_2 \hat{\varepsilon} \tag{2}$$

We further implement Fishers Price Index to remove the effect of inflation. Fishers Index can be written as:

$$Fishers\ index = \sqrt{Laspeyers\ index \times Paasche\ index}$$
$$Laspeyres\ index = \frac{\sum_{n=1}^{N} p_n^t q_n^{t-1}}{\sum_{n=1}^{N} p_n^{t-1} q_n^{t-1}}$$
$$Paasche\ index = \frac{\sum_{n=1}^{N} p_n^t q_n^t}{\sum_{n=1}^{N} p_n^{t-1} q_n^t} \tag{3}$$

Where, p_n^t is the price of product n at t time and q_n^t is the quantity consumed of product n at t time. p_n^{t-1} and q_n^{t-1} are the price and quantity of same product at $t-1$ time.

Table 1 represents the descriptive statistics of explanatory variables including unit price and IV price, price indices, income, family size, marital status, age, employment, education, and race. We find 22.87% of households (2,132 out of 9,321 households) consume PBMA at least once in 2018 and 2019. The average unit price and average IV price are very similar \$4.1817 and \$4.1803, respectively. However, the standard deviation is substantially different 0.3838 and 0.1301 for unit price and IV price. The unit price index and IV price index are also very similar.

Table 1: Descriptive statistics (number of households, N=9,321)

Variables	Unit	Mean	SD
Price	$/unit	4.1817	0.3838
IV price	$/unit	4.1803	0.1301
Price index	Number	1.0001	0.0206
IV price index	Number	0.9999	0.0002
Household income	Number	22.9022	4.8687
Small family	Binary	0.8451	0.3617
Large family	Binary	0.1541	0.3617
Married	Binary	0.9668	0.1790
Unmarried	Binary	0.0331	0.1790
Male ≤ 45 years	Binary	0.4066	0.4912
Male > 45 years	Binary	0.5933	0.4912
Female ≤ 45 years	Binary	0.4601	0.4984
Female > 45 years	Binary	0.5398	0.4984
Employed male	Binary	0.8130	0.3898
Unemployed male	Binary	0.1869	0.3898
Employed female	Binary	0.6317	0.4823
Unemployed female	Binary	0.3682	0.4823
Male ≤ high school degree	Binary	0.6918	0.4617
Male > high school degree	Binary	0.3081	0.4617
Female ≤ high school degree	Binary	0.8014	0.3989
Female > high school degree	Binary	0.1985	0.3989
Caucasian	Binary	0.8564	0.3506
Asian	Binary	0.0528	0.2237
African American	Binary	0.0907	0.2871
Hispanic	Binary	0.0693	0.2539
Non-Hispanic	Binary	0.9306	0.2539

Household income range from 3 (under $5000) to 27 (above $100,000). The average household income 22.90 represents income very close to $69,999. Here, small family represents a household size of less than or equal to 4 members whereas any household having more than 4 members are considered as a large family. Among the selected households 84.51% are small families and only 15.41% are large families. We also find a substantial portion of household with married couple (96.68%). Household heads aged over 45 years are dominating the observation regardless of male (59.33%) and female (53.98%) members. Moreover, a large portion of household heads are employed regardless of gender. Surprisingly most of the household head does not any degree more than high school for both male (69.18%) and female (80.14%) gender. Also, 85.64% of households are Caucasian, 5.25% are Asian, and 9.07% are African American. The household scanner panel data contains Hispanic origin household observations that are not included in the race variable. We find 6.93% of Hispanic households in our sample whereas 93.06% are non-Hispanic.

3. Econometric Model:

The determinants of plant-based meat consumption embody the idea of a two-stage budgeting decision known as the double hurdle model (Cragg, 1971) due to the presence of a significant percentage of zero quantity purchases in the dataset. The first stage is called the participation equation, which identifies the households' decision on whether to purchase or not. The second stage is called the consumption equation, which determines the households' decision on the quantity of purchases from the retail market given the circumstances. If y_i denotes the consumption amount of household i, then we can model it as

$$f(x) = \begin{cases} x_i\beta + \epsilon_i & if \ \min(x_i\beta + \epsilon_i, z_i\gamma + u_i) > 0 \\ 0, & otherwise \end{cases}$$

$$\begin{pmatrix} \epsilon_i \\ u_i \end{pmatrix} \sim N(0, \Sigma), \Sigma = \begin{pmatrix} 1 & \sigma_{12} \\ \sigma_{12} & 1 \end{pmatrix} \quad (4)$$

The above equation holds true for cross-sectional data where each household has only one time period observation. However, we are using household consumption data of panel format where each household has 12 months observation of 2018 and 2019. Hence, we are utilizing the panel-hurdle framework developed by Dong and Kaiser (2008) to capture milk consumption behavior using ACNielsen Homescan Panel data of the U.S. We are using Engel & Moffatt (2014) notations of constructing panel-double hurdle model.

