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Food value chain transformations in developing countries: selected hypotheses on nutritional implications

Miguel I. Gómez^a and Katie D. Ricketts^a

Abstract

We examine how the transformation of food value chains (FVCs) influence the triple malnutrition burden (undernourishment, micronutrient deficiencies and over-nutrition) in developing countries. We propose a FVC typology (modern, traditional, modern-to-traditional, and traditional-to-modern) that takes into account the participants, the target market, and the products offered. Next, we propose selected hypotheses on the relationship between each FVC category and elements of the triple malnutrition burden. The primary finding is that the transformation of FVCs creates challenges and opportunities for nutrition in developing countries. For example, Modern FVCs may increase over-nutrition problems and alleviate micronutrient deficiencies for urban people with relatively high incomes. However, they have little nutritional impacts among rural residents and urban poor people, who primarily depend on traditional FVCs to access adequate quantities of calories and micronutrients. In addition, modern food manufacturers are leveraging traditional distribution networks (modern-to-traditional FVCs), substantially increasing access to low-priced processed/packaged foods in rural areas and low-income urban neighbors with mixed impacts on the triple burden of malnutrition. Further research should focus on the influence of FVC transformation on reduction of micronutrient deficiencies, on modeling demand substitution effects across food categories and the attendant policy implications for malnutrition.

Key words: Food value chains, developing countries, triple malnutrition burden, food access.

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1. Introduction

Malnutrition affects millions of individuals worldwide and presents a continuing challenge to government, donors, and individual decision-makers. Pinstrup-Andersen and Watson (2011) characterize malnutrition in developing countries as a triple burden: Undernourishment (insufficient calorie and protein intake), micronutrient malnutrition (hidden hunger), and over nutrition (excess calories leading to overweight and obesity). In 2010, undernourishment and micronutrient malnutrition affected about 0.9 and two billion people respectively in developing countries (FAO 2012; Gómez et al. 2013). By themselves, or in combination with such conditions as diarrhea, respiratory illnesses, and infectious diseases, undernourishment and micronutrient deficiencies may result in growth retardation, impaired cognitive development, and poor school performance in children, low labor productivity, reduced disease resistance, anemia, blindness and even death (Kennedy et al. 2003; WHO/UNICEF 2004). Meanwhile, over-nutrition, reflected in escalating overweight and obesity rates along with higher incidence of chronic diseases like diabetes, continues to expand in developing countries (Popkin 1999 and 1998). The causes of this triple burden are multiple but the availability, variety, and composition of foods that make up peoples' diets play a major role. Healthy diets contain a variety of nutrient dense foods from several food groups and limited amounts of foods and beverages with added fats and sugars (Miller and Welch, 2013).

In this paper, we review the literature and examine how food value chain (FVC) transformations, described below, are influencing the triple burden of malnutrition in developing countries. In addition, we identify areas that require more attention from researchers and decision-makers. FVCs are changing rapidly in developing countries due to several factors. These include population and income growth, urbanization, and the expansion, globally and domestically, of modern food retailing, distribution, and wholesaling firms (FAO 2010; Reardon and Timmer 2007). As a result, today's developing country FVCs exhibit great diversity, as modern sector firms either establish their own food chains or interact with traditional FVC actors, such as smallholder farmers and traders, wet markets, corner stores, and street vendors. We argue that a deeper understanding of the drivers of emerging FVC arrangements, the motivations of actors who participate in them, the products offered, and the markets targeted can provide valuable insights into the policy options for curbing the influence of malnutrition in developing countries.

We first classify FVCs into four categories. These categories differentiate based on participants and their interactions, markets targeted, and types of products offered to end consumers. We label the categories 'modern', 'traditional', 'modern-to-traditional', and 'traditional-to-modern' (we describe them in detail in the next section and in Table 1 below). Second, we develop hypotheses to test how each influences undernourishment, micronutrient deficiencies, and over-nutrition through the physical distribution, pricing, and marketing of food products. To develop these hypotheses, we follow the approach of Hawkes and Ruel (2011) and scrutinize an extensive literature to gather evidence on how each FVC category affects food access in terms of 1) availability (the presence or absence of a variety of food products in a specific location at a specific time) and 2) affordability (whether individuals can afford to buy the foods available). We conclude with a discussion of the empirical evidence and offer suggestions for future academic research on issues of particular relevance for decision-makers concerned with the implications of the transformation of FVCs on malnutrition in developing countries.

