Responding to the Plastic Crisis: Local Government Plastic Bans and Consumer Behavior Towards Single-Use Plastic Bags in Tarlac, Philippines

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Abstract. The Philippine province of Tarlac adopted a provincial plastic ban in 2020. However, the ban has not been uniformly enforced throughout its 17 municipalities and one city. The purpose of this research is to examine the intersection between local plastic ban enforcement and individual choices pertaining to single-use plastic bag consumption and the use of reusable shopping bags, to better understand the factors that motivate individuals and communities to reduce their single-use plastic consumption. Residents throughout Tarlac were surveyed to better understand what predicts their weekly plastic bag consumption and frequent use of reusable shopping bags. Results suggested that an individual's willingness to pay for a reusable shopping bag predicted weekly plastic bag consumption, and knowledge of where to obtain a reusable shopping bag and plastic ban implementation predicted frequent use of reusable shopping bags. However, the presence of business plastic charges and level of education were not predictors in both models.

***Keywords*:** plastic ban implementation; decentralization; individual behavior

The plastic crisis has become apparent as an environmental catastrophe. Nations around the world continue to struggle with the management of plastic waste, of which a significant amount has entered aquatic ecosystems (Borrelle et al., 2020). More discussion has arisen in recent decades regarding the plastic crisis through the recurring consequences of the environmental effects (Millican & Agarwal, 2021). Plastic bans have been a significant part of the discussion.

Background on the Tarlac Provincial Plastic Ban

The Philippine province of Tarlac illustrates issues related to decentralization and enforcement of plastic bans. Tarlac adopted a provincial plastic ban on 22 June 2020 for its 17 municipalities and one city. The ban prohibits the distribution and consumption of single-use plastic bags within the province. However, it has not been enforced uniformly, and this is reflected through observations of the discrepancies in individual's single-use plastic consumption patterns among the residents of Tarlac. Visual observations suggested that some residents and municipalities within Tarlac were not using single-use plastic bags, while others continued to frequently use plastic bags since the adoption of the plastic ban. Although reviewed literature

Publication History. Received 24 November 2022 | Accepted 27 June 2023 | Published Online

on the role of community and individual behaviors provides notable insights into discrepancies in single-use plastic consumption levels among consumers, there is a lack of literature that examines the roles of decentralized government structures in explaining these discrepancies.

Rationale for the Research

Given the previously discussed notable literature gap, the purpose of this research is to examine the relationship between the enforcement of the plastic ban and individual behavior. This research took the motivations for single-use plastic reduction into account, as well as the use of reusable shopping bags, to address the following two research questions: Does plastic ban implementation predict weekly single-use plastic consumption in the decentralized province of Tarlac? Does plastic ban implementation predict the frequent use of reusable shopping bags in the province? The models used to address both research questions controlled for other variables commonly cited as predictors of the dependent variables. This research is significant for the study of policymaking and the broader discipline of public administration, because it aims to provide insights and policy recommendations for unique challenges pertaining to the enforcement of plastic bans in decentralized government structures. The following section provides a review of related literature pertaining to the plastic crisis. The subsequent section explains the methodology, results, discussion, and conclusion.

Review of Related Literature

Mitigation efforts pertaining to the plastic crisis are heavily influenced by the role of community and individual behaviors, plastic bans and taxes, the use of reusable shopping bags, and the enforcement of plastic bans. The following subsections provide a literature review for each of these topics.