Let us consider observations of $i \ (i = 1, \ldots, n)$ number of households each containing $t \ (t = 1, \ldots, T)$ time period and denote y_{it} as the decision of i^{th} household at time t. Hence, we can write the two hurdles as following:

First hurdle

$$d_i^* = z_i'\alpha + \varepsilon_{1,i}$$

$$d_i = 1 \ if \ d_i^* > 0, d_i = 0 \ otherwise$$

$$\varepsilon_{1,i} \sim N(0,1) \quad (5)$$

The most essential feature of constructing panel-double hurdle model is to configure the first hurdle that contains only one outcome for each household for all the time periods. It means, $d_i =$

0 for i^{th} household indicates all the observations on y along the timeframe must be 0 for that household.

Second hurdle

$$y_{it}^{**} = x_{it}'\alpha + u_i + \varepsilon_{2,it}$$

$$y_{it}^{*} = \max(y_{it}^{**}, 0)$$

$$\begin{pmatrix} \varepsilon_{1,i} \\ u_i \\ \varepsilon_{2,it} \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho\sigma_u & 0 \\ \rho\sigma_u & \sigma_u^2 & 0 \\ 0 & 0 & \sigma^2 \end{pmatrix}\right] \tag{6}$$

Observed

$$y_{it} = d_i y_{it}^{*} \tag{7}$$

The second hurdle is similar to standard tobit model where y_{it} is the PBM consumption of i^{th} household at time t. y_{it}^{**} is the latent variable that cannot be observed directly but has effect on y_{it} (Tshabalala & Sidique, 2020). u_i is the random effect that is subject-specific. We assume that the error term is normally distributed with zero mean in the joint distribution and ρ indicates the correlation between $\varepsilon_{1,i}$ and u_i.

The model can be estimated using two stages where the first stage evaluates β_1 (probit model) and the second stage β_2 (OLS) (Tshabalala & Sidique, 2020). If $\varphi(.)$ is the distribution function, then probit log-likelihood function can be written as:

$$lnL_i = \sum \ln\big(1 - \varphi(-x_1\beta_1)\big) + (1-d).\ln(\varphi(-x_1\beta_1)) \tag{8}$$

The OLS log-likelihood function is:

$$lnL_i = \sum \ln\big(1 - \varphi(y_i^* > 0)\big) + \sum \ln(\varphi(y_i^* > 0))g(y_i^*|y_i^* > 0) \tag{9}$$

The panel-double hurdle estimates are generated by Maximum simulated likelihood (MSL) method that use the Halton draws technique and hence the probabilities are not exact. We further calculate the average marginal effect of exogenous variables on three quantities of interest: (i) the probability of consumption (equation 9), (ii) the expected quantity of consumption given the household consume PBM (equation 8), and (iii) the expected quantity of consumption at unconditional level (equation 7). These three conditions can be written as:

$$E(q_{it}) = Prob(d_i = 1).\left\{\varphi\left(\frac{x_{it}\beta}{\sqrt{\sigma_1^2 + \sigma_2^2}}\right).x_{it}\beta + \sqrt{\sigma_1^2 + \sigma_2^2}.\theta\left(\frac{x_{it}\beta}{\sqrt{\sigma_1^2 + \sigma_2^2}}\right)\right\} \quad (10)$$

$$E(q_{it}|q_{it} > 0) = x_{it}\beta + \sqrt{\sigma_1^2 + \sigma_2^2}.\frac{\theta\left(\frac{x_{it}\beta}{\sqrt{\sigma_1^2 + \sigma_2^2}}\right)}{\varphi\left(\frac{x_{it}\beta}{\sqrt{\sigma_1^2 + \sigma_2^2}}\right)} \quad (11)$$

$$Prob(q_{it} > 0) = Prob(d_i = 1).\varphi\left(\frac{x_{it}\beta}{\sqrt{\sigma_1^2 + \sigma_2^2}}\right) \quad (12)$$

$$Prob(d_i = 1) = \varphi(z_i\gamma) \quad (13)$$

Where, $\varphi(.)$ is the cumulative distribution function and $\theta(.)$ is the probability distribution function.