2. Conceptual Framework

Food value chains (FVCs) comprise all activities necessary to bring farm products to consumers, including agricultural production, processing, storage, marketing, distribution, and consumption (Gómez et al. 2011). Value chain analysis considers linkages between participating actors (e.g. farmers, manufacturers, retailers, consumers) and examines the flow of foods from farmers to distributors and to retailers (Kaplinsky and Morris 2001; Gereffi et al. 2005; Webber and Labaste 2010; Burch and Lawrence 2007).

Developing country FVCs have experienced a rapid transformation in recent years. Only a few decades ago, most people in developing countries lived in rural areas and worked in agriculture. A large share of food was grown for household consumption and sold in nearby markets (Gómez et al. 2013). Today, in contrast, the share of food reaching consumers through longer FVCs including multiple segments (e.g. processors, wholesalers) has increased dramatically, due to changes in food consumption patterns prompted by rapid urbanization, income growth, and expansion of modern retailers, processors and distributors. Increasingly, an expanding urban population and middle class are utilizing modern supermarkets and are diversifying their diets. The demand for products such as meats, dairy, fruits and vegetables is increasing. In addition, the market for processed/packaged food categories is expanding, including breakfast cereals, confectionaries, ready-to-eat meals, and carbonated sodas, among others (Hawkes and Ruel 2011; Goldman Sachs Group 2007). At the same time, many rural residents depend on FVCs for their food intake because most of them, including the poor, are net-food buyers and are employed in the food sector (Barrett and Dorosh 1996; Byerlee et al. 2006; Seshan and Umali-Deininger 2007; Ivanic and Martin 2008).

2.1 Typology of FVCs and hypotheses

Our conceptual framework to examine the effects of these FVC transformations on nutrition is shown in Table 1. First, we classify developing country FVCs into four categories. For each FVC category, the table describes the primary characteristics and participants, explains the essential mechanisms affecting food access (availability and affordability), and states selected hypotheses regarding the influence on elements of the triple malnutrition burden grounded on existent evidence from empirical research. This sets the stage for examining the links between FVC transformation and nutrition.

In Table 1, we offer a typology that assigns FVCs into four broad categories to reflect the aforementioned transformations. The typology recognizes the existence of a modern sector (e.g. large commercial farms, agribusinesses, multinational food manufacturers, and modern supermarkets), a traditional sector (e.g., smallholder farmers and traders, wet markets, and ‘mom and pop’ stores) and the interaction between modern and traditional actors at different FVC stages. Our proposed FVC categories are:

Table 1. Food value chain typologies and their hypothesized influences on nutrition

Type	Participants	Implications for Food Access	Hypothesized Nutritional Impacts
Traditional	Traditional traders buy primarily from smallholder farmers, and sell to consumers and traders in wet, mostly local, markets.	<p>Affordability: A local ‘clearing-house’ for products, with flexible prices, product volumes, and quality standards.</p> <p>Availability: Food ‘hub’ for consumers and local ‘mom and pop’ stores to access directly from traders and smallholder farmers; market offerings are highly dependent on production seasonality.</p>	<ul style="list-style-type: none"> • Traditional FVCs help reduce micronutrient deficiencies and undernourishment by offering low-priced fruits, vegetables, livestock products, and staples, particularly in rural areas and in poor neighborhoods of urban areas. • Production seasonality, combined with lack of post-harvest and distribution infrastructure, increase FVC intermediation costs and limit the ability of traditional FVCs to reduce micronutrient deficiencies and undernourishment.
Modern	Domestic and multinational food manufacturers procure primarily from commercial farms and sell through modern supermarket outlets.	<p>Affordability: Economies of scale enable the production, marketing, and distribution of packaged/processed foods at low per-unit prices.</p> <p>Availability: Modern supermarkets provide year round, wide product assortment, primarily in urban areas; supermarkets are expanding successfully the market for processed and packaged foods.</p>	<ul style="list-style-type: none"> • Modern FVCs may contribute to alleviate micronutrient deficiencies by offering a wide assortment of products year round; but supermarket’s physical location and quality standards may imply higher retail prices, missing the poor. • Modern FVCs may contribute to obesity/overweight malnutrition by expanding the reach of inexpensive, calorie-dense processed/packaged foods, primarily in urban areas.
Modern-to-traditional	Domestic and multinational food manufacturers sell through the network of traditional traders and retailers (e.g., ‘mom and pop’ stores).	<p>Affordability: Food manufacturers benefit from economies of scale to connect with traditional distributors and retailers, offering low-priced processed foods to reach low income consumers.</p> <p>Availability: By linking with traditional retailers, food manufacturers develop intense distribution strategies in urban areas and in rural, isolated markets.</p>	<ul style="list-style-type: none"> • Expansion of processed/packaged foods into isolated, rural regions may alleviate undernourishment; but it can result in over-nutrition among urban consumers. • Food fortification initiatives focusing on modern-to-traditional FVCs may contribute to reduce micronutrient malnutrition.
Traditional-to-modern	Supermarkets and food manufacturers source food from smallholder farmers and traders.	<p>Affordability: Increased income opportunities in high value crop and livestock production for smallholder farmers and traders can expand food budgets because most are net-food buyers.</p> <p>Availability: Increased production and crop diversification may increase food available for local consumption.</p>	<ul style="list-style-type: none"> • Traditional-to-modern FVCs may reduce micronutrient deficiencies and undernourishment of smallholder farmers through and traders through higher incomes leading to diet diversification. • Opportunities for smallholder farmers and traders to benefit directly from participation appear limited and may miss asset-poor farmers; substantial benefits happen through off-farm employment opportunities.

Source: Developed by authors based on the review of the literature.

1) *Traditional FVCs* - Consumers in these FVCs follow long-lived patterns and most often purchase food directly from smallholder farmers and traders in regional and local wet markets, or from a network of traditional retailers that include independently-owned, ‘mom and pop’ corner stores, street vendors, or roadside stands (Reardon et al. 2010; Reddy et al. 2010; Gorton 2011; Ruben et al. 2007). Wet markets, in turn, can include large, regional markets that function like distribution hubs, or smaller, local, weekly markets with more limited product assortment. Product availability in these FVCs tends to be seasonal. Traditional FVCs are common in small rural markets located relatively close to production regions. Products delivered by traditional FVCs also travel longer distances to reach urban consumers, primarily in lower-income neighborhoods (Ruben et al. 2007).

We explore two hypotheses on the relationship between traditional FVCs and nutrition (see Table 1). First, we posit that traditional FVCs contribute to reduced micronutrient deficiencies by enhancing access to fruits, vegetables, and livestock products in rural areas and in lower income neighborhoods in urban areas; similarly, they reduce undernourishment, primarily in rural, remote markets, by facilitating access to staple foods. Second, lack of post-harvest and distribution infrastructure is hypothesized to limit year-round availability of diverse foods that can enhance diets. Consequently, the nutritional benefits of traditional FVCs may be highly seasonal; and high intermediation costs may, to some extent, offset the ability of FVCs to offer low-prices, particularly for fresh products.

2) *Modern FVCs*- These FVCs are largely driven by the expansion of modern retail enterprise in developing countries, primarily in urban areas. They generally involve domestic and multinational food manufacturers and wholesalers, as well as commercial agribusinesses and farms (Reardon and Timmer 2007; Reardon and Gulati 2008). In general, modern FVC participants coordinate the supply chain through formal, well documented contractual arrangements that feature predetermined product standards, volume requirements, and price levels (Reardon and Barrett 2000). Such tight coordination, together with access to a network of global and domestic suppliers, allows modern FVCs to offer a year round, wide assortment of fresh and processed/packaged food products. These chains also generally benefit from economies of size in the production, marketing, and distribution of shelf-stable packaged/processed foods. Although the market share of modern FVCs the developing world is small, it is expected to grow significantly in the future and it is therefore important to examine their effect on nutrition.

We examine two primary hypotheses on how the expansion of modern FVCs influences nutrition (see Table 1): 1) Modern FVCs provide year round availability of a wide variety of foods, mainly for high and middle income households primarily in urban areas; and 2) Modern FVCs contribute to urban over-nutrition by enhancing the availability of inexpensive, processed/packaged food categories.

3) *Modern-to-traditional FVCs* - These FVCs consists of food manufacturers utilizing traditional wholesale and retail networks to market primarily processed/packaged foods. Two key characteristics of these FVCs are that food manufacturers (domestic and multinationals) benefit from economies of size in production and distribution, and from increased ability to coordinate the downstream supply chain (as opposed to negotiate with often powerful supermarkets). These two characteristics allow modern-to-traditional FVCs to implement intensive year round distribution strategies for processed/packaged foods, targeting lower income consumers in urban areas as well as consumers in smaller, remote markets in rural areas.

We examine two hypotheses for modern-to-traditional FVCs (see Table 1): 1) Modern-to-traditional FVCs give food manufacturers the leverage to extend processed/packaged products into remote rural areas and urban neighborhoods where residents have little or no access to modern supermarkets; and this expansion contributes to reducing undernourishment in rural areas while increasing over-nutrition in urban areas; and 2) Modern-to-traditional FVCs offer opportunities for collaborations among food manufacturers, donors and governments to implement profitable processed/packaged food fortification initiatives that target micronutrient deficiencies.

4) *Traditional-to-modern FVCs*- These chains are characterized by smallholder farmers and traders selling primarily high value crop and livestock products (e.g. meats, dairy, fruits and vegetables) to modern supermarkets and food manufacturers. In these FVCs we are interested primarily in the impact on the nutrition of smallholder farmers and traders, not of end consumers. The impacts come from higher income opportunities, which may involve directly selling products to supermarket supply chains; or indirectly, through off-farm employment in food production and post-harvest activities. This is a critical consideration because, as explained earlier, most smallholder farmers and traders in rural areas are net food buyers (Barrett 2008). Additionally, our review concentrates on smallholder farmer and trader sales to modern supermarkets because developing country FVCs are mostly oriented toward domestic markets (Gómez et al. 2011). Selling to modern FVC actors may imply higher incomes for smallholder farmers and traders, increasing their ability to afford a more diversified diet.

We examine two hypotheses for traditional-to-modern FVCs: 1) Higher incomes derived from traditional-to-modern FVC participation allows smallholder households to reduce undernourishment and increase access to an affordable diverse diet thereby alleviating micronutrient deficiencies; however, 2) most benefits happen indirectly through off-farm employment opportunities in commercial farms and post-harvest businesses.

We argue that the influence of these four FVC categories on the triple burden of malnutrition differ in fundamental ways, given the differences in the food categories offered (e.g., processed/packaged foods, fruits and vegetables), the target markets (e.g., middle income urban consumers, rural poor consumers), the spatial and temporal availability of foods offered, and the prices paid by end consumers in retail outlets. We recognize that classifying developing country FVCs into these four broad categories is far from perfect, because these chains are complex and the boundaries among them are not always clear. However, we think that these categories adequately reflect the transformation experienced by developing country FVCs in recent years and provide an appropriate conceptual framework for systematic examinations of their influence on nutrition.

2.2 Food categories and nutrition

Prior to examining the hypotheses stated in Table 1, it is important to discuss briefly the nutritional properties of different foods, given that each FVC category has advantages for delivering specific products. Foods may be classified into groups based on their nutrient composition. The following food groups are useful for assessing the nutritional quality of diets: fruits and vegetables, livestock products (meats, poultry, fish), dairy products (milk, cheese, yogurt), and staple foods (cereals and root crops). Each food group can be associated with elements of the triple burden.

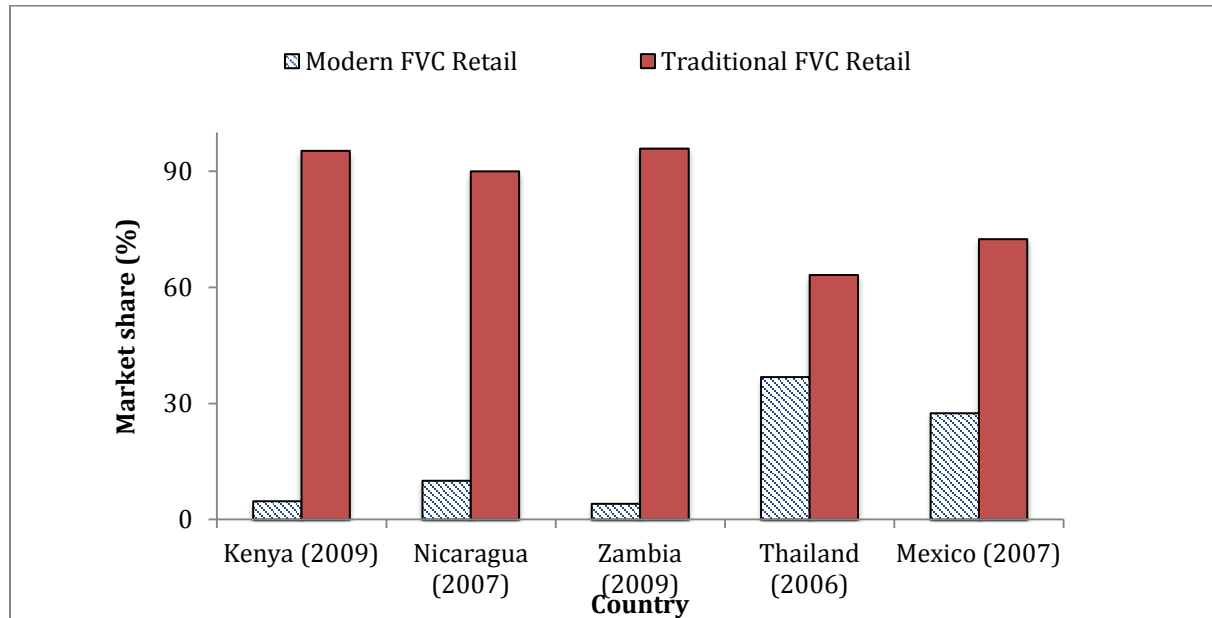
Fruits and vegetables are low in fat, carbohydrate, and protein but are good sources of many essential vitamins, minerals and other bioactive components such as beta-carotene, a precursor of vitamin A. Low intakes are associated with micronutrient deficiencies. Meat, poultry, and fish are good sources of protein, iron, zinc, and vitamin B-12. Dairy products are rich in protein, calcium, and vitamin A. Consumption of animal-source foods by children is associated with improved growth and cognitive development in children (Miller and Welch, 2013). Staple foods are good sources of calories and may contain significant amounts of protein and some micronutrients but tend to be low in vitamin A and bioavailable forms of calcium, iron and zinc. They are completely devoid of vitamin B-12. Monotonous diets composed primarily of staple foods are associated with increased risk for micronutrient malnutrition (Miller and Welch, 2013).

Another approach to classifying foods according to nutritional content is by degree of processing. While most foods that reach the consumer's table have been processed to some extent, the degree of processing can range from simple washing, peeling, and in-home cooking to industrial scale processing that includes extracting and purifying certain components such as sugars and fats, refining grains to remove bran and germ layers and form white flours, and adding fats, sugars, and salt to manufactured foods. These highly processed foods are convenient, highly palatable, and often high in calories. Consumption of some highly processed foods, especially sugar sweetened soft drinks, has been associated with increases in obesity (Shang et al. 2012). At the same time, certain processed/packaged foods are fortified to target specific micronutrient deficiencies (Underwood 1999; Wojcicki and Heynman 2010). Food fortification has been demonstrated repeatedly to be effective in reducing prevalence of micronutrient malnutrition in many countries (Miller and Welch, 2013).

3. Traditional Food Value Chains

Despite the expansion of modern supermarkets, there is strong evidence that food categories that are important sources of micronutrients continue to be accessed primarily through traditional FVCs in developing countries (FAO 2005; Guarin 2011). For example, Figure 1 shows that over 90 percent of all fruits and vegetables are purchased in traditional FVC retail outlets in Kenya, Zambia and Nicaragua. Even in countries with high modern supermarket penetration, like Thailand and Mexico, the traditional FVC outlet share is high, reaching 63.2 and 72.5 percent, respectively.

Figure 1: Fresh fruit and vegetable market share of modern and traditional FVC retail sales



Note: Countries arranged in order of GDP per capita (World Bank, 2008)

Sources: Tschirley et al. (2009), Zambia and Kenya; Reardon et al. (2010), Mexico and Nicaragua; Gorton et al. (2011), Thailand.

Similar to fruits and vegetables, animal source foods are disproportionately accessed by developing country households through traditional FVC retail outlets (Jabbar et al. 2010; FAO 2005). For example, 90 percent of households in Ethiopia (across all income groups) buy their beef through a local butcher in a wet market (Table 2). Further evidence in Kenya (camel milk, meat), Bangladesh (meat, dairy), Vietnam (pork), Ethiopia (beef, raw milk) indicate that traditional FVCs remain the primary access point for fresh meat, especially for low income households (Jabbar et al. 2010). Traditional FVC retail outlets, therefore, are the primary place for lower income consumers to access foods rich in micronutrients, including fruits, vegetables and livestock products.

Table 2. Retail outlet choice for meat purchases in Ethiopia

Retail Outlet	Percent of households within the income group			
	Total sample	Low income	Medium income	High income
Producers residence or local market	1	0	1	1
Butcher in a local wet market	90	60	94	74
Supermarket	14	0	11	54
Special butcher shop	60	73	57	18

Source: Authors' creation based on Jabbar and Admassu (2010).

Traditional FVCs are also important for consumer access by consumers of the staples necessary to meet minimum caloric requirements. In Zambia, for example, traditional FVCs have the largest retail market share of staple sales for high and low income household quintiles (72 and 99 percent, respectively); and in Nairobi, Kenya, 66 percent of staple foods are purchased in traditional FVC retail outlets (Tschirley et al. 2009; Mason and Jayne 2009).

3.1 Factors facilitating food access in traditional FVCs

These large market shares are largely the result of three advantages accruing to traditional FVCs, particularly with respect to perishable products: 1) ability to offer products at low prices, 2) considerable flexibility in product standards, and 3) convenience for consumers due to flexible retail market locations (Guarin 2011; Schipmann and Qaim 2010; Wanyoike et al. 2010; Jabbar and Admassu 2010; Minten 2008).

There is strong evidence that prices of high value foods such as meats, fruits and vegetables, are lower in traditional FVC retail outlets. Schipmann and Qaim (2010), for example found significantly higher prices of vegetables in modern supermarkets in Thailand compared to traditional FVC retail outlets, even after controlling for differences in product characteristics. Mergenthaler et al. (2009) and Lippe et al. (2010) studied food chains in Thailand and Vietnam and showed that low income consumers overwhelmingly prefer to purchase fruits and vegetables in traditional FVC retail outlets because of lower prices.

Traditional FVC retailers typically operate under structures that give them pricing advantages relative to modern supermarkets. For example, Goldman et al. (2002) show that lower labor and overhead costs, as well as higher product turnover rates, result in lower per-unit retailing costs in traditional FVC retail outlets. The same study points out that modern supermarkets must provide additional services (e.g., processing, sorting, re-packing, refrigerating) and control significant physical assets (e.g., buildings and equipment), all suggesting further cost advantages to traditional FVC retailers. These material differences in cost structure allow traditional FVC retailers to develop flexible pricing strategies in rural and urban areas. For instance, evidence from urban markets in Latin America shows that food prices in wet markets located in high income neighborhoods are higher than those in supermarkets; and, the opposite is true in low income neighborhoods in the same city (Dirven and Faiguenbaum 2008).

Second, flexibility in product standards provides additional advantages to traditional FVCs, particularly for perishable products (Lee et al. 2010; Henson and Reardon 2005). Product standards in traditional FVCs tend to be less strict, permitting the marketing of foods that would otherwise be rejected by modern supermarkets. Minten (2008), for example, examined differences in consumers perception of quality and retail prices of meat products in Madagascar and found that meat type and odor are important attributes influencing choices among modern and traditional FVC retail patrons. However other product attributes typically valued by supermarket consumers, including product origin, date of slaughter, fat content, and constant refrigeration, tend to be unimportant for shoppers in traditional FVC retail outlets. The author also shows similar meat products were priced 70 to 95 percent higher in modern supermarkets in comparison to in traditional FVCs retailers.

Jabbar et al. (2010), in a study on livestock food demand in Asia and Africa, found that all consumers are willing to pay a price premium for higher standards of livestock products. However, this willingness to pay is substantially higher among wealthy, urban dwellers who have more ready access to supermarkets. The study also suggests that, although no official standards for meats exist in Ethiopia and Bangladesh, consumers use specific informal criteria and indicators to differentiate quality, including color and odor, among others. These informal standards tend to be less restrictive for low income households, in turn influencing the lower meat prices observed in traditional FVC outlