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The effects of social networks on the diffusion of consumer goods: Evidence from rural Indonesia

Ryosuke Nakai
University of Tokyo

Yasuyuki Todo
Waseda University

Abstract

This study examines the effect of social networks on the decision to purchase consumer products among 337 rural households in Indonesia. In particular, we focus on two types of products: gas stoves and probiotic drinks. The two types are different in that the benefits of the use of gas stoves are easily observed by users, whereas the benefits of probiotic drinks are not. Using multinomial logit estimations, we find that households with more friends who have bought a high-quality brand of gas stove are more likely to purchase the same brand. In contrast, households with more friends who have recently consumed probiotic drinks are less likely to consume these drinks. The results suggest that when the benefits of a product are easily observable, social networks contribute to the diffusion of the product by promoting its good reputation, whereas the effect of social networks can be negative through the proliferation of a product's bad reputation when its benefits are not observable.

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Contact: Ryosuke Nakai - riyaok8211@gmail.com, Yasuyuki Todo - yastodo@waseda.jp.
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1. Introduction

In recent years, consumer markets in less developed countries (LDCs) have attracted considerable attention from consumer-goods firms in developed countries. Prahalad (2004) argues that the poor in LDCs, or the 'Bottom of Pyramid' (BOP), constitute a substantial market because the population of the poor is quite large despite their low purchasing power per capita. Moreover, the recent surge of emerging economies has been associated with the development of a wide middle class in these economies (Kharas, 2010). Accordingly, the ways in which firms in developed countries can penetrate the market to reach BOP consumers and the middle class have been studied in the academic literature (Hart, 2010).

Using household-level data from rural Indonesia, an LDC, this study examines the effects of the diffusion of reputation through social networks on the purchasing behaviors of consumers. Although such network effects have been extensively examined theoretically (Kempe et al., 2005; López-Pintado, 2008) and empirically using data for markets in developed countries (Hill et al., 2006), few studies have examined this issue in the context of BOP and middle-class consumers in LDCs. One notable exception is Banerjee et al. (2013), who examined diffusion of participation in microfinance in Indian villages. They found that information passing from participants and non-participants positively affect participation, while endorsement from neighboring participants does not. This paper extends the literature in the following two ways, focusing on endorsement effects of Banerjee et al. (2013). First, we incorporate multiple brands of consumer goods into the set of consumers' choices. Second, we examine possible differences in endorsement effects depending on observability of benefits for each good.

2. Conceptual Framework

We assume that the effect of social networks through the diffusion of reputation on the decision to purchase a particular product depends on whether the benefits of the product are easily observed. This assumption comes from the argument by Rogers (2003) that observability, defined as the degree to which the results of an innovation are visible, is an important determinant of how much and how quickly the innovation is adopted. When the benefits of a product are easily observed, a good reputation from using it is likely to be diffused through social networks. In contrast, when benefits are obtained but are not easily observed, the use of the product may disappoint its users, and its bad reputation may spread through social networks.

In rural areas of LDCs in particular, the diffusion of the reputation of products relies heavily on social networks in the rural community rather than other channels, such as advertisements on TV or in newspapers. Therefore, the role of social networks in the diffusion of products is of particular importance in business with the BOP and middle class in rural areas of LDCs.

In this study, we focus on gas stoves and probiotic drinks, such as yogurt drinks, to represent two different types of products. Gas stoves are an example of products whose benefits are easily observable, whereas probiotic drinks are an example of products whose benefits are not observable. Both types of products are relatively new in the survey area of this study, as we will explain in detail. When consumers first use a gas stove, particularly a high-quality gas stove, after using only wood, charcoal, or kerosene stoves, they can easily recognize the benefits of the gas stove, such as its ease of use, high temperature, and smoke-free nature. Users may extend information about the good reputation of the product to their friends so that these friends are likely to purchase a gas stove of the same brand. However, when consumers drink a probiotic

drink, they may not realize any benefit from it even when they do, in fact, benefit by improving their digestion and immune system. These consumers may complain to their friends that the probiotic drink had no effect on their health. This bad reputation may spread to others through social networks in the region, discouraging the purchase of probiotic drinks.