4. Results and Discussion:

Table 2 represents the estimated coefficients of the panel-double hurdle model. We find several factors determine the participation of PBMA consumption such as marriage, age, employment, education, and race. The price, income, and size of the household do not have a significant effect on participating in PBMA consumption. Married households as well as young females aged less than or equal to 45 years, employed females, and highly educated females (having more than high school education) have a positive significant effect in the participation equation. However, Male aged less than 45 years and Asian households have a negative significant effect. In case of the consumption equation, price is negatively correlated with PBMA consumption indicating an increase in price results in a decrease in consumption. Small households, females less than 45 years old, employed males, highly educated males and females, and African Americans have a positive significant effect in the consumption equation.

Table 3 indicates the average marginal effects of independent variables on plant-based meat consumption based on three properties. The participation equation measures the probability that a household consumes plant-based meat. The consumption equation represents the expected quantity consumed given that the household consumed plant-based meat (conditional) and the expected quantity of plant-based meat consumed by a household (unconditional).

Results indicate that price has a significant negative effect on all cases. 1% increase in price results in a 1.93% less probability of consuming PBMA whereas 19.43 and 5.14 less quantities of consumption at conditional and unconditional levels, respectively. However, household income does not have a significant effect on PBMA consumption in both equations. These results are expected as PBMA is not a mainstream product and still far away to become a substitute of conventional meat products. Therefore, we find a substantial reduction of quantity consumption at both conditional and unconditional levels with even only 1% increase in price. A majority of the households consume PBMA to test the product for first time and then switch back to the animal meat. Thus, the probability and the quantity of consumption is not affected by the change in household income level. Zhao et al. (2022) also found a similar result while investigating PBMA demand elasticity. They found the own-price elasticity of PBMA (-1.5) is the highest among all conventional animal protein sources such as beef, chicken, pork, fish, lamb, and duck.

Table 2: Estimated parameters of panel-double hurdle model (Maximum Simulated likelihood)

Variables	**Participation equation**		**Consumption equation**	
	Estimate	Standard Error	Estimate	Standard Error
Price index	13.4763	54.3268	-154.1849**	66.5525
Income	0.0796	0.0936	0.0026	0.0266
Small Family	-0.4785	0.6056	0.6871***	0.0916
Married	2.5364***	0.6583	-0.2641	0.1828
Male ≤ 45 years	-1.4572***	0.3949	0.0984	0.0991
Female ≤ 45 years	1.3622**	0.5652	0.3503***	0.0991
Employed Male	-7.0149	29.2075	0.4452***	0.0892
Employed Female	1.0759**	0.5026	0.0224	0.0684
Male > high school degree	10.4574	90.006	0.6235***	0.0785
Female > high school degree	3.5144***	0.7520	0.4078***	0.1171
Asian	-1.8846**	0.8329	-0.1862	0.1332
African American	0.6786	0.5929	0.4041***	0.1001
Hispanic	-0.1205	0.8493	0.0510	0.1251
Constant	4.5417	29.2378	-12.4073***	0.2599

Notes: *** and ** represent rejecting null hypothesis at 1% and 5% level of significant, respectively.

Household demographic characteristics play a significant role in determining PBMA consumption. Small households have 0.83% higher probability of consuming PBMA. Also, they tend to consume 0.08 and 0.02 quantities more at conditional and unconditional levels, respectively compared to large households. The age of female head plays a significant role in PBMA consumption. The results suggest that the younger female head has a higher probability of consumption than the older female head, and if they purchase then they tend to consume more quantity of PBMA. For instance, females aged less than or equal to 45 years have a 0.52% more probability of consumption than elderly females and they consume 0.03 and 0.01 quantity more at conditional and unconditional levels, respectively.

