

Factors affecting fluid milk purchasing sources in Turkey [☆]

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Abstract

This study investigated main factors affecting fluid milk purchasing sources of households in Turkey. From the collected household survey data, a multinomial logit model was estimated to analyze households' choices among unpacked, processed and processed-unpacked fluid milk alternatives within the utility maximization framework. The results indicated that number of children, household size, educational level and income were among the important household characteristics that influence fluid milk purchasing behaviors. In particular, processed fluid milk purchases were made by households with high-income levels, higher educated and small households in comparison to unpacked fluid milk purchases. On the other hand, results revealed that response of households to price difference and other usages of fluid milk significantly stimulate households to choose unpacked and processed-unpacked alternatives over the processed fluid milk choice. The implications of these results for government agencies and fluid milk processing firms in developing countries are discussed.

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1. Introduction

Milk is the most nutritionally essential food to humans and contains nearly all nutrients. Therefore, it is advisable to consume an adequate amount of milk and milk products for healthy lifestyle. However, there is a significant gap between developed and developing countries in terms of fluid milk consumption. For instance, annual per-capita fluid milk consumption in developed and developing countries is 60–170 and 2–40 kg, respectively (USDA, 1999). In developed countries, fluid milk consumption pattern has changed significantly over the last several decades. Due to health concerns, aging of the population, increased education and income level factors in developed countries, low-fat milk consumption has shown an increase but per-capita consumption of whole-fat milk has decreased, (Jensen,

1995). In contrast, consumption of fluid milk in developing countries has not peaked yet and unpacked fluid milk takes a significant share of fluid milk consumption.

The annual per-capita consumption of fluid milk in Turkey, as of 2000, was 20 kg. It is obvious that fluid milk consumption in Turkey is very low compared to developed countries. Cultural, educational and economic reasons often limit fluid milk consumption in Turkey. The traditional perception of fluid milk was as a product for children. In recent years, advertising campaigns have emphasised the nutritional value of fluid milk.

Fluid milk consumption pattern in developing countries such as Turkey is quite different from more developed countries. As a developing country in Turkey, 47% of fluid milk is consumed as unpacked milk, which is often unhygienic (Setbir, 2000). According to US standards, bacterial count in unpacked milk is generally high and is regarded as 'C', which is accepted dangerous for human consumption. In fact, one of the recent research results showed that unpacked fluid milk contained pathogenic organisms above tolerable limits in Turkey (Altun, Besler, & Unal, 2002). Similar results were reached by some other studies conducted in Izmir and Adana provinces of Turkey (Aytur, 1990; Caglarirmak, 1987; Kavas, 1991). In addition to milk sanitation

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problems, the quality of unpacked milk is also generally very low. This problem partly stems from additives, which are added to prevent spoilage of unpacked fluid milk.

Unpacked fluid milk is mainly delivered to consumers directly by individual farmer-distributors in Turkey. The milk sellers deliver unpacked fluid milk directly from farms to residential areas, doorsteps and come to the same delivery point every day or certain days of week. This marketing structure enables farmer-distributors to avoid paying exact amount of tax and sale fees. More importantly, unpacked fluid milk is delivered to consumers without having any safety controls. Furthermore, milk sellers incur no packing costs since consumers supply their own milk containers. Hence, the price of unpacked fluid milk is much lower than processed milk, and this might stimulate households, especially those with a low income, to select unpacked fluid milk as their primary fluid milk source. In addition to price concerns, processing fluid milk into yogurt and some other usages are also important factors with respect to purchasing unpacked fluid milk.

This poor marketing structure creates unfair competition environment for processed milk firms that have only 18% market share and prevent the development of fluid milk sub-sector in Turkey (Setbir, 2000). As a comparison, 90% of raw milk in EU is consumed by industrial processors. It is obvious that processed milk ratio in Turkey is far below than developed countries. Currently, the organizational structure of the fluid milk sub-sector is somewhat mixed in that there are some firms (7%) that use advanced technology. On the other hand, most of the firms (93%) are small, and these firms process milk and milk products under primitive conditions. Modern and primitive firms hold 56% and 44% of the fluid milk capacity in Turkey, respectively (Buyukkilic & Arpacioğlu, 1990).

Realizing the fluid milk marketing structure and consumption pattern, the Turkish government has followed some policy tools and prohibited unpacked fluid milk marketing. For instance, the Turkish government has favored milk consumption and extensive advertisement campaigns have been launched in the media to highlight about the importance of processed fluid milk. However, it should be pointed out that these policies so far have not worked efficiently. Given the current structure of the fluid milk marketing in Turkey, there is a need for empirical research studies that determine main factors affecting fluid milk purchasing behaviors of households. To date, considerable work has been conducted on the factors affecting purchasing patterns of milk and milk products (Gould, 1995; Hsu & Kao, 2001; Hsu & Liu, 2000; Jensen, 1995; Nayga & Siebert, 1999; Watanabe, Suzuki, & Kaiser, 1999). Nevertheless, none of these studies has focused on unpacked fluid milk purchasing behaviors of households.

In this study, we presented a model to estimate the impact of socioeconomic and other relevant factors on fluid milk purchasing alternatives of households. The major contribution of this study is to provide insights into factors that influence fluid milk purchasing sources of households. In addition, the results will also be of interest to milk processing firms and government agencies that could use the information derived from this study in determining marketing strategies and setting up new policy tools. The next section describes the data and theoretical framework while results of the econometric analysis and discussion are given in Section 3. In the last section, conclusion and several implications of this study are given.

2. Data and method

Data used in this analysis were based on household cross-sectional data collected by the research team, conducted in 2001 for the urban area of Antalya province in Turkey. In this study, proportional stratified sampling method was employed. Proportional stratified sampling was based on geographical location of households for each district in the population. The major advantage of this sampling method is that it guarantees representation of defined groups in the population. Hence, it improves the precision of inferences made to the full population. For this purpose, Antalya province was divided into three geographical districts namely Muratpasa, Kepez and Konyaalti. There are around 147 thousand households living in Antalya province. The proportional shares of districts in total population are 49.3 (Muratpasa), 46.1 (Kepez) and 4.6 (Konyaalti). There are significant socioeconomic differences among the households across these districts. However, households in one district have similar socioeconomic characteristics. For instance, households living in Kepez district have relatively low income and education level compared to other districts. Furthermore, households living in Konyaalti have the highest income and education level. Hence, this sampling method captured different socioeconomic characteristics of households and enabled us to represent Antalya province. Households' responses were obtained through face to face interviews. Before collecting data, a pilot survey was carried out by a group of randomly selected households and these pre-tested surveys were not included in the final data set. A random sample of 384 households was surveyed. However, 34 households with not consuming milk were dropped from the sample. After the elimination of these households, the data set contained 350 questionnaires were analyzed. In the questionnaire form, households answered questions about their choices of purchasing fluid milk alternatives and provided socioeconomic information.

Survey results revealed that households have more than two choices for purchasing fluid milk: processed, unpacked and processed-unpacked. If there are a finite number of choices greater than two, multinomial logit estimation is appropriate to analyze the effect of exogenous variables on choice. The multinomial logit model has been used widely in recent years by researchers such as Ferto and Szabo (2002), El-Osta and Morehart (1999) and Schup, Gillepsie, and Reed (1999).

In this study, we follow a standard random utility model as its theoretical basis (Hanemann, 1984; McFadden, 1981). The households face a choice decision among products that is assumed to be generated from the household's utility maximization. Suppose that each household i ($i = 1, 2, \dots, N$) has a choice set $J + 1$ ($j = 0, 1, \dots, J$) consisting of alternative choices, where $j = 0, 1$ and 2 are choices on processed, unpacked and processed-unpacked fluid milk, respectively. Let P_{ij} be the probability that household i selects j th choice as the primary fluid milk purchasing source. We assume that indirect utility function for each household is given as:

$$U_{ij} = \chi_i \beta_j + \varepsilon_{ij} \quad (i = 1, 2, \dots, N; \quad j = 0, 1, \dots, J) \quad (1)$$

where χ_i represents a vector of socioeconomic characteristics of households and other variables, β_j denotes a vector of parameters to be estimated, and ε_{ij} is stochastic term. If household i chooses on purchasing fluid milk alternative j which maximizes utility, then the level of utility is expressed as:

$$P_{ij} = \text{Prob}(U_{ij} > U_{ik}) = \frac{e^{\chi_i \beta_j}}{\sum_{k=0}^J e^{\chi_i \beta_k}} \quad \text{for } j = 0, 1, 2, \dots, J \text{ and } j \neq k \quad (2)$$

In Eq. (2), it is assumed that U_{ij} is the maximum among the $J + 1$ choices when household i selects fluid milk purchasing source j . Multinomial logit¹ model is under identified in the current form in Eq. (2). In order to identify the parameters of the model, it is required to remove an indeterminacy in the model. We normalized the model assuming $\beta_0 = 0$ that is reference choice is 'processed fluid milk'. Hence, Eq. (2) can be expressed as:

$$P_{ij} = \frac{e^{\chi_i \beta_j}}{1 + \sum_{k=1}^J e^{\chi_i \beta_k}} \quad \text{for } j = 1, 2, \dots, J \quad (3)$$

Using Eq. (3), log-odds ratios of J can be computed: $\ln(P_{ij}/P_{i0}) = \chi_i \beta_j$. Thus, the coefficients, β_j , in the model denote the effect of socioeconomic characteristics on the relative size of probability that the household i will select j th alternative as opposed to reference choice. Multinomial logit model (3) can be estimated by the maximum likelihood method. The coefficient estimates for

the β_j vectors that maximize the log likelihood function can be obtained using the Newton method (Greene, 2000). Estimated coefficients β do not allow direct determination of marginal effects in multinomial logit models but measure the marginal change in the logarithms of odds alternatives j over the reference alternative.

Therefore, given a household's socioeconomic characteristics and using sample mean values, marginal effects were obtained from the multinomial logit results employing the following formulation (Greene, 2000):

$$\frac{\partial P_j}{\partial \chi_i} = P_j \left(\beta_j - \sum_{k=1}^J P_k \beta_k \right) \quad \text{for } j = 0, 1, 2, \dots, J \quad (4)$$

This research is exploratory in nature; there are a few previous researches to help in selecting exogenous variables that might effect on choice of fluid milk alternatives. In previous studies of dairy food purchases, educational status, household size, income, number of children, ethnicity, advertising, etc., have been included as exogenous variables (Hsu & Liu, 2000; Schmit, Chung, Dong, Kaiser, & Gould, 2000; Watanabe, Suzuki, & Kaiser, 1997). In this study, the variables considered affecting choices of households among fluid milk alternatives are: number of children under the age of six (NC), average household size (AHS), education (EDU), income (INC), response of households to price difference between unpacked and processed milk (PRICE), and other usages of fluid milk (USAGE). In this study, variables were coded as binary variables and adding the number of sub-groups was not possible due to not having sufficient number of observations in each sub-group that reduces reliability of estimates in the multinomial logit model (Kennedy, 1996). These variables and codes are defined in Table 1.

It is hypothesized that households who have children under the age of six are more likely to choose processed

Table 1
Definition of variables

Variable	Definition
NC	1 if the household has at least one or more children under the age of six and 0 otherwise
AHS	1 if the average household size is 3.4 or higher and 0 otherwise
EDU	1 if the highest level of education by the head of household is higher than high school degree and 0 otherwise
INC2	1 if the household income is between 401 and 700 million TL and 0 otherwise
INC3	1 if the household income is greater than 700 million TL and 0 otherwise
PRICE	1 if the fluid milk price is a major factor on household choice and 0 otherwise
USAGE	1 if the fluid milk is devoted to other usages and 0 otherwise

1\$ = 1320 thousand Turkish Lira as of July 2001.

¹ The reader is referred to Maddala (1983) and Greene (2000) for a more rigorous exposition of the model.