3. Data

We conducted a survey of agricultural households in Tanggamus Regency, Lampung Province, which is located on the southern edge of the Sumatra Island of Indonesia, from late August to early September 2013. The survey targeted 343 agricultural households in 16 farmer groups randomly selected from 36 coffee- or cacao-producing farmer groups in the regency. The self-reported head of each household was interviewed in person for approximately one hour. The sample households were located in remote areas to which it takes approximately twenty minutes to one hour to travel by motorcycle (the most frequently used mode of transportation in the region) from the central small town in Tanggamus where gas stoves and probiotic drinks are available for purchase. From Tanggamus, it takes three more hours by car to reach Bandar Lampung, the capital city of Lampung Province.

We collected information on past purchases of gas stoves, brand names of the purchased gas stoves, the consumption of probiotic drinks in the previous two weeks, the brand names of the recently consumed probiotic drinks, and the year the respondent began to drink any probiotic drink. There are several brands of gas stoves available in the region, including a foreign brand that is high quality and popular (hereafter, foreign brand G1), a domestic low-quality brand that is the second most popular brand (local brand G2), and several other unpopular brands. Among the target households, gas stoves were first used in 1995, and only 3 percent of the households used a gas stove in 2003. Before using gas stoves, these households relied on wood or kerosene stoves. At the time of the survey, 29.5 percent of agricultural households used the top Japanese brand, 20.4 percent used the second-most-popular domestic brand, and 43.2 percent had not purchased any brand of gas stove.

Similarly, there are several brands of probiotic drinks, including the most popular foreign brand (brand P1). Although probiotic drinks first appeared in the local market in approximately 1980, according to our interview, the penetration ratio of probiotic drinks remains low in the area. The share of households that drank P1 in the previous two weeks was 18.1 percent, whereas 9.9 percent drank other probiotic drinks in the previous two weeks.

The data include information about the person each household head consults for information about agricultural techniques. Because the major income source of the sample households is agriculture, we assume that these information networks for agricultural skills reflect fundamental social networks among the households. Accordingly, we use the number of households that a given household asks for agricultural information (hereafter, we denote those households as “friends”) and that purchased a given brand before the household made the decision to purchase any brand as an index of the degree of the personal social networks of the household that influence decisions to purchase a given brand. Because our survey targeted all households in selected farmer groups, we can fully identify these friends in the data.

The summary statistics of the sample households are shown in Table 1. Our sample consists of 337 households among the 343 for which the necessary data are available.

Table 1: Summary Statistics

Independent Variables	Mean	Standard Deviation	Min.	Max.
Age of the head of household	44.1	11.6	23	88
Years of schooling of the head of household (in logs)	2.06	0.457	0	2.89
Total income (mil. rupiah, in logs)	16.3	1.21	11.5	19.5
Share of agricultural income	0.755	0.321	0	1
Number of household members	3.91	1.14	1	8
Number of children	1.10	0.823	0	4
Number of friends who bought				
Gas stove brand G1	0.190	0.500	0	3
Gas stove brand G2	0.0861	0.311	0	2
Other gas stove brand	0.0326	0.178	0	1
No gas stove	0.9170	1.38	0	9
Probiotic drink brand P1	0.374	0.717	0	4
Other probiotic drink brand	0.196	0.479	0	3
No probiotic drink	1.98	1.85	0	9

4. Empirical Methodology

To examine the effect of social networks on the decision to purchase a particular brand of gas stoves, we employ a multinomial logit model in which the dependent variable is a categorical variable that shows whether the household purchased brand G1 (the most popular high-quality foreign brand), brand G2 (the second-most-popular low-quality local brand), any other brand, or no gas stove. The key independent variables are the number of the household's friends that purchased a particular brand of gas stoves before the household purchased any gas stove. We hypothesize that the number of friends who previously purchased a particular brand has a positive effect on the probability that the household will purchase the same brand because the reputation of the observable benefits of using the brand can spread through social networks.

