Tougher Plastics Ban Policies in China

Subjects: Environmental Sciences | Behavioral Sciences | Operations Research & Management Science
Contributor: Yong Li

After the Chinese government's new plastics ban policies issued in 2020, another set of tougher plastics ban measures were introduced in Shanghai, China in 2021. The tougher plastic ban polices completely forbade the usage of plastic carrier bags and required all supermarkets to sell only cloth or nylon carrier bags priced from RMB 1.0 to 39.0. Tougher plastics ban policies are penalty-oriented. The tougher plastics ban policies produce positive plastics reducing effects by observing significantly decreased usage of charged carrier bags by 46%, and significantly increased usage of old plastic bags and reusable bags by 117% and 36%, respectively. Policy execution loopholes are found in some supermarkets which do not follow the tougher plastics ban measures. Fortunately, the spill-over effects from tougher-measure-executing supermarkets fix this issue to some extent. The tougher 2021 measures fail to be the most powerful impacting factor on people's usage of each type of bag. To produce better plastics reducing results, other bag-targeted measures are necessary.

Keywords: plastic waste crisis ; plastic bags ; China's plastics ban policies ; policy execution loopholes ; spill-over effects

1. Introduction

China, with the largest population in the world, has been active in cracking down on the plastics crisis. After the first introduction of national plastics ban law in 2008, the Chinese government introduced new plastics ban policies in January 2020 and required all supermarkets in major cities stop using non-biodegradable plastic carrier bags by the end of 2020 [1] [2]. One year later, other tougher plastics ban measures were introduced in Shanghai, China, which completely forbade the usage of plastic carrier bags and required all supermarkets to sell only cloth or nylon carrier bags priced from RMB 1.0 to 39.0. Retailers violating the rules will be fined RMB 10,000–100,000 according to the Law on the Prevention and Control of Environmental Pollution by Solid Waste, which was revised in April and came into effect in September 2020 [3] [4]. As of this study, measures for plastics management in China are all penalty-oriented. According to Gray's theory of personality, there exists a behavioral activation system (BAS) that controls people's sensitivity to penalty and avoidance motivation [5]. Although the penalties of new tougher laws did not target consumers, as price serves as one of the most important determinants in consumers' purchase motivation [6], the forbidden high price for charged carrier bags may work similarly to a penalty. Viewing this, we are interested to know how consumers respond to the new 2021 plastics ban policies, and whether the policies work effectively in modifying people's bag-using behaviors. Therefore, we conduct a field study by counting people's usage of different types of bags within supermarkets. Results of this study could provide valuable insights on policy effectiveness and offer potential constructive suggestions on plastics crisis management.

2. Analysis on Results

2.1. Plastic Bag Usage before and after Tougher Measures

As shown in **Table 1**, all the KW tests support significant ($p < 0.05$) changes in people's bag usage. Facing tougher measures, the consumers reduce their purchasing of charged carrier bags by almost 46%. Two options have been made to meet people's carrying demand. First, they choose to bring significantly more reusable bags ($\chi^2 = 124.500$; $p = 0.000$) and old plastic bags ($\chi^2 = 124.300$; $p = 0.000$). The usage of reusable bags has seen an increase of 36%, while that value for old plastic bags surprisingly reaches 117%. Second, they choose to use significantly ($\chi^2 = 40.705$; $p = 0.000$) more free inner bags, but the extent of increase is just 0.4%.

Table 1. The mean values and KW test results for the usage of different bags before and after tougher measures.

Measure Status	Inner	Reusable	Old	Charged

Before	0.630	0.327	0.094	0.304
After	0.633	0.446	0.204	0.165
Change	0.40%	36.39%	117.02%	−45.72%
KW test	$\chi^2 = 40.705$	$\chi^2 = 124.500$	$\chi^2 = 155.300$	$\chi^2 = 151.660$
	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$

Note: *N*=9786

As mentioned above, two of the nine investigated supermarkets do not follow the tougher measures at all. As these two supermarkets are non-grocery markets, this study compares their dynamic bag usage to that of their four non-grocery counterparts where tougher measures are strictly executed. As shown in **Figure 1**, within markets either with or without tougher measures, the usage of reusable bags and old bags increases, and the usage of charged bags decreases. Except for the usage of old plastic bags, the changing amount of other bags is smaller within these two markets compared to that within their tougher-measure-executing counterparts. The spill-over effects are found from tougher-measure-executing supermarkets.

