Will the new rich waste more food? Evidence from China

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Abstract

In the last decade, many developing countries have witnessed a tremendous increase in economic growth. Prior to this growth, food insecurity was generally systemic. With food security (new rich), from higher food purchasing power, came the new problem of food waste. Current literature indicates food consumption increases with economy growth, but limited or no literature focuses on the dynamic change of household food behavior. As a first attempt, empirical evidence is provided on the new-rich food-waste consumption behavior. Employing a probit-selection model, results indicate the new rich are associated with not consuming all their restaurant food (leftovers) and are less likely to take-home any leftovers. Further, results support evidence of the compensatory-consumption hypothesis, which sheds light on a new theory for explaining emerging developing countries' increasing food waste.

Keywords: New Rich, Food Waste, China, Compensatory Consumption

1.   Introduction

Food waste is a serious threat to the global environment and economy, with an estimated one-third of all the food produced lost at a cost of $400 billion annually in waste disposal and associated government costs (WRAP, 2015). Most food waste ultimately ends in landfills, where it decomposes and produces methane gas, which represents 7% of greenhouse gases (WRAP, 2015). Consumption in restaurants is one of the major venues in food waste. In China alone, annual edible restaurant food waste is equivalent to nearly 10% of the country's annual crop production or enough to feed 200 million people (CCTV news, 2012).

A major cause of escalating food waste is developing countries' tremendous increase in economic growth leading to food security. In the context of a growing economy, consumption patterns are changing where emerging consumers who suffered from past food insecurity are now relatively rich (new-rich). The developing world's emerging new-rich is a critical economic and social actor with a potential feedback mechanism in engineering further growth. This is particularly true in the largest developing countries such as China and India. A downside of the new-rich is their conspicuous consumption. The popular press reports the new-rich flaunting wealth by ordering excess restaurant food (CNR, 2013). Such reports are antidotal with limited if any empirical analysis supporting such reports and providing evidence of possible underlying causes. Conspicuous consumption has a foundation compensatory-consumption theory. This theory states a lack of z could be cured by an experiencing z, but may also be cured by experiencing e (Grunert, 1993; Woodruffe, 1997; Woodruffe-Burton and Elliott, 2005). In terms of food waste, lack of control over past food insecurity, z, may be compensated by current wasting of food, e. This suggests a possible fundamental underlying difference in food waste generation between developed and developing countries.

The food-waste problem is especially serious in China, with feeding 1.4 billion people and the objective of pulling 56 million out of poverty by 2020. Also, China is one of the fastest growing countries comprising the largest population of new-rich. The aim is to then determine whether China's new-rich tend to waste relatively more food, and if yes, investigate the underlying causes. Without such an understanding, policies directed toward reducing food waste may be inefficient. The underlying hypothesis, is compensatory-consumption theory can explain why the new-rich tend to waste more food. This research is a first attempt to place food waste in a compensatory-consumption perspective and provide evidence of food waste as a possible economic growth downside. As a test of this hypothesis, restaurant food waste is investigated in a two-stage process where customers first determine if they will have leftover food and then determine if they will take it home. For the new-rich, the question is if compensatory-consumption explains if they have leftovers, and if so, will they take it home?

2.   Literature review

The consumer food-waste problem is mainly an issue in developed countries (Hodges, et al., 2010). Most studies on consumer food waste are conducted in the United States and Europe (Bettina et al., 2016). Various studies in developed countries indicate that food choice and eating behavior in out-of-home consumption settings relate to a wide set of personal, social, and situational factors (Bettina et al., 2016). These included food-related values (Lusk and Briggeman, 2009), attitudes (Sparks et al., 1992), social norms (Cruwys et al., 2015), personal comfort (Byker et al., 2014) and choice design (Hanks et al., 2012). With respect to the impact of social determinants, Bettina et al. (2016) provide support for the relevance of subjective norms for behavioral intention. Although this impact is relatively weaker than the impact of attitudes and perceived behavioral control. Additionally, a report from the Waste and Resources Action Program noted the problem is getting worse because the global middle class is expanding (WRAP, 2015). Considering the role of social and cultural drivers in food waste, caution is required when extending their results to emerging developing countries.