Table 3: Estimated Elasticities

Variables	**First Hurdle**	**Second Hurdle**	
	Probability	Conditional Level	Unconditional Level
Price index	-1.9308**	-19.4386**	-5.1413**
	(0.8383)	(8.3703)	(2.2301)
Income	0.0000	0.0000	0.0002
	(0.0003)	(0.0034)	(0.0008)
Small Family	0.0083***	0.0882***	0.0223***
	(0.0011)	(0.0124)	(0.0029)
Married	-0.0016	-0.0432	-0.0052
	(0.0022)	(0.0291)	(0.0060)
Male ≤ 45 years	0.0003	0.0181	0.0012
	(0.0012)	(0.0155)	(0.0032)
Female ≤ 45 years	0.0052***	0.0386**	0.0136***
	(0.0012)	(0.0154)	(0.0032)
Employed Male	0.0011	0.0838	0.0050
	(0.0188)	(0.1246)	(0.0412)
Employed Female	0.0009	-0.0014	0.0022
	(0.0008)	(0.0118)	(0.0021)
Male > high school degree	0.0145	0.0368	0.0355
	(0.0578)	(0.3634)	(0.1267)
Female > high school degree	0.0073***	0.0373	0.0186***
	(0.0011)	(0.0265)	(0.0031)
Asian	0.0035**	-0.0159	-0.0088*
	(0.0017)	(0.0207)	(0.0045)
African American	0.0055***	0.0481***	0.0144***
	(0.0012)	(0.0137)	(0.0033)
Hispanic	0.0005	0.0068	0.0015
	(0.0014)	(0.0172)	(0.0039)

Notes: ***, **, and * represent rejecting null hypothesis at 1%, 5%, and 10% level of significant, respectively. Standard error inside the parenthesis.

Employment does not have any significant effect on PBMA consumption. Although male education level does not affect consumption, the education level of females has a significant positive effect. Highly educated females (having more than high school degree) are more likely to consume PBMA and if they consume, they tend to purchase more compared to less educated females at unconditional level. Moreover, race plays a vital role in determining consumption. Both

Asian and African American households are not only more likely to consume but also quantity demand for PBMA increases at conditional (not for Asian) and unconditional levels compared to Caucasian households.

Although PBMA is one of the fastest growing products compared to conventional meat in the U.S., consumers acceptance of PBMA as a substitute for animal protein remains unsatisfactory. Most of the consumers are willing to try the product once or twice rather than a permanent shift. In that case, promotion plays a positive role to derive consumer demand for PBMA in recent years (Zhao et al., 2022). Most households started to consume PBMA since 2019 but 75% of them tried it only once before dropping out (Cuffey et al., 2022). This indicates there is a dire need for improving the product in terms of quality, appearance, and flavor to attract new consumers and provide a better incentive to continue the consumption for the existed ones.

The findings of this study also indicate that male-headed households are less likely to consume PBMA regardless of the age, employment, and education level. However, highly educated young females are more prone to consume PBMA which may be due to test and preference, and the awareness about the detrimental health effect of animal meat products.

5. Conclusion:

PBMA is designed to replicate the test and texture of conventional meat products by removing the detrimental health effects of red meat. Although PBMA industry is growing at an exponential rate, still now the demand for PBMA compared to animal meat products is substantially lower. The lower demand may be associated with the consumers' unfamiliarity and barrier to consuming new products. Also, the average price of PBMA is comparatively higher than most animal meat products which may be one of the major reasons for lower demand. So far, we do not have a clear understanding of the factors influencing household determinants of PBMA consumption in the United States. Hence, in this study, we utilize panel-double hurdle framework using retail level consumer scanner data instead of survey and questionnaire to shed light on the household socioeconomic and demographic characteristics that influence PBMA consumption.

We find PBMA price, household head marital status, age, employment, education, and race plays a significant role in PBMA consumption. A small increase in price results a substantial decrease in PBMA purchase. The result is expected as PBMA is still not a mainstream product and become a perfect substitute for most of the animal meat. In fact, Zhao et al. (2022) found PBMA is a complement for beef and pork. Consumers prefer to try the product for once or twice rather than permanently shifting to PBMA and thus promotion plays a vital role to increase the demand (Zhao et al., 2022). Surprisingly, we find household income does not influence PBMA demand regardless of participation and consumption equation.

We also find small households are not only more likely to consume PBMA but also the quantity demanded is significantly higher than large households. Hence, an increase in household member negatively influences PBMA consumption. Male-headed households have no influence on PBMA consumption regardless of age, employment, and education. However, young and educated females have a higher probability of consuming the product. Also, Asian and African American are more prone to consume PBMA than Caucasian.

The findings of this study will play an essential role in implementing suitable policies for the betterment of both consumers and PBMA industry. To become a mainstream product in the near future, attracting not only meat reducers-flexitarians but also traditional meat consumers, and become a substitute of animal meat, PBMA price needs to be lower than its counterparts. The product needs more promotional activities and increase quality, appearance, and flavor to mimic the animal meat products. Hence, it necessary to invest more in research and development in the PBMA industry so that consumers can decide for themselves if PBMA could be a staple on their plate.

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