Role of Community and Individual Behaviors

Much of the mitigation efforts for plastic pollution come down to community and individual behaviors. A myriad of studies have aimed to address the various aspects of this phenomenon. One of these aspects is an individual's awareness of the impacts of plastics on the environment. Ari and Yilmaz (2017) observed consumer behaviors and attitudes pertaining to the use of plastic and cloth bags in Eskisehir, Turkey. They found that individuals who were aware of the impacts of plastics on the environment had stronger tendencies to reduce their plastic bag use (Ari & Yilmaz, 2017). Similarly, field studies on the effects of a single-use plastic bag charge in Buenos Aires City, Argentina revealed that most consumers carried their own shopping bags to protect the environment (Jakovcevic et al., 2014). Furthermore, Afroz et al. (2017) conducted a study that examined individuals' willingness to participate in the plastic reduction campaign in Kuala Lumpur. They found that people who were more informed and convinced of their knowledge had a more positive attitude towards recycling than their counterparts (Afroz et al., 2017). In a study that looked at plastic bag use in South Africa, O'Brien and Thondhlana (2019) concluded that education and environmental consciousness influenced people's willingness to pay for plastic bags, but the relationships were generally weak. In contrast, Crowley (2020) found that education variables and perceptions of plastic bags as bad for the environment

were not predictors of single-use plastic bag consumption in three municipalities in Ilocos Norte, Philippines.

Impacts of Plastic Bans and Taxes

Past research also cited the impacts of plastic bans and taxes on individual behavior. For example, Jia et al. (2019) found that an individual's plastic pollution mitigation actions could be motivated by increasing behavioral costs, like bans and taxation. Nielsen et al. (2019) estimate that banning and taxing single-use plastic bags in Europe motivated consumers to reduce their plastic consumption by 66%-90%. Furthermore, Willis et al. (2021) observed that compliance strategies were strongly influenced by plastic legislation and levies.

The impacts of plastic bans and taxes remain influential in other parts of the world as well. For example, Sobaya et al. (2018) examined consumer responses to the plastic bag levy in Yogyakarta, Indonesia. They found that most consumers reduced plastic bag usage following the implementation of the policy (Sobaya et al., 2018). Similarly, Luis et al. (2020) studied the psychosocial and economic impacts of Portugal's lightweight plastic bag charge. Results indicated that participants agreed with the charge and with widening it to all types of plastics (Luis et al., 2020).

Factors that Influence the Use of Reusable Shopping Bag

The literature also reflects factors that influence the use of reusable shopping bags. Arifani and Haryanto (2018) found an individual's attitude to be an accurate predictor of their use of reusable shopping bags. They went on to find that the attitude variable is influenced by several independent variables, including environmental knowledge, product appearance, perceived price, and perceived value (Arifani & Haryanto, 2018). Moreover, Smith et al. (2016) concluded that young consumers valued environmentally friendly shopping bags (EFSBs) and would buy apparel from retailers that provided recycled or reusable shopping bags. Cristi et al. (2020) examined the action plan for plastic reduction in Chile and found that the percentage of surveyed individuals who owned a reusable shopping bag increased in all localities for the period in between the pre- and post-campaign survey. Spranz et al. (2019) conducted a project in Indonesia to understand and measure the effectiveness of non-monetary interventions for plastic bag reduction. They found that there was increased support for reusable shopping bags when the head of the village supported the practice (Spranz, 2019). Dunn et al. (2014) estimated consumers' willingness to accept paying for reusable shopping bags in Logan, Utah. They found that older and lower- to middle-income individuals, as well as larger-sized households, are more likely to switch to using reusable shopping bags when presented with a tax on plastic bags (Dunn et al., 2014). Furthermore, Rivers et al. (2017) analyzed the impacts of a plastic bag levy in Toronto and concluded that the levy was very effective in encouraging people who frequently used reusable bags to use them more frequently, but it was not effective for infrequent users. In addition, Zambrano-Monserrate and Ruano (2020) found that heads of households with more education were more likely to use reusable bags than those who were less educated. On a similar note, Sadegholbayan (2018) conducted a study in Tehran that found that less than half of people reported using reusable shopping bags, and the main reasons for not using them pertained to the conveniences of plastic bags and a lack of access to reusable bags.

Enforcement of Plastic Bans

The enforcement of plastic bans is another common theme discussed in the literature. For example, Adam et al. (2020) found that plastic bans in West Africa lack proper planning, coordination, and implementation. Similarly, Arathi et al. (2014) concluded that mere knowledge of plastic bag environmental hazards does not help until policy measures are taken to implement strict measures of plastic bans. Kish (2018) expressed a negative perception of single-use plastic bans, arguing that there is little evidence that they will produce meaningful results given the difficulties of their enforcement.

Decentralized government structures further challenge the implementation of plastic bans. This was illustrated by Chandi et al. (2018) in their study of plastic waste reduction in Uganda. They went on to propose a decentralized municipal solid waste strategy for Uganda that aims to enforce central plastic bans at the local municipal levels (Chandi et al., 2018). Browning et al. (2021) acknowledged the disproportionate challenges of the plastic crisis on nations of the global South, and proposed the implementation of a locally managed decentralized circular economic principle to empower local communities to take control of plastic waste management.

The Philippines is an example of a nation with a decentralized government structure. The nation is overseen by a president and central government, and then further subdivided into provinces with individual governors and municipalities and cities with respective mayors. Eisma-Osorio (2021) noted the marine plastic debris crisis in the Philippines and the gaps in the institutional and legal frameworks in enforcing plastic bans in a decentralized government structure.

Material and Methods

Sampling

Surveys were distributed to residents of Tarlac across the 17 municipalities and one city to measure their single-use plastic bag consumption habits, as well as their use of reusable shopping bags. The researchers distributed the surveys initially through the local government units (LGUs). The LGU officials, then went on to distribute the surveys using cluster random sampling, where the population was divided into clusters that are randomly selected (Acharya et al., 2013). This method of sampling was used due to the scattered nature of the population in Tarlac (N = 163). Although the sample size was small, it reflected an equal distribution of the residents of Tarlac by municipality/city. Because the research examined discrepancies in single-use plastic consumption by municipality and city, it was important to equally distribute the survey by this level of government. The surveys were distributed by the LGU officers via Qualtrics to the residents of Tarlac through email. The emails contained a link to the anonymous survey. The integrity of the survey was promoted by creating a uniform statement at the beginning of the survey that acknowledged the purpose of the research, that participation was voluntary, that respondents could stop participating at any time with no penalties, and that there were minimal risks to participants. The research was determined to be exempt status by the Institutional Review Board (IRB) at Western Carolina University prior to the distribution to respondents [Project Title: 1814098-1]. As part of the IRB process, a detailed application was submitted to the IRB that explained the design of the research, any potential risks to participants, and copies of the surveys. The research

qualified for exempt status because the only interactions with subjects involved anonymous Qualtrics surveys and the information was collected in a manner that did not reveal the identities of subjects. Furthermore, it was determined that the research presented no more than minimal risk to participants.

Variable Selection

Two models were run, and the dependent variables included the number of times a week that respondents consumed single-use plastic bags, and how often respondents bring reusable shopping bags with them to the store. Independent variables consisted of information detected in the literature review as influencing single-use plastic bag consumption and use of reusable shopping bags. These included highest level of education, the presence of a business charge for plastic bags, an individual's willingness to pay for a reusable shopping bag, knowledge of where to obtain a reusable shopping bag, and the perceived implementation of the plastic ban. Based on the previous literature review, it was hypothesized that the presence of a business charge for plastic bags, an individual's willingness to pay for a reusable shopping bag, and knowledge of where to obtain a reusable shopping bag would be positive predictors of the weekly single-use plastic consumption and the frequency of reusable shopping bag use. However, there were conflicting findings in the literature regarding the directions of education and the implementation of a plastic ban as predictors of the dependent variables. All data was derived from the surveys.

Data Analysis

The analysis began by running descriptive statistics on each of the variables. A multiple linear regression was then run to examine the predictors of the number of times in a week that an individual used single-use plastic shopping bags. All categorical variables were coded into dummy variables with two groups each. A score of 1 for plastic bag business charge indicated yes while 0 was the baseline group for no. A score of 1 also indicated yes if an individual knows where to get a reusable shopping bag, while 0 was the baseline group for no. As for an individual's highest level of education, 1 denoted college, while 0 indicated no college. Finally, a score of 1 meant that the plastic ban was implemented in the municipality/city, and 0 indicated otherwise. An individual's willingness to pay for a reusable shopping bag was measured in Philippine pesos as a continuous variable.

The assumptions of linear regressions were examined for the regression model. No multicollinearity between the independent variables was detected, as none of the R-values exceeded ±9. For this reason, all the independent variables were included in the model. The Durbin-Watson statistic of 1.792 indicated that the assumption that the values of the residuals are independent of each other was met. A normal probability plot indicated that the assumption that the values of the residuals are normally distributed was met. Since none of the Cook's Distance statistics exceeded 1, it could be concluded that the assumption that there are no influential cases biasing the model was met. However, a scatterplot of the model depicted the presence of heteroscedasticity. As a result of this finding, a weighted least square regression model was run to account for the presence of heteroscedasticity.

A second model was run with the dependent variable being how often an individual brings a reusable shopping bag to the store. The three options were "most of the time," "sometimes", and "never". However, none of the respondents indicated "never"so the variable was coded as dichotomous where 1 denotes "most of the time" and 0 indicates "sometimes". A binary logistic regression was run with the same independent variables as the first model.

Results

Descriptive Statistics

Due to the clustered random sampling approach, respondents represented an equal distribution of the municipalities and city that make up the province of Tarlac. The mean amount in Philippine pesos that respondents were willing to pay for a reusable shopping bag was 43.84 (SD = 67.47) (N = 163). The mean number of times a week that individuals reported consuming single-use plastic bags was 2.71 (SD = 2.49) (N = 163). Table 1 below provides frequencies for all other variables with nominal values.

Overall, more respondents reported having a college education. Furthermore, more respondents indicated that their municipality or city implemented the plastic ban, but fewer respondents indicated the presence of a plastic bag charge in their municipality or city. More respondents reported having knowledge of where to obtain a reusable shopping bag than those who did not have the knowledge. Finally, slightly more respondents reported that they sometimes use a reusable bag for shopping.

Table 1
Frequencies of the Nominal Variables

	Respondents
Education (N = 163)	
College	115
No college	50
Perceived plastic ban implementation (N = 163)	100
Yes	63
No	
Knowledge of where to obtain a reusable shopping bag (N = 163)	
Yes	114
No	47
Frequency of reusable shopping bag use (N = 163)	
Often	77
Sometimes	86

Weighted Least Square Regression for Weekly Plastic Bag Consumption

The independent variables as a group predicted the average weekly plastic bag consumption, F (5, 113) = 3.26, $p < .001$, $f^2 = .14$. This is a medium-effect size. The adjusted R-square value indicated that the variables have 8.7% of their variability

in common. A value of 3.46 represented the Y-intercept, and error in prediction remained at .64 weekly plastic bag consumption units.

The amount in Philippine pesos that respondents are willing to pay for a reusable shopping bag was considered a predictor of their weekly single-use plastic bag consumption (B= -.007, p= .002). As the amount respondents are willing to pay for a reusable shopping bag decreased, the number of single-use plastic bags consumed on a weekly basis increased. However, the presence of a plastic bag business charge (B= .137, p=.898), knowledge of where to obtain a reusable shopping bag (B= -.570, p= .263), highest level of education (B= .019, p= .972), and the perceived implementation of the plastic ban (B= =.249, p= .634), were not statistically significant predictors of the weekly single-use plastic bag consumption. Table 2 below summarizes the coefficients of the independent variables in the model.

Table 2

Weighted Least Squares (WLS) Regressions with Weekly Single-Use Plastic Bag Consumption as the Dependent Variable

Predictor Variables	*B*
Constant	Constant
	(.639)
Plastic bag business charge	.137
	(1.071)
Willingness to pay for a reusable bag (PHP)	-.007**
	(.002)
Knowledge of where to obtain a reusable bag	-.570
	(.506)
College degree	.019
	(.546)
Perceived plastic ban implementation	-.249
	(.522)
Adjusted R-Square	.087
F-Statistic	3.257**
Durbin-Watson Statistic	1.792
N	163

Notes. *p-value < .05; **p-value < .01; ***p-value < .001
Standard errors are reported in parentheses.