Emerging economies are increasingly facing a similar food-waste challenge with income growth and demographic changes over the past 20 years modifying eating habits. In China, consumer waste, mainly linked to restaurants and canteens, is increasing; driven by growing affluence, urbanization, and the growth of the restaurant and catering sector (Liu, 2014).

Compensatory consumption is an unexplored research topic in consumer behavior (Burton & Elliott, 2010). The theory of compensatory consumption states consumption could be motivated in an effort to assuage a broad range of psychological threats including a sense of mastery over one's environment. According to Gronmo (1988), the theories underlying the concept were described as early as 1933 (Jahoda et al., 1933) and the work of Caplovitz (1963) explored links between compensatory behavior and consumption. The concept of compensatory consumption has attracted little attention from marketing and consumer researchers and yet the literature suggests possible relations (Elliott, 1994): compulsive buying, O'Guinn and Faber, 1989; self-gift giving, Mick and DeMoss, 1990 and Luomala, 1988; compensatory eating behavior, Grunert,1993; mood repair, Rook and Gardner, 1993; and conspicuous consumption, Mason, 1981 and Page, 1992). In terms of food waste, no literature exists explaining food waste in terms of compensatory consumption.

With regard to the childhood experiences, Duncan and Brooks-Gunn (1997) indicate family economic conditions in early childhood appear to matter more for shaping later development than economic conditions during adolescence. Child developmental theory suggests that given the nature of developmental tasks, sensitivity to change, and interactions with the environment, early childhood is a developmental period that may be especially sensitive to environmental conditions affected by family income (Shonkoff & Phillips, 2000; Duncan et al., 2010). Based on the current literature, the objective is to build on the key conclusions by testing compensatory-consumption theory in China considering early family economic conditions.

2. Theory

It is assumed the customer's problem is to maximize following indirect utility function

$$v\{y_1[c(\bar{e}), \bar{x}][\max\ u[y_2(c(\bar{e}), \bar{x})]\},$$

where y_1 is an indicator with 1 if leftovers are taken and 0 otherwise, y_2 denotes the amount of leftovers taken home, c is compensatory consumption, $\bar{e}$ denotes a vector of observable compensatory variables, and $\bar{x}$ is a vector of control variables. Customers first determine if they will experience leftovers and if so then determine the amount of leftovers to take come. As a test of the compensatory-consumption theory for food waste, leftovers and taking home leftovers are regressed against observable compensatory variables in a Heckman two-step probit model

$$y_1 = y_1[c(\bar{e}), \bar{x}],$$

$$y_2 = y_2(c(\bar{e}), \bar{x}).$$

3 Data

3.1. Data and methodology

For analysis, new-rich is defined as individuals who suffered from childhood food shortages, (specifically ten-years old) and whose family income has reached at least the middle-income level. Based on Forbes income groups, family income of 100,000 RMB ($14,500) is set as the lower bound and 500,000 RMB ($72,550) is the upper bound(Forbes, 2010). Incomes above 500,000 RMB are classified as very-rich. By employing these two income standards, the research could further explore whether compensatory-consumption theory explains food waste.

As a test of the hypothesis, empirical research was conducted based on an urban survey in three China cities (Beijing, Hangzhou, and Qinhuangdao). This represents, respectively, large, medium, and relatively small Chinese cities. For each city, the survey was conducted with randomly selected restaurants resulting in 419 completed questionnaires. In the survey, households are asked whether they experienced hunger before and questions describing their family condition in the past along with their

socio-economic demographics and a record of whether they had uneaten food (leftovers). With this survey, a Heckman two-step probit model was employed to investigate whether they experience of food insecurity, and if yes what are the underlying mechanisms.

3.2. Sample statistics

Table 1 presents the summary statistics of collected data. On average, the sample population was 36-years old with 55% in the age range of 30 to 50. More than half of the population had experienced food insecurity during childhood. Statistically significant at the 90% confidence level, the income group who experienced a childhood food insecurity tended to have less likelihood to take home leftovers, but we didn't find evidence to support difference of leftovers between the two groups Compared to general statistics on urban citizens in China, this sample is representative concerning average age (36), gender (47 % female), and yearly family income categories(China Profile, 2017)

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Table 1. Sample statistics

Characteristics	419 observations	
2016 family income (thousands)	<100 (38%), 100 -500 (58%), >500 (5%)	
Staple food at ten-years old	experienced food insecurity (54%)	
	had enough food (46%)	
Income groups	At age ten	Current age
	Poor	rich (28%)
	Poor	yery rich(2%)
	Poor	poor (24%),
	Rich	rich (29%)
	Rich	very rich(3%)