Similarly, when we examine the effect of social networks on the decision to purchase probiotic drinks, the dependent variable is a categorical variable that shows whether the household consumed brand P1 (the most popular foreign brand), any other brand, or no probiotic drinks. We categorize probiotic drinks simply into two groups because if we have more categories, the multinomial logit estimation does not converge, which is most likely due to the small number of households that consumed each of the other brands. In contrast to the case of gas stoves, we hypothesize that the consumption of a particular type of probiotic drink by the household's friends has no positive effect on the household's consumption of the same brand because the benefits of the consumption are not observable.

In both cases, we include the age of the head of the household, the log of the years of schooling of the head of the household, the log of the total household income, the share of income from agriculture, the number of household members, and village dummies as control variables. The base case in the multinomial logit estimation is the case in which the household did not purchase a gas stove.

5. Results

The results from the multinomial logit estimation for gas stoves are shown in Table 2. For brevity, Table 2 shows only the marginal effect on the probability of purchasing G1, G2, any other brand, or no gas stove, assuming that each independent variable is at its mean. The third row from the bottom shows the *p* values from a Hausman test of the assumption of the independence of irrelevant alternatives (IIA) for the four alternative choices. The *p* values indicate that the IIA assumption is satisfied in this estimation.

We find that the number of friends who previously purchased the high-quality foreign brand G1 has a positive and significant effect on a consumer choosing the same brand. This result indicates that when one additional friend purchases a gas stove of brand G1, the probability that the particular household will purchase a gas stove of the same brand increases by 23 percentage points. However, the number of friends who previously purchased the low-quality local brand G2 has no significant effect on the consumer choosing any brand. Another notable result is that income has a positive and significant effect on choosing the high-quality brand G1. This result is reasonable because the price of the G1 gas stove is relatively high.

Table 2: Estimation of multinomial logit model for a household's brand choice of gas stoves

Choice	G1	G2	Others	None
Age of the head of the household	-0.0011	-0.0010	0.0008	0.0013
	(0.0022)	(0.0022)	(0.0013)	(0.0023)
Log of years of schooling of the household head	0.0447	-0.0073	0.0313	-0.0687
	(0.0547)	(0.0510)	(0.0380)	(0.0571)
Log of total income	0.0832***	-0.0171	-0.0013	-0.0647***
	(0.0225)	(0.0198)	(0.0125)	(0.0218)
Share of agricultural income	0.0831	-0.1566**	-0.0170	0.0905
	(0.0718)	(0.0646)	(0.0433)	(0.0779)
Number of household members	0.0267	-0.0093	-0.0247*	0.0073
	(0.0187)	(0.0197)	(0.0140)	(0.0221)
Number of friends who bought				
G1	0.2273***	-0.0660	0.0330	-0.1943***
	(0.0516)	(0.0726)	(0.0313)	(0.0883)
G2	0.0882	0.0491	-0.0068	-0.1305
	(0.0796)	(0.0904)	(0.0517)	(0.1343)
Any other brand	1.6626	1.5522	-0.6158	-2.5990
	(174.8)	(163.8)	(293.4)	(367.6)
No gas stove	-0.0402*	0.0043	0.0064	0.0294
	(0.0227)	(0.0191)	(0.0116)	(0.0199)
Hausman statistic (*p* value)	0.00 (1.00)	0.00 (1.00)	0.061(0.996)	10.3(0.993)
Number of observations	337			
Log likelihood	-348.87			

Notes: The results are based on multinomial logit regression estimations. The base outcome is "None" (i.e., the household did not buy a gas stove). Marginal effects are calculated assuming that all of the independent variables are at their mean. Standard errors are in parenthesis. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