milk than unpacked milk due to considering unpacked fluid milk generally unhygienic. In addition, we assume that average household size and educational level are significant factors on choice of households for consuming fluid milk. We hypothesized that households whose average size higher than average (3.40) are less likely to purchase processed fluid milk and higher educated households are more likely to choose processed fluid milk alternative. Household income level is an essential characteristic that influences household purchasing behavior. In order to reveal the purchasing behaviors of households for the different income levels, we divided income level into three groups: low-income (INC1), middle-income (INC2) and high-income (INC3). Low-income level was chosen as a reference group that represents those respondents with characteristics omitted from the explanatory variables. Since the variable was coded as dummy variable, omission of at least one variable is necessary to avoid the dummy variable trap and ensures that perfect multi-collinearity is avoided. It is hypothesized that high-income households are more likely to consume processed fluid milk than other income level households. Regarding price variable, we considered that fluid milk price is one of the major factors with respect to households' decision since there is a significant price difference between processed and unpacked fluid milk prices. We expect that households who consider price is a significant factor have propensity to choose unpacked fluid milk as a primary fluid milk source. In the research area, it has been observed that significant share of unpacked fluid milk was used by households for various purposes such as processing into yogurt and preparing for some foods in addition to drinking purpose. Hence, we also counted this variable in the model. These households who use fluid milk for other usages are hypothesized to choose unpacked and processed-unpacked choices over the processed fluid milk. All estimations were carried out using the Shazam 8.0 software program (White, Wong, Whistler, & Haun, 1997).

3. Results

According to the survey results, the average household size was found to be 3.40 people that is lower than the average household size (4.3 people) in the urban area of Turkey (SIS, 1997). The majority of the households (72.3%) consist of 3–4 people suggesting that nucleus family type is dominant in the research area. The survey results demonstrated that 45.1% of the households' head were high school-university graduates, 36.3% were secondary school, 17.2% were primary school graduates, and 1.4% were illiterate. Average annual income of sampled households was found \$7380 of which about 28.2% were spent on food expenditures. As it is ex-

pected, the ratio of food expenditure in the total expenditure was substantial (47%) in the lowest income group. The households with low income spent almost all of their income (96.7%), whereas these ratios were 83.25% and 60.4% in the middle and high-income groups, respectively.

Survey results revealed that 35.14% of households purchase unpacked fluid milk, 32.29% and 32.57% choose processed-unpacked and processed fluid milk as primary fluid milk purchasing sources, respectively. In the sample households, the monthly per-capita consumption quantities of unpacked and processed fluid milk were found as 3.60 and 2.36 kg, respectively. The majority part of unpacked fluid milk consumption (67.5%) was devoted to other usages such as yogurt, cream-cake etc. In other words, about 32.5% (1.17 kg) of unpacked milk was purchased for drinking purposes. It is obvious that fluid milk consumption in the sample households was very low in the form of both processed and unpacked milk.

The estimated results of the multinomial logit model are provided in Table 2. The model is statistically significant at the 1% level. The likelihood ratio test statistics suggests that hypothesis of all coefficients being 0 rejected at the 0.01% significance level. The likelihood ratio of 0.27 and the model's ability to correctly predict 61% of the observations implies a reasonable goodness-of-fit.

Table 2
Estimates of the multinomial logit model

Variable	Unpacked milk vs. processed milk	Processed-unpacked vs. processed milk	Unpacked milk vs. processed-unpacked milk
Constant	0.028 (0.044)	-1.070 (-1.631)	1.098 (2.025)
NC	-0.731 (-1.814)***	-0.063 (-0.166)	-0.668 (-2.224)**
AHS	1.080 (2.312)**	-1.060 (-2.365)**	0.020 (0.044)
EDU	-0.990 (-2.624)**	-0.268 (-0.742)	-0.722 (-2.395)**
INC2	0.553 (1.480)	0.330 (0.884)	0.223 (0.797)
INC3	-0.667 (-3.323)*	-0.342 (-1.833)***	-0.325 (-2.042)**
PRICE	4.258 (3.990)*	4.082 (3.832)*	0.176 (0.596)
USAGE	2.388 (6.170)*	2.316 (6.406)*	0.072 (0.256)

Log likelihood: -280.05; Likelihood ratio index: 0.27; Restricted log likelihood: -383.12; Likelihood ratio test: 206.14.

*, **, and *** indicate the significance level of 1%, 5%, and 10%, respectively.

Table 2 shows that all of the socioeconomic characteristics except medium income level significantly affected households' choices of unpacked over the processed fluid milk source in the case of first equation. Regarding to households' choice of processed-unpacked over the processed fluid milk alternative, half of the exogenous variables appeared to have statistically significant effects. However, these exogenous variables with the exception of number of children, education level and highest income level were found statistically not significant in explaining household choice between unpacked and processed-unpacked fluid milk alternatives.

Results indicate that households' choices of fluid milk sources were significantly influenced by the number of children (NC). Specifically, households who have children under the age of six are less likely to choose unpacked fluid milk over the processed fluid milk, whereas more likely to consume processed-unpacked and processed fluid milk as the primary source. This result is consistent with our priori expectations that households who have children tend to consume processed fluid milk. Results show that average household size (AHS) is significant with a positive sign for unpacked fluid milk alternative and a negative but not significant for processed-unpacked fluid milk choice. This finding suggests that households whose average size is higher than average tend to choose unpacked fluid milk alternative.

As an expectation, it was hypothesized that there would be a positive relationship between educational level (EDU) and purchasing behavior of processed fluid milk. The sign of education variable is negative and statistically significant for unpacked fluid milk choice. Results fit with this hypothesis and show that households with higher educated were less likely to choose unpacked over the processed and processed-unpacked fluid milk alternatives. Regarding income variable, the results reveal that high-income level (INC3) has a significant influence on the households' decision in choosing of fluid milk alternatives. Households with high-income level appeared to choose less likely unpacked and processed-unpacked fluid milk choices than low-income level households. Households with middle-income level were more likely than low-income level households to choose unpacked and processed-unpacked fluid milk, but it was found statistically not significant. This is probably a result of considering unpacked fluid milk as unhygienic and not using milk for other purposes such as making yogurt. Therefore, our hypothesis that high-income level households are more likely to choose processed over unpacked and processed-unpacked fluid milk alternatives than other income groups is confirmed.

In addition to socioeconomic characteristics of households, other variables, fluid milk price (PRICE) and other usages (USAGE), were included in the model. The results indicate that households' choices of pur-

chasing fluid milk sources were significantly influenced by the price level. In fact, survey results showed that there is about twofold price difference between unpacked and processed fluid milk. Due to price concerns, many households were more likely to select unpacked and processed-unpacked fluid milk, and less likely to choose processed fluid milk. As mentioned previously, a significant share of fluid milk consumption (67.5%) was devoted to other usages in the research area. The positive sign on usage coefficient supports the hypothesis that other usages of fluid milk increases the probability of choosing unpacked and processed-unpacked fluid milk alternatives.

The estimated parameters of multinomial logit results are better interpreted in the concept of marginal probability, which measures the change in the probability of each fluid milk outcome with respect to a change in each explanatory variable. Following Eq. (4), marginal probabilities were calculated from the estimated multinomial logit model and presented in Table 3.

Marginal effect of children number indicates that having children under the age of six increases the probability by 9.0% and 6.9% for processed and processed-unpacked fluid milk alternatives, respectively. On the other hand, it decreases the probability of selecting unpacked fluid milk choice by 15.9%. Marginal effect of average household size implies that the average household size increases the probability of choosing unpacked fluid milk choice by 36.6%, whereas decreases unpacked-processed and processed fluid milk alternatives by 35.4% and 1.2%, respectively. Regarding education level, higher education level of households' head enhances the probability of purchasing processed and processed-unpacked fluid milk by 14.1% and 5.4%, while, as it is expected, it negatively influences selection of unpacked fluid milk choice. This finding implies that higher educated households are more concerned about safety and hygienic conditions of fluid milk, hence, they have propensity to choose processed-unpacked and processed fluid milk alternatives. Marginal effect of income variable indicates that the probability of selecting unpacked and processed-unpacked fluid milk alternatives increases for middle-income groups by 8.9% and 0.9%, while it

Table 3
Estimated marginal probabilities

Variable	Fluid milk alternatives		
	Unpacked milk	Processed-unpacked milk	Processed milk
NC	-0.159	0.069	0.090
AHS	0.366	-0.354	-0.012
EDU	-0.195	0.054	0.141
INC2	0.089	0.009	-0.098
INC3	-0.113	0.001	0.112
PRICE	0.507	0.409	-0.916
USAGE	0.282	0.235	-0.517

decreases processed fluid milk choice for this income group by 9.8%. It appears that households who purchase processed-unpacked fluid milk increase their unpacked fluid milk choice for other usages and processed fluid milk for drinking purpose in response to a positive change in the three income groups. On the other hand, choosing processed fluid milk as a primary purchasing source was positively associated with increasing income. In fact, the probability of choosing processed and processed-unpacked fluid milk alternatives increases by 11.2% and 0.1% for high-income level households, whereas it decreases by 11.3% for unpacked fluid milk alternative. This finding supports our priori expectation that high-income level has a positive impact on the choice of purchasing processed fluid milk.

Households' response to price level of fluid milk seems to be the variable with the strongest influence on the households' decision to choose among fluid milk alternatives. The price level of fluid milk has a positive influence on the households' decision in selecting unpacked and processed-unpacked fluid milk alternatives, whereas the opposite was true for the processed fluid milk choice. Results show that households' response to price difference increases the probability of selecting unpacked and processed-unpacked fluid milk alternatives by 50.7% and 40.9%, respectively. On the other hand, it decreases the probability of selecting processed fluid milk choice by 91.6%. This confirms the hypothesis that existence of price difference stimulates households to purchase unpacked and processed-unpacked fluid milk rather than processed milk. The variable, other usages of fluid milk, suggests that probability of selecting unpacked and processed-unpacked fluid milk alternatives will increase by 28.2% and 23.5%, respectively, in response to a positive change in using fluid milk for other purposes. This result supports the hypothesis that other usages of fluid milk increase the probability of choosing unpacked and processed-unpacked fluid milk alternatives.

In developed countries, many researches have been conducted on factors affecting fluid milk consumption behaviors of households. Most of the studies have implied that low-fat milk consumption is positively related to income and whole milk consumption is negatively affected by income level. Furthermore, previous studies indicate that household size, presence of children in a household and higher education levels are positively affected on low-fat milk consumption (Cornik, Cox, & Gould, 1994; Gould, 1995; Jensen, 1995; Schmit et al., 2000).

4. Conclusions

Fluid milk marketing system in Turkey is quite different from developed countries and almost half of the fluid milk is consumed in the form of unpacked fluid

milk. Additionally, per-capita fluid milk consumption in Turkey is very low and this indicates a potential to expand the market of fluid milk and milk products. In this study, we examined the impact of various factors affecting on households' choices of fluid milk purchasing alternatives namely unpacked, processed and processed-unpacked. For estimation technique, multinomial logit model was specified and analyzed using household data.

The findings of the study revealed that price difference between unpacked and processed fluid milk was the most important factor on household choice. Results also show that larger households are more likely to purchase unpacked fluid milk. Results also showed that unpacked and processed-unpacked fluid milk alternatives were found as the primary source of fluid milk purchases for households especially with middle-income levels. In addition to these, households who have children are more likely to choose processed fluid milk over the unpacked fluid milk alternative. Also, results implied that the higher education level of households' head, the more likely the households would purchase processed and processed-unpacked fluid milk alternatives. Due to habit, tradition and economic factors, fluid milk was used by households for other purposes especially processing into yogurt in Turkey. Results imply that usage variable had positive influence on the decision to purchase unpacked and processed-unpacked fluid milk choices.

Results from this study have several implications and may help government agencies and fluid milk marketing participants in planning marketing strategies, targeting health information and anticipating future trends in the market. Even though unpacked fluid milk marketing has been prohibited by law, a significant share of fluid milk in Turkey is delivered to consumers as unpacked fluid milk without having any inspection. It is suggested that the Turkish government should take necessary actions to prevent marketing of unpacked fluid milk. In order to improve fluid milk marketing system, Turkish government needs to establish some standards in the fluid milk marketing system and impose high amount of charges for unpacked fluid milk sellers. One of the reasons for a significant share of unpacked fluid milk consumption arises due to having structural problems of dairy farms. This structure can be improved by supporting modern dairy farms and encouraging marketing cooperatives. It appears that households with especially low- and middle-income levels had a propensity to choose unpacked and processed-unpacked fluid milk choices due to significant lower price of unpacked fluid milk. Therefore, fluid milk processing firms need to improve their technology levels to reduce cost of processing fluid milk to attract more households. Since current fluid milk marketing structure in Turkey creates unfair competition environment for modern fluid milk processors, Turkish government should introduce new policy tools in favor of fluid milk processors such as providing financial

credit at low interest rate, reducing tax and encouraging investment for both domestic and international firms. Moreover, government and fluid milk processors should stress the importance of consuming processed milk.

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