



Access to variety contributes to dietary diversity in China



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ABSTRACT

In the canonical consumer demand problem, an agent makes a decision about quantities to consume, under the assumption that all varieties can be accessed at zero cost. In reality, the cost of accessing variety may not be zero. In this paper we study the effect of variety access cost on the consumption of food variety and its role in explaining regional differences in dietary diversity in China. We find that a higher cost of access negatively affects the individual's ability to diversify her diet in terms of both the total counts and the balancing of varieties consumed. The primary policy implication of this research is that attempts to create a healthy food environment in China must be differentiated along rural and urban lines. In rural communities where consumers have been limited in their ability to diversify food baskets by high electricity and transportation costs, infrastructure development and modernization may effectively improve nutritional balance. For more urbanized communities where the cost of consuming additional food variety is relatively low, food policies might instead focus on interventions that promote healthy eating to mitigate the burden of over-nutrition.

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Introduction

Like many developing countries, China is experiencing a nutrition transition, in which income growth and urbanization begin to shift diets away from coarse grains and legumes towards greater consumption of sugar, edible oil, and animal protein (Popkin, 2014). This shift raises the possibility that China is, or will soon be facing a double disease burden resulting from both under-nutrition among the poor and over-nutrition among the non-poor. The latter is of special concern given the rapid rise over the past two decades in the rates of those in China who are overweight (Gordon-Larsen et al., 2014). Since increases in overweight prevalence will continue to outpace reductions in underweight prevalence (Dearth-Wesley et al., 2007), the focus of food policy in China must evolve from food security to health-related considerations. As a result, nutrition balance and diet diversity will become more relevant dimensions of healthy diets in China, compared with calorie and nutrition adequacy. It is generally thought that an increase in variety brings about nutritional improvements, a view supported by research (e.g. Kant et al., 1993; Lo et al., 2013), but improvements are not guaranteed. Outcomes depend on the

choices consumers make, which in turn depend on the choices available to them.

Studies of dietary diversity among Chinese consumers are somewhat rare. Exceptions include Kim et al. (2003) who construct a Diet Quality Index-International (DQI-I) to assess diet quality (including variety) but do not account for regional distinctions, and Li et al. (2009) who compare rural–urban DQI-I but focus on differences among families with and without youth. Liu et al. (2012) investigate urban–rural nutritional disparities, but do not include all categories of food and study the status of children only. Moreover, most of these studies share a common interest in the role of particular household socio-economic characteristics such as income, household size, age, sex composition, employment status, education level of the household head, but do not directly explore the idea that the cost of access to variety and the technology-related cost of seeking and accessing additional variety may be determined by the setting in which consumers make choices. Understanding this is important, since variety due to greater access may have different nutritional and policy implications than variety brought about by increases in income or other demand-side factors. This is a key aspect of the debate in high income countries, where some argue that taxes and restrictions on the food environment are required to improve nutrition (Miljkovic et al., 2008; Kuchler et al., 2005) while others emphasize the importance of consumer education (Freeland-Graves and Nitzke, 2002).

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Understanding variety in food consumption is also of economic importance. A diversified diet improves a consumer's welfare both because greater variety increases the likelihood of matching a consumer's preferences with product characteristics and because variety counteracts diminishing returns to quantity (Li, 2013). Furthermore, understanding diversification in food demand can be particularly important to understanding the evolution and structure of food marketing systems (Reardon et al., 2003; Pingali, 2007).

In this study we examine regional differences in dietary diversity in China and offer explanations for these differences. Here diversity is measured by both the total number of varieties consumed and the consumption balance in terms of quantity and food categories.³ It is not our objective to measure the relationship between dietary diversity and nutritional outcomes. Instead, we are interested in the question "What could have possibly contributed to the evolution in dietary diversity among Chinese consumers?" When approaching this question, we place a special emphasis on the cost of accessing variety in urban/rural settings and on what this cost implies for strategic attempts to promote healthy diets among Chinese consumers. Our contribution is primarily empirical. Our results suggest that a higher cost of access, driven by lower availability, higher transaction costs of seeking and obtaining variety, and limited access to improved food storage, adds a marginal cost to the market price of variety and creates friction in the individual's ability to diversify her diet. We also find that this friction is somewhat greater in rural areas, resulting in less diversity. Consuming less variety may or may not imply lower nutrition, but as long as nutritional differences are associated with differences in diversity, an implication of the result is that the same food and nutrition policies may not apply equally to rural and urban China.

Conceptual framework

Traditional modeling of consumer choice, based on strict convexity, implies an inherent preference for variety, as reflected by the indifference contours that are asymptotic to the axes and bowed toward the origin (Lancaster, 1990). It assumes that consumers can access all available varieties at no cost beyond the price of the good. Maximum utility is achieved by adjusting the quantity of each good, rather than the composition of varieties. Despite the popularity of this approach, however, the assumption of costless and infinite variety is at odds with evidence (Bell et al., 1998). Because consuming more variety is constrained by limits on resources (information, time and monetary) and the marginal utility of variety diminishes, the consumer ends up with some but not all varieties.

In an attempt to explain the consumption of variety, Jackson (1984) formally introduced the concept of hierarchical demand. He demonstrates how only a subset of all goods available is actually consumed and how the variety of goods purchased increases with income. In the context of food consumption, a series of country-specific studies confirm Jackson's finding, and further identify which socio-economic characteristics determine preference for dietary diversity in addition to food expenditure (Thiele and Weiss, 2003; Torheim et al., 2004; Thorne-Lyman et al., 2010; Rashid et al., 2011; Bhagowalia et al., 2012; Drescher and Goddard, 2011; Shimokawa, 2013). In a recent paper, Li (2013) carefully derives the optimal choice of variety that equates marginal benefit and marginal cost of consuming variety. He shows

that consumption of variety is positively correlated with expenditure but negatively correlated with variety accessing cost.

A second branch of the literature focuses on why consumers might exhibit a taste for variety. Consumers may seek variety because of intrinsic stimuli, such as a self-generated desire for change, as in McAlister and Pessemier (1982), or because of inherent uncertainty regarding current or future preferences, as in Walsh (1995). On the other hand, extrinsic stimuli such as environmental change, promotion, word-of-mouth and external constraints contribute to patterns in which consumers may be willing to try new things (Howard and Sheth, 1969; McAlister and Pessemier, 1982). The degree of variety-seeking can also be associated with characteristics of goods (Adamowicz and Swait, 2013). Goods that are characterized by less concentrated market share distribution, more frequent replenishment rates and lower unit prices (implying smaller consequences of misjudgments) are more likely to expand the set of available and revealed choices (Adamowicz and Swait, 2013). In addition, how variety is purchased – the "variety cycle" – matters. Those who make fewer trips to satisfy their demand for variety than to complete their quantity demand are less variety-seeking than those who contemplate two demands at the same time (Berne and Mugica, 2010).

Based on these theories, we hypothesize that: (1) wealthier people consume more varieties than their poorer counterparts, other things being equal; (2) consumer characteristics affect preference for variety; (3) high cost of access, caused either by a low degree of modernization or by the household's low productivity, generates friction in a consumer's ability to consume variety. We now turn to an empirical investigation of these conjectures in the context of our sample.

Empirical strategy

Measurement of dietary diversity

There are several ways that dietary variety can be measured. In the nutritional literature, count measures are frequently applied (Kant, 1996), whereby the number of consumed food items and food groups is recorded. Some well-known indices measuring dietary diversity and overall diet quality based on this method are dietary diversity score (DDS) developed by Kant et al. (1993), dietary variety score (DVS) by Drewnowski et al. (1997), Healthy Eating Index (HEI) by Kennedy et al. (1995), Diet Quality Index (DQI) by Patterson et al. (1994), Diet Quality Index (DQI)-Revised by Haines et al. (1999), DQI-China by Stookey et al. (2000), and DQI-International by Kim et al. (2003). These indices, although handy for interpretation, have an important disadvantage: a minor food counts as much as an important component of the individual's diet.

The economic literature, however, tends to measure variety not only by the number of foods but also by their distribution – for a given number of foods, diversity increases as their shares of the diet are more evenly distributed. The most often applied measures are Entropy (E), the Simpson Index (SI) and the Cumulative Share (CS) (Lee and Brown, 1989; Theil and Finke, 1983; Jekanowski and Binkley, 2000). The basic idea behind each of these measurements is that maximum diversity occurs when consumption shares are equally distributed among varieties. Entropy is defined as a function of the consumption share w_i :

$$E = \sum_{i=1}^n w_i \log \left(\frac{1}{w_i} \right), \quad (1)$$

where high diet diversity corresponds to a large index value of E . A maximum of $\log n$ is reached when consumption is evenly distributed across all varieties. SI is computed as one minus the Herfindahl index, a commonly used measure for market concentration:

³ We use standard food categories that are linked to nutrition. In the original diet diary from which our data are derived, each food item is assigned a unique six-digit food code. The first two digits indicate food categories. The four subsequent digits indicate subgroups within the category. Among all twenty-one categories, the first twelve are major foods (cereals, tubers, beans, vegetables, fungi and algae, fruits, nuts, meat, poultry, dairy, egg and seafood). The remainder are minor foods (including desserts, snacks, spices, beverages, sauces and candy).

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