The results for probiotic drinks shown in Table 3 are completely different from those for gas stoves. Note that although the Hausman statistic is negative in one case, Hausman and McFadden (1984) claim that a negative Hausman statistic is evidence that IIA is not violated. The number of friends who began consuming the top foreign brand P1 or other brands before the household head began to drink any probiotic drink has a negative rather than a positive and significant effect on consuming a probiotic drink of the same category. In addition, the level of education of the household head has a positive and significant effect on consuming any probiotic drink, particularly the foreign brand P1.[1]

Table 3: Estimations of a multinomial logit model for a household's brand choice of probiotic drinks

Choice	P1	Others	None
Age of the head of the household	-0.0017	-0.0013	0.0030
	(0.0021)	(0.0017)	(0.0024)
Log of years of schooling of the household head	0.1960***	0.0731	-0.2691***
	(0.0623)	(0.0504)	(0.0660)
Log of total income	-0.0009	0.0043	-0.0034
	(0.0185)	(0.0146)	(0.0209)
Share of agricultural income	-0.0852	0.0266	0.0585
	(0.0650)	(0.0551)	(0.0755)
Number of household children	0.0168	0.0095	-0.0263
	(0.0248)	(0.0202)	(0.0282)
Number of friends who bought			
P1	-0.1333***	-0.0394	0.1727***
	(0.0511)	(0.0360)	(0.0506)
Any other brand	-0.0466	-0.1314**	0.1780***
	(0.0532)	(0.0650)	(0.0663)
No probiotic drinks	0.0085	0.0184**	-0.0269**
	(0.0112)	(0.0082)	(0.0126)
Hausman statistic (*p* value)	-3.61(NA)	1.52(1.00)	0.026(1.00)
Number of observations		337	
Log likelihood		-225.3273	

Notes: The results are based on multinomial logit regression estimations. The base outcome is "None" (Never drinks probiotic drinks). Standard errors are in parenthesis. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

6. Discussion

These results highlight the differences in the effects of social networks on consumers' decisions to purchase products. In the case of gas stoves, we find an endorsement effect defined by Banerjee et al. (2013), i.e., positive effects of friends who already purchased a high-quality brand on purchasing the same brand. By contrast, we find a negative endorsement effect in the case of probiotic drinks: A household is less likely to consume probiotic drinks when more friends consume probiotic drinks. We presume that this difference comes from that the benefits of the

[1] We further include several centrality measures, such as indegree centrality, of each household in the village network as regressors to examine effects of village networks in general, rather than effects of friends who bought the same brand in particular. We find that the main results remain the same while the centrality measures have no significant effect on purchasing behaviors. These results are available upon request.

use of gas stoves are easily observed while those of the use of probiotic drinks are not.

If our presumption is correct, our results suggest that firms in emerging economies and LDCs selling high-quality products whose benefits are easily observable should fully utilize existing social networks through which the good reputation of such products spreads. For example, providing free samples to consumers in the center of networks may promote a product's diffusion to other related consumers. However, firms selling products whose benefits are not easily observed should not rely on social networks. Instead, because our result also indicates that education can mitigate the negative effect of social networks by teaching consumers about the benefits of the products, firms should educate consumers about their benefits. As consistent with this implication, the top foreign brand P1 of probiotic drinks utilizes specialized workers who regularly visit households, offices, and schools to explain the benefits of its products and sell the products.

In fact, it may not be appropriate to conclude as above from the only two cases, and the difference in results between the two can be due to other reasons. For example, the quality of probiotic drinks in our survey villages may be low because the temperature in refrigerators there is too high due to frequent black-outs. If this is the case, probiotic drinks have a negative endorsement effect because they provide no actual benefit. Therefore, further studies are required to clarify whether different observability of benefits leads to different endorsement effects.

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