Binary Logistic Regression for Frequency of Reusable Plastic Bag Use

The binary logistic regression model explained 38.6% (Nagelkerke R-square) of the variance. Respondents who knew where to obtain a reusable shopping bag were more than 11 times more likely to report using a reusable shopping bag most of the time compared with those who did not know where to obtain a reusable shopping bag (OR = 11.32, 95% CI = 3.49, 36.74, p < 0.001). In addition, respondents who

reported that the plastic ban was implemented in their municipality or city were three times more likely to report using a reusable bag for shopping most of the time compared with respondents who reported that the plastic ban was not implemented in their municipality or city (OR = 3.03, 95% CI = 1.13, 8.17, p = .028). On the other hand, the presence of a plastic bag charge (OR = .977, 95% CI = .27, 3.58, p = .973), willingness to pay for reusable shopping bags (OR = 1.004, 95% CI = 1.00, 1.01, p = .340), and highest level of education (OR = 1.172, 95% CI = .40, 3.40, p = .771) were not significant predictors of using a reusable shopping bag most of the time. Table 3 below summarizes the coefficients of the independent variables in the model.

Table 3

Binary Logistic Regression with Frequent Reusable Shopping Bag Use

Predictor Variables	*B* (SE)	Wald's X^2	*p* Value	Odds Ratio	Confidence Interval	
					Lower	Upper
Constant	-2.830	12.235	<.001	11.32	3.49	36.74
	(.809)					
Plastic bag business charge	-.023	.001	.973	-.023	.27	3.58
	(1.071)					
Willingness to pay for a reusable bag (PHP)	.004	.910	.340	.004	1.00	1.01
	(.004)					
Knowledge of where to obtain a reusable bag	2.426	16.313	<.001	11.32	3.49	36.74
	(.601)					
College degree	.158	.085	.771	.158	.40	3.40
	(.543)					
Perceived plastic ban implementation	1.109	4.810	.028	3.03	1.13	8.17
	(.506)					
Nagelkerke R-square	38.6%					
N	163					

Discussion

The results showed the intersection between plastic ban implementation and individual behaviors related to single-use plastic bag consumption and the use of reusable shopping bags. This section connects the results to the literature and provides policy implementation suggestions.

The amount in Philippine pesos that respondents are willing to pay for a reusable shopping bag was a statistically significant predictor of their weekly single-use plastic bag consumption. This result correlated with previous findings by Sadegholbayan (2018) pertaining to the individual's values of using single-use plastic bags versus investing in a reusable shopping bag. The relationship between the willingness to pay for a reusable shopping bag and the weekly single-use plastic bags is logical, because the reusable shopping bag will likely encourage the consumer to decline a single-use plastic bag.

Other independent variables were not statistically significant predictors of an individual's single-use weekly consumption of plastic bags. Knowledge of where to obtain a reusable shopping bag was not a significant predictor of the weekly plastic bag consumption, suggesting that such an awareness might not discourage or encourage the use of single-use plastic bags. It is possible that reusable shopping bags were readily available in the municipal markets, and that the more important variable was how much the participant is willing to pay for the bag. Contrary to the findings of Dunn et al. (2014); Jakovcevic et al. (2014); Jia et al. (2019); Luis et al. (2020); and Sobaya et al. (2018), the presence of a plastic bag business charge was not a statistically significant predictor of the weekly single-use plastic bags consumed by respondents. Likewise, the implementation of the plastic ban was not a statistically significant predictor of the weekly plastic bag consumption, also contradicting previous studies (Nielsen et al., 2019; Willis et al., 2021). The decentralized nature of Tarlac's municipalities and city could be an explanation for these insignificant predictors, as charges and ban implementations were not enforced uniformly (Browning et al., 2021; Chandi et al., 2018; Eisma-Osorio, 2021). Finally, in conjunction with the findings of Crowley (2020), education was not a statistically significant predictor of the weekly plastic bag consumption in Tarlac. One explanation for this could be the variability of solid waste management education programs in the schools across the province of Tarlac. For example, Crowley (2020) examined variations in plastic ban consumption in the province of Ilocos Norte and found that the municipality of Solsona's solid waste education system was significantly stronger than those of Vintar and Sarrat. Similar to Ilocos Norte, Tarlac also has distinctive municipalities and a city with different schools. This creates the potential for variations in the values of waste management practices at the schools, as there is currently no uniform standardized solid waste education program across the schools. Further research is needed on the extent to which solid waste education programs differ in schools through Tarlac. Furthermore, such discrepancies can potentially apply to primary, secondary, and tertiary schools, but further research is also needed to examine the differences in single-use plastic consumption between individuals with at least a bachelor's degree and those with no college degree.

The willingness to pay for a reusable shopping bag as the only statistically significant predictor of weekly plastic bag consumption suggests that single-use plastic consumption was more heavily motivated by the individual's values and willingness, in contrast to collective actions like plastic bag business charges and ban implementation. However, the lack of uniformity across the province pertaining to plastic bag business charges, ban implementation, and education systems could be another explanation for these findings (Crowley, 2020; Kish, 2018). Additional studies should compare other provinces to Tarlac.

The findings of the second model, which pertains to the frequent use of a reusable shopping bag, were contradictory to the results of the first model. On one hand, knowledge of where to obtain a reusable shopping bag was a significant predictor of frequent use of the reusable shopping bag. In contrast, an individual's willingness to pay for a reusable shopping bag was not a predictor of frequent reusable shopping bag use. A possible explanation for this finding could pertain to habits (Crowley, 2020). Once an individual has obtained a reusable shopping bag, they might become

accustomed to using it, and then disregard the price as a factor influencing the use of a reusable shopping bag. Implementation of the plastic ban was also a predictor of frequent reusable shopping bag usage, which correlates with the findings of previous studies (Jia et al., 2019; Luis et al., 2020; Nielsen et al., 2019; Sobaya et al., 2018; Willis et al., 2021). It is likely that municipalities that implemented the plastic ban encouraged the use of reusable shopping bags among residents, thus making this variable a significant predictor.

Like in the previous model, which examined the predictors of weekly plastic bag consumption in Tarlac, the presence of a plastic bag charge and highest level of education were not significant predictors of frequent use of reusable shopping bags. The lack of uniformity among the municipalities and cities in Tarlac may also explain these variations in terms of the businesses' plastic bag charges and the educational emphasis on plastic reduction in the province's schools. This possibility was discussed in previous studies pertaining to the role of decentralized government structures in implementing plastic bans (Browning et al., 2021; Chandi et al., 2018; Eisma-Osorio, 2021). Furthermore, there has not been a standardized price charged throughout the province of Tarlac for single-use plastic bags. This could have potentially prevented measurable patterns from occurring in the data for the variable on plastic bag business charge, compared with the variable on the implementation of the plastic ban.

Conclusion

This research examined the predictors of weekly plastic bag consumption and reusable shopping bag use in Tarlac, Philippines. An individual's willingness to pay for a reusable shopping bag was the only statistically significant predictor of their weekly plastic bag consumption levels, while knowledge of where to obtain a reusable shopping bag and the implementation of the plastic ban were the only significant predictors of frequent use of reusable shopping bags.

Single-use plastic bag consumption can be reduced with more standardized educational practices. It is recommended that the provincial superintendent for Tarlac adopt a curriculum related to sustainability and plastic reduction to be taught across all schools. It is also recommended that the governor of Tarlac implement uniform guidelines for plastic bag business charges across the province.

A limitation of this study pertains to the small sample size (N = 163). However, this sample reflected an even distribution of Tarlac's municipalities and city. Another limitation is that the research only examined the province of Tarlac. While Tarlac's unique policy situation pertained to plastic bag consumption warranted the study, future research should also include other provinces in the Philippines and compare the findings to this research. This should include other provinces that may have provincial plastic bans but lack uniformity in enforcement at the municipal and city level, provinces that uniformly enforce plastic bans, and those that do not have provincial plastic bans.

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Acknowledgment. The author wishes to acknowledge Pearl Angeli Erguiza-Pacada for her work in translating the surveys from English to Tagalog, and distributing the surveys.