	Rich	poor (13%)
Age		<30 (37%), 30-50 (55%), >50 (9%)
Feelings of childhood family income compared to		(above the average)18% , (about the average)
average income		61%, (below the average) 21%
Gender		Female (47%), male (53%)
Household size		
Residence during childhood (rural or non-rural)		Rural area (35%), non-rural area (65%)

Table 2 lists leftovers, and if so, if they took them home. Approximately 20% of the respondents had no leftovers. Of all who had leftovers, 52% took them home.

Table 2. Number of leftovers and taken-home

	Leftovers	
	No	Yes
Taken-home		
No	43	179
Yes	–	197

4. Empirical model

Only if there are leftovers is it observed if leftovers are taken-home. The model is then based on whether leftovers are taken-home, given the selection leftovers equation. This requires first testing whether the new-rich tend to be associated with less leftovers taken-home

$$Takehome = f(poor\_rich, poor\_vrich, poor\_poor, rich\_vrich, rich\_poor,$$
$$other\ control\ variables),$$

where poor_rich, poor_vrich, and poor_poor denote respondents who experienced childhood food insecurity and entered into the new-rich, very-rich, or remained poor, respectively; rich_rich, rich_vrich, rich_poor denote respondents who experienced no childhood food insecurity and entered into the new-rich, very-rich, or poor, respectively. The other control variables along with city dummies are listed in Table 1. Relationships within a restaurant party may also play a role in explaining food leftovers. In both the probit and selection equations, a variable is included measuring how often respondents and their party eat together, which suggests some type of relationship. Eating at a restaurant for the first timer may suggest incomplete information about the portion of each plate and lead to food waste. By considering the average price of a restaurant, it is expected less food will be ordered the higher the price, resulting in lower food waste. Table 3 lists the control variable hypothesized signs.

Table 3. Control variable's hypothesized signs

	Take home leftovers	Leftovers
Rest_level	+	−
Num_gathering	?	?
Often	+	−
First_timer	+	+
Household	+	?
Rural_childhood	+	?
Age	+	?
Particular		−

In case the missing take-home leftovers are not random, a probit selection model is employed,

$$Leftovers = f(\ poor\_rich,\ poor\_vrich,\ poor\_poor,\ rich\_vrich,\ rich\_poor,$$

$$particular, other\ control\ variables) \tag{1}$$

For consistency with the Heckman probit selection model, the selection model contains an additional variable, so assume leftovers are also affected by whether a respondent is careless or particular in ordering food.

5. Results

Estimated results of (1) are listed in Table 4 with the Wald Chi-square test indicating significant explanatory variables at the 1% level. From the take-home leftovers regression, the significant negative coefficient, at the 5% level, associated with Poor_rich indicates the new rich are likely to waste more food. Specifically, respondents who experienced childhood food shortages and then entered into the middle class will tend to waste food by not taking home any leftovers. The other significant variables mitigate this negative effect of the Poor_rich variable. How often the respondent eats out in a group, if it is the respondent's first time at the restaurant, and if the restaurant is located in Beijing or Hangzhou will increase the likelihood of taking home leftovers at the 10%, 5%, 5%, and 1% significance level, respectively.

Considering the leftovers regression, the significant positive coefficient, at the 1% level, associated with the Poor_vrich variable indicates the very-rich are likely to not finish eating all their meals, which directly leads to food waste. The city dummy variables for Beijing and Hangzhou are again positively significant at the 5% and 1% level, respectively. The Rest_level coefficient, significant at the 10% level, indicates the more expensive a meal, the less likely there will be leftovers. This indicates higher food prices may reduce food waste.

For testing the hypothesis that compensatory-consumption theory can explain food waste, further investigation involves whether childhood experience could have any explanatory power in the two regressions. This involves two variables: inferior feeling of childhood family income, Inferior_childhood, and experience of childhood food insecurity, Staple_childhood. Further, to avoid the

interaction effect of current income situation family income in 2016 is also included, Famincome2016. Including these variables results in the models 2-5 in Table 4.

In table 4, all the results indicate high explanatory power given the Wald Chi-square tests, which are significant at 1% level. Results also indicate that both of childhood experience of food insecurity, Staple_childhood, and childhood memory of inferior feelings, Inferior_childhood, significantly, reduce the probability of taking home leftovers. In contrast, family income in 2016, Famincome2016, is not significant, at the 10% level, in any of the models, which suggesting a lack of linkage between current income status and food-waste behavior. These negative effects of taking home leftovers associated with Inferior_childhood and Stable_childhood support the hypothesis that compensatory-consumption theory can explain food waste.

For additional support, model 6, in Table 4, considers inferior feeling relative with others in terms of family income in 2016, Income_less_than_others. Results support inferior feelings reducing the probability of taking home of leftovers. This further supports that new-rich food waste behavior may be based on compensatory-consumption theory. Inferior feelings relative to others in terms of income could provide a compensatory motivation in food consumption.

Table 4. Model results[a]

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Take home leftovers						
Poor_rich	−0.411**					
	(0.185)					
Poor_vrich	-0.381					
	(0.521)					
Poor_poor	-273					
	(0.201)					
Rich_poor	-0.102					
	(0.230)					
Rich_vrich	-0.212					
	(0.404)					

Rest_level	0.002	0.002	0.002	0.002	0.002	0.002
	(0.004)	(0.004)	（0.004）	（0.004）	(0.004)	(0.004)
Num_gathering	0.054	0.056	0.053	0.057	0.055	0.064
	(0.039)	(0.038)	(0.038)	(0.038)	(0.038)	(0.039)
Often	0.295*	0.271*	0.260*	0.264*	0.256*	0.301**
	(0.140)	(0.140)	(0.140)	(0.140)	(0.140)	(0.145)
First_timer	0.319**	0.345*	0.347**	0.356**	0.356**	0.362**
	(0.143)	(0.141)	(0.141)	(0.145)	(0.142)	(0.147)
Household	−0.064	−0.071	−0.064	−0.067	−0.063	−0.063
	(0.047)	(0.047)	(0.048)	(0.047)	(0.048)	(0.049)
Rural_childhood	0.247	0.143	0.220	0.236	0.281*	0.212
	(0.164)	(0.159)	(0.164)	(0.163)	(0.166)	(0.167)
Age	0.010	0.005	0.007	0.010	0.011	0.007
	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.007)
City1	0.564**	0.573**	0.589***	0.583**	0.593***	0.694***
	(0.231)	(0.244)	(0.223)	(0.237)	(0.221)	(0.252)
City2	0.749***	0.787***	0.772***	0.753***	0.748***	0.857***
	(0.217)	(0.231)	(0.202)	(0.221)	(0.199)	(0.249)
Staple_childhood					−0.330**	−0.263*
					(0.150)	(0.153)
Income_less_than_others						−0.549*
						(0.214)
Inferior_childhood			−0.471***		−0.403**	
			(0.181)		(0.185)	
Famincome2016		0.031	0.065	0.055	0.080	0.154
		(0.151)	(0.152)	(0.153)	(0.153)	(0.161)
Constant	−0.989*	−0.886**	−0.917**	−0.909*	−0.929*	−1.105*
	(2.18)	(0.435)	（0.420）	(0.440)	(0.427)	(0.452)
Leftovers						
Poor_rich	0.049					
	(0.252)					
Poor_vrich	3.762***					
	(0.303)					
Poor_poor	0.217					
	(0.265)					
Rich_poor	0.200					
	(0.300)					
Rich_vrich	=0.235					
	(0.577)					
Rest_level	−0.009*	−0.009*	−0.010**	−0.009*	−0.011*	−0.009*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Num_gathering	−0.050	−0.049	−0.051	−0.049	−0.052	−0.049
	(0.042)	(0.042)	(0.041)	(0.042)	(0.041)	(0.042)
Often	−0.168	−0.158	−0.152	−0.158	−0.158	−0.155
	(0.199)	(0.200)	(0.194)	(0.197)	(0.193)	(0.198)
First_timer	0.055	0.026	0.032	0.031	0.038	0.036
	(0.199)	(0.204)	(0.198)	(0.201)	(0.196)	(0.207)

	(1)	(2)	(3)	(4)	(5)	(6)
Particular	0.201	0.223	0.211	0.221	0.207	0.229
	(0.181)	(0.181)	(0.181)	(0.180)	(0.180)	(0.183)
Rural_childhood	0.123	0.147	0.197	0.119	0.155	0.172
	(0.211)	(0.214)	(0.210)	(0.211)	(0.211)	(0.214)
Age	0.015	0.014	0.016	0.013	0.014	0.013
	(0.013)	(0.012)	(0.011)	(0.012)	(0.012)	(0.013)
City1	0.519**	0.536**	0.556**	0.532*	0.549**	0.570**
	(0.257)	(0.253)	(0.256)	(0.252)	(0.257)	(0.253)
City2	1.766***	1.738***	1.748***	1.751***	1.763***	1.748***
	(0.429)	(0.408)	(0.419)	(0.404)	(0.414)	(0.418)
Inferior_Childhood			−0.276		−0.314	
			(0.212)		(0.215)	
Famincome2016		0.172	0.186	0.165	0.171	0.188
		(0.200)	(0.199)	(0.201)	(0.200)	(0.208)
Income_less_than_others						-0.129
						(0.237)
Staple_Childhood				0.079	0.141	
				(0.192)	(0.197)	
Constant	1.064*	0.821*	0.854	0.823	0.873	0.865
	(2.13)	(0.479)	(1.83)	(1.74)	(1.89)	
Wald Chi2(12)	28.56***	25.10***	32.39***	28.29***	34.36***	25.08***
Wald test of indep	2.56	1.95	5.40**	2.44	5.81**	1.35
athrho	−0.858	−0.854	−0.914*	−0.943	−0.943**	−0.622
	(0.584)	(0.611)	(0.393)	(1.75)	(0.391)	(0.535)
Number of observations	417	417	417	417	417	417

[a] Standard errors are in the parentheses with *, **, ***denoting 10%, 5%, and 1% level of significance, respectively. Rest_level denotes average price of the restaurants, Num_gathering is number of participants in interviewed group, Often is a dummy variable with 1 indicating respondent and major participants eating together more often than once per month and 0 otherwise, First_timer is an indicator variable if whether it is the respondent's first at the restaurant, Inferior_Childhood is a dummy variable with 1 indicating respondent had an inferior childhood experience and 0 otherwise, Famincome2016 is a dummy variable with 1 indicating family income is over 100,000 RMB and 0 otherwise, City1 and city2 are indicators for Beijing and Hangzhou, respectively.
[b] We have also tried the model with famincomevrich and famincomerich as 2016 family income indicators, famincomevrich equaling 1 indicating family income is over 500,000 RMB and 0 otherwize, and famincomerich, equaling 1 indicating familying income is over 100,000 RMB but no more than 500,000 RMB and 0 otherwise. But the income indicators are also insignificant., and don't affect the significance and magnitude of other variables. So for the sake of simplicity, we only report the results using famincome2016 as the indicator of family income.

6. Conclusions and policy implications

As the first attempt in providing empirical evidence for the new-rich consumption behavior in food waste, this research sheds light on a new theory for explaining increasing food waste in emerging developing countries. Although current literature indicates food-consumption demand increases with economy growth, limited if any literature focuses on the dynamic change itself. Employing a Heckman probit model, results indicate the new-rich is associated with leftovers and less likely to take food home, which support the compensatory-consumption hypothesis.

In the context of emerging economies, such as China, India, and a number of African countries, the new-rich are changing their consumption patterns. For policy deliberations, results indicate the memory of childhood food insecurity should be noted. This memory appears to still dominate the new-rich current food-waste behavior.

The impacts of compensatory-consumption theory for the new-rich also indicate that the market demand are far more complex than previous modeling efforts have considered. This suggests that a linear extrapolation forecast of food demand may not be correct. Understanding the empirical evidence supporting compensatory-consumption theory may improve forecasts that feed into early warning systems for food security.

These results run counter to the ideals of emerging economies. In terms of food consumption, emerging countries who witness the largest economic development during the last decades may see a large increase in food waste and other forms of consumption waste. This may be an even larger issue than food-production development.

Furthermore, developing countries have different characteristics than developed countries in terms of food waste. This requires a targeted policy framework different from food-waste policies designed specifically for the developed countries. The FAO and other institutions aiming to reduce food waste in developing countries must guard against the possible consequences of possible emerging compensatory consumption and target the most vulnerable groups.

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