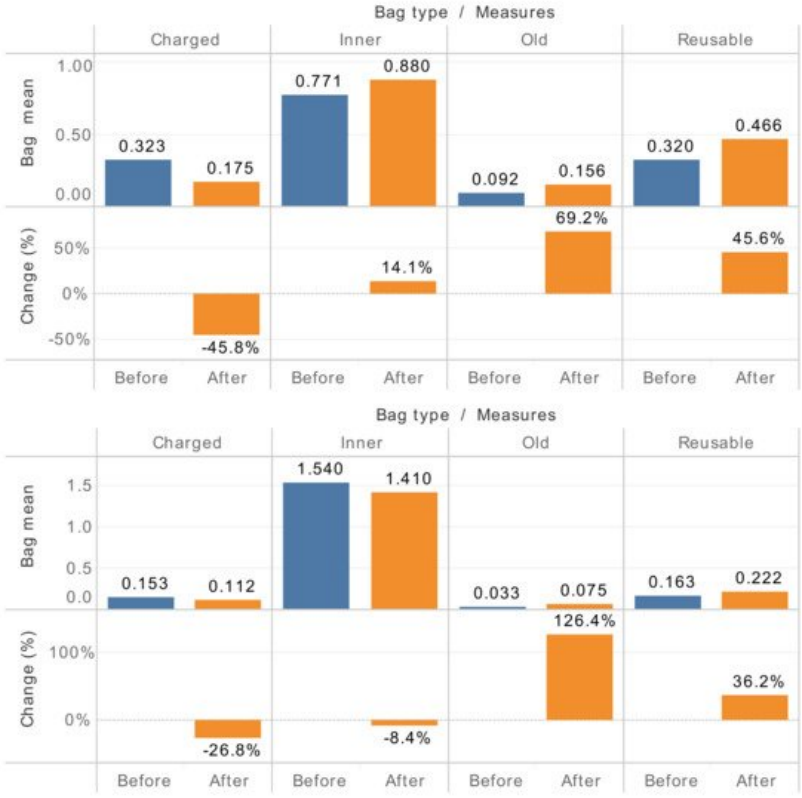

Figure 1. Comparative bag usage of non-grocery markets with (upper) and without (lower) tougher measures.

2.2. Plastic Bag Usage between Different Packaging Styles before and after Tougher Measures

On average, both grocery and non-grocery markets show reduced usage of charged carrier bags by over 40%. Regarding the usage of inner bags, the two types of markets vary in changing directions. As shown in **Table 2**, the usage of inner bags drops by over 50% within grocery markets but increases by 2.7% within non-grocery markets. As inner bags are rarely available in grocery markets, packaging style may primarily account for the different changes of inner bag usage. Thus, source control is inferred to be effective in curbing the usage of inner bags.

Table 2. The mean values, before/after usage changes, and KW test results for the usage of different types of bags between different packaging styles before and after tougher measures.

Packaging Styles	Measure Status	Inner	Reusable	Old	Charged
G	Before	0.179	0.348	0.102	0.242
	After	0.086	0.402	0.308	0.142
	Change	−51.96%	15.52%	201.96%	−41.32%
	KW test	χ^2 = 29.303	χ^2 = 8.247	χ^2 = 94.032	χ^2 = 31.837
		p = 0.000	*p* = 0.004	*p* = 0.000	*p* = 0.000
NG	Before	0.945	0.283	0.078	0.286
	After	0.970	0.419	0.140	0.163
	Change	2.65%	48.06%	79.49%	−43.01%
	KW test	χ^2 = 4.638	χ^2 = 126.24	χ^2 = 49.418	χ^2 = 113.01
		p = 0.031	*p* = 0.000	*p* = 0.000	*p* = 0.000

Note: *N*=9786

2.3. Impacting Patterns of Different Factors on the Usage of Different Bags

We use the techniques of logistic regression to learn how each influential factor modifies people's usage of different types of bags. We classify people's bag usage into a binary situation, i.e., to use or not to use. We then use this binary choice as the dependent variable, and the factors of gender, generation, packaging style, and tougher measures as independent variables. We first examine the potential influence of each factor by the KW test and only those significantly influential on people's bag usage are further analyzed in logistic regression models. As shown in **Table 3**, the VIF value of each factor is around 1.0 in the regressions models, indicating a multi-collinearity-free status of the independent variables [7]. For charged carrier bags, generation is the most powerful impacting factor, then followed by tougher measures. Regarding old plastic bags, its usage is dominated by tougher plastics ban measures. As for reusable bags and inner bags, the most powerful impacting factors are gender and packaging style, respectively.

Table 3. The logistic regression results of influential factors on people's usage of different bags.

Bag Type	Impacting Factors	VIF	Coefficients
Inner	Gender, *generation* ***, *packaging* ***, *measures* ***	(—, 1.010, 1.009, 1.002)	(—, 0.445, −1.652, 0.377)
Old	*Gender* ***, *generation* ***, *packaging* ***, *measures* ***	(1.007, 1.042, 1.058, 1.013)	(−0.268, 0.390, 0.581, −0.770)
Reusable	*Gender* ***, *generation* ***, *packaging* *, *measures* ***	(1.015, 1.040, 1.047, 1.011)	(−0.706, 0.659, −0.106, −0.468)

Charged	*Gender ***, generation ***, packaging *, measures ****	(1.008, 1.023, 1.033, 1.007)	(0.209, −0.857, 0.284, −0.702)

Notes: Italic factors and factors superscripted with asterisk(s) are verified as significantly influential on bag usage by KW test results and regression results, respectively; * p < 0.05, *** p < 0.001; gender: 1 = male, 0 = female; generation: 1 = old; 0 = middle–young; packaging style: 1 = grocery style, 0 = non-grocery style; measures: 1 = new tougher measures; 0 = old measures; bold factors are the most powerful factor in the usage of each type of bags.

3. Current Insights

3.1. Effectiveness of Tougher Plastics Ban Measures

Generally, the tougher 2021 plastic ban measures work effectively in modifying people's usage of different bags by significantly reducing people's purchase of charged carrier bags, and by significantly increasing people's usage of reusable bags and old plastic bags. Unavoidably, random data collection errors or other factors may account for the change. However, this valuable change is explained best by the execution of the tougher 2021 measures. The reasons are two-fold. Firstly, the data was collected at the same markets and at the same time of a day during our two field studies. The only difference lies in the execution of tougher plastic ban policies. Secondly, the regression results also support the significant impact of the execution of tougher policies on the usage of all types of bags. With the tougher 2021 policies, on the one hand, plastic charged carrier bags are banned, which compels consumers to change; while, on the other hand, only expensive cloth or nylon charged carrier bags are available, which could again force those price-sensitive consumers to seek other cheaper options. Consequently, the consumers reduce their usage of charged carrier bags by nearly 46%, which is similar to the 49% decrease in carrier bag usage observed previously [8], while, as for inner plastic bags, their usage increases significantly as some consumers would take advantage of policy loopholes and turn to free inner plastic bags as alternatives for carrier bags. A similar loophole exploiting behavior is also observed in Portugal where the consumption of plastic garbage bags increases dramatically thanks to the introduction of plastic ban policies [9]. That is to say, as long as loopholes exist, people will exploit them to their best interests. However, what surprises us is the tiny increase in inner bag usage, i.e., 0.4%, which is quite different from observations from existing studies [10][11]. This is partially due to the complete ban of free inner bags within some grocery supermarkets. However, even within non-grocery supermarkets, the increased amount is also just 2.7%. That is to say, the majority decreased usage of charged carrier bags is offset by the increased usage of old bags and reusable bags rather than that of inner bags, which is positive for plastics management. For these positive results, by no means are they achieved simply through the tougher 2021 policies. As shown in the previous study [12], the 2020 policies could boost people's usage of reusable bags by forbidding the usage of non-biodegradable plastic carrier bags and imposing high prices for biodegradable plastic carrier bags. The tougher 2021 policies continue to strengthen people's behavioral change that was already shaped by 2020 policies. For example, no-bag shopping and bag-carrying behaviors start to prevail after the introduction of national regulations and the behaviors become more popular and widely accepted in 2021. Therefore, the strengthening effect could in turn explain the tiny increase in inner plastic bag usage in 2021.

Regarding this study, measures for plastics policies in China are all penalty-oriented. Incentives are not available for businesses or consumers to comply with the plastic bag ban policies. To improve the effectiveness of plastics management, future studies are encouraged regarding how various incentives could shape people's usage of plastic bags.

3.2. Spill-Over Effects on Bag Usage from Tougher-Measure-Executing Supermarkets

Spill-over effects are found within the two no-tougher-measure supermarkets by observing similar changes in the usage of different bags. It is possible that the similar changes arise from data collection errors; however, the spill-over effects could explain better. The reasons are three-fold. To begin with, within the two rounds of data collection we keep bag counting rules the same and repeat the data collection for each site three times to keep random collection errors as few as possible. Secondly, except for old plastic bags, the amount of usage change of other bags is much smaller within no-tougher-measure markets compared to that within tougher-measure-executing supermarkets. Thirdly, people are generally consistent in their habits and behaviors [13]. When consumers are forced to bring reusable bags or old plastic bags for shopping in tougher-measure-executing supermarkets, bag-carrying habits could be formed and reinforced.

References

1. BBC News. Single-Use Plastic: China to Ban Bags and Other Items. 2020. Available online: https://www.bbc.com/news/world-asia-china-51171491 (accessed on 16 December 2020).
2. China National Development and Reform Commission. Opinions on Further Strengthening the Control of Plastic Pollution. 2020. Available online: https://www.ndrc.gov.cn/xxgk/zcfb/tz/202001/t20200119_1219275_ext.html (accessed on 13 December 2020).
3. Beijing Haidian Government. Penalty for Violating Plastic Ban Policies could be as High as 100,000 RMB. 2021. Available online: https://baijiahao.baidu.com/s?id=1698078635288936750&wfr=spider&for=pc (accessed on 30 September 2021).
4. Xinhua New Agency. The Reviesed Law on the Prevention and Control of Environmental Pollution by Solid Waste will be Effective on 1 September 2020. Available online: http://www.npc.gov.cn/npc/gtfw3/202101/44dbfdd8fe244a759fe58d2a0f4b7ac3.shtml (accessed on 30 September 2021).
5. Gray, J.A. A Critique of Eysenck's Theory of Personality. In A Model for Personality; Springer: Berlin, Germany, 1981; pp. 246–276.
6. Wolfinbarger, M.; Gilly, M.C. Shopping online for freedom, control, and fun. Calif. Manag. Rev. 2001, 43, 34–55.
7. Mansfield, E.R.; Helms, B.P. Detecting multicollinearity. Am. Stat. 1982, 36, 158–160.
8. He, H. Effects of environmental policy on consumption: Lessons from the Chinese plastic bag regulation. Environ. Dev. Econ. 2012, 17, 407–431.
9. Martinho, G.; Balaia, N.; Pires, A. The Portuguese plastic carrier bag tax: The effects on consumers' behavior. Waste Manag. 2017, 61, 3–12.
10. Wang, B.; Li, Y. Plastic bag usage and the policies: A case study of China. Waste Manag. 2021, 126, 163–169.
11. Lally, P.; Van Jaarsveld, C.H.; Potts, H.W.; Wardle, J. How are habits formed: Modelling habit formation in the real world. Eur. J. Soc. Psychol. 2010, 40, 998–1009.
