



Supermarket Shopping and Nutritional Outcomes: A Panel Data Analysis for Urban Kenya

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Summary. — Overweight and obesity are growing health problems in many developing countries. Rising obesity rates are the result of changes in people's diets and lifestyles. Income growth and urbanization are factors that contribute to these changes. Modernizing food retail environments may also play a certain role. For instance, the rapid spread of supermarkets in many developing countries could affect consumer food choices and thus nutritional outcomes. However, concrete evidence about the effects of supermarkets on consumer diets and nutrition is thin. A few existing studies have analyzed related linkages with cross-sectional survey data. We add to this literature by using panel data from households and individuals in urban Kenya. Employing panel regression models with individual fixed effects and controlling for other factors we show that shopping in supermarkets significantly increases body mass index (BMI). We also analyze impact pathways. Shopping in supermarkets contributes to higher consumption of processed and highly processed foods and lower consumption of unprocessed foods. These results confirm that the retail environment affects people's food choices and nutrition. However, the effects depend on the types of foods offered. Rather than thwarting modernization in the retail sector, policies that incentivize the sale of more healthy foods—such as fruits and vegetables—in supermarkets may be more promising to promote desirable nutritional outcomes.

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Key words — dietary choices, overweight, obesity, supermarkets, panel data, Africa

1. INTRODUCTION

Overweight and obesity are growing health problems worldwide. During 1980–2013, the global proportion of overweight or obese adults increased from 29% to 37% in men, and from 30% to 38% in women (Ng *et al.*, 2014). Developing countries are also increasingly affected. The rapid rise in people's body mass index (BMI) strongly contributes to various non-communicable diseases (NCDs), such as diabetes, hypertension, and some forms of cancer (NCD Risk Factor Collaboration, 2016). Obesity and NCDs are associated with morbidity and mortality, lost labor productivity, and high healthcare costs (Bommer *et al.*, 2017; Herman, 2013; IFPRI, 2016; Withrow & Alter, 2011; World Economic Forum, 2011).

Rising rates of obesity are caused by income growth, urbanization, and related changes in people's lifestyles and diets. The “nutrition transition” is particularly characterized by higher consumption of processed foods that are dense in sugar, fat, and salt (Popkin, Adair, & Ng, 2012). Changes in the food retail environment may also play a role. In many developing countries, modern supermarkets are spreading rapidly (Reardon, Timmer, Barrett, & Berdegue, 2003). As supermarkets sometimes offer different types of products than traditional markets and shops, such modernization of the retail sector could possibly contribute to negative nutrition and health outcomes (Hawkes, 2008; Popkin, 2014; Qaim, 2017).

Concrete evidence about the effects of supermarket shopping on people's diets in developing countries is thin. Very few studies analyzed related linkages, with mixed results. Tessier *et al.* (2008) showed that supermarket shopping is associated with improved dietary quality in Tunisia. However, average living standards in Tunisia are higher than

in most other African countries. Moreover, data from a large city, such as Tunis, may not be representative for other regions. Studies with data from Kenya and Guatemala revealed that supermarkets contribute to higher overall energy consumption and a larger share of energy from processed foods (Asfaw, 2008; Kimenju, Rischke, Klasen, & Qaim, 2015; Rischke, Kimenju, Klasen, & Qaim, 2015). The same studies for Kenya and Guatemala also suggested that supermarket shopping increases adult BMI and the likelihood of being overweight or obese. A study with data from Indonesia found no significant association between supermarket shopping and BMI (Umberger, He, Minot, & Toiba, 2015). These existing studies used cross-sectional survey data, partly employing instrumental variable (IV) approaches to draw causal inference. However, finding a valid instrument that is correlated with supermarket shopping but uncorrelated with diets and nutrition is very difficult. Hence, causal inferences based on cross-section observational data remain tentative (Bound, Jaeger, & Baker, 1995).

We contribute to this research direction by using panel data and panel regression models for more robust causal inference. The main aim is to get a better understanding of the effects that the spread of supermarkets in developing countries has on consumers' diets and nutrition. In particular, we use data collected in urban Kenya in 2012 and 2015 to analyze the effects of supermarket shopping on adult BMI and dietary composition. Kenya has one of the most prospering supermar-

* This research was financially support by the German Research Foundation (DFG) as part of the GlobalFood Program (RTG 1666). We thank Ramona Rischke and Simon Kimenju for sharing the first-round survey data collected in Kenya in 2012. We also thank Stephan Klasen, Sebastian Vollmer, and two anonymous reviewers of this journal for valuable comments. Final revision accepted: July 10, 2017.

ket sectors in sub-Saharan Africa (Neven, Odera, Reardon, & Wang, 2009; Rischke *et al.*, 2015). The share of grocery sales through supermarkets is about 10% at national level, but already much higher in large urban centers (Planet Retail, 2016). A rapid growth of supermarkets is also expected in other parts of Africa. Better understanding the nutrition effects of modernizing retail environments can help to design policies aimed at reducing negative health externalities.

2. FOOD ENVIRONMENT AND DIETARY CHOICES

Food choices are determined by various biological, socioeconomic, and psychological factors (Nestle *et al.*, 1998). Food availability, price, type of display, quality, personal income, attitudes, taste, time constraints, and several other factors play a role when people decide on what to eat (Dover & Lambert, 2016; Ventura & Worobey, 2013). Economic development is typically associated with profound changes in people's diets. Income growth, urbanization, technological change, advances in food preservation, and advertising through mass media, all contribute to higher consumption of relatively energy-dense processed foods and beverages. These dietary shifts are often referred to as the "nutrition transition" (Popkin, 2014; Popkin *et al.*, 2012). In most developed countries, this nutrition transition already occurred several decades ago. In many developing countries, it is now happening at a relatively fast pace.

The nutrition transition can contribute to increases in body weight in two ways. First, consuming energy-dense foods will likely lead to higher overall energy intakes. Second, nutrient composition and processing levels play important roles for the human body's energy usage during food digestion and storage. On average, the human body's energy use for food digestion and storage makes up around 15% of total daily energy expenditures (Barr & Wright, 2010). However, this value varies with dietary composition. For instance, the body requires more energy for digesting proteins than for carbohydrates and fats (Westerterp, 2004). Also, the digestion of fresh and whole foods with higher fiber contents requires more energy than the digestion of processed foods (Barr & Wright, 2010). Higher energy intakes and lower body energy expenditures may have positive nutrition effects in situations where people suffer from energy deficiency. However, for people with sufficient energy consumption, the nutrition transition contributes to overweight and obesity (Popkin *et al.*, 2012).

Changing retail environments may possibly speed up the nutrition transition. In developing countries, supermarkets and other modern retail outlets are spreading rapidly, partly crowding out more traditional markets and small shops (Reardon *et al.*, 2003). Supermarkets tend to be larger than traditional outlets, and they usually offer a bigger range of products under one roof. Another major difference is that supermarkets have self-service character, providing greater freedom of choice for customers. Supermarkets respond to changing consumer preferences and lifestyles, offering the types of foods that customers with rising incomes and appeal for modernity demand. However, it is likely that supermarkets do not only react to changing consumer preferences but, in turn, also shape these preferences to some extent. Influence on consumer food choices can occur through locational factors, the range of products offered, the positioning of items in the shelves, packaging sizes, promotional campaigns, and general shopping atmosphere (Battersby & Peyton, 2014; Hawkes, 2008; Timmer, 2009).

Compared to small traditional shops, supermarkets can better exploit economies-of-scale. Hence, certain foods can be

offered at lower prices (Drewnowski, Aggarwal, Hurvitz, Monsivais, & Moudon, 2012; Rischke *et al.*, 2015). This is especially relevant for non-perishable processed food items. In fact, outside of bigger cities, supermarkets in developing countries often concentrate primarily on the sale of processed foods.¹ Cheaper access to processed foods can improve food security and nutrition for very poor population segments (Kimenju & Qaim, 2016; Reardon *et al.*, 2003). However, heavy reliance on processed foods does not necessarily improve dietary quality and can intensify the obesity pandemic. Hence, the spread of supermarkets in developing countries can have both positive and negative nutrition and health effects.

3. MATERIALS AND METHODS

(a) Data

We use data from a survey of households and individuals carried out in two rounds in Central Kenya. The first round was carried out in 2012, the second in 2015. The survey concentrated on small towns (<70 thousand inhabitants), because this is the typical size of towns that supermarket chains currently enter in Kenya. All larger cities in the nation already have one or more supermarkets, whereas in rural areas supermarkets are not yet observed. In 2012, we purposively selected three towns in Central Kenya with differences in the availability of supermarkets.² The three towns are Ol Kalou and Njabini in Nyandarua County, and Mwea in Kirinyaga County. Ol Kalou has had a supermarket since 2002. In Mwea, a supermarket was opened in 2011. Njabini had no supermarket, neither in 2012 nor in 2015. This provides a quasi-experimental setting for the analysis of supermarket impacts on diets and nutrition.³ Except for these differences, the three towns are similar in terms of infrastructure and other economic development indicators (Kenya National Bureau of Statistics, 2010).

Systematic random sampling was used to select households for interview within the urban and peri-urban areas of the three towns. Since recent census data did not exist, we used available population statistics and the help of local administrators. At first, all neighborhoods (residential estates) in each town were listed. Then, household lists were compiled for each neighborhood, from which we randomly selected the required number of households. We selected households from all neighborhoods, in order to avoid clustering and obtain a representative sample at town level.

In each selected household, whenever available one male and one female adult (>18 years) were included in the study for interviews and anthropometric measurements. In 2012, we included 432 randomly selected households and 601 adults. In 2015, we tried to reach the same households and individuals, but were only able to track 219 households and 286 adult individuals of those that were also included in 2012. Unlike in rural areas, where extended families often live in the same place for several generations, in urban areas households are often much smaller and relocate more frequently. Hence, higher attrition rates in urban panels are commonplace. Attrition households were replaced with other randomly selected ones in the same towns and neighborhoods. In total, in 2015 we collected data from 430 households and 598 adult individuals. Thus, the total sample includes 1,199 individual adult observations.

Table 6 in the Appendix compares key variables for individuals that were included in both survey rounds (balanced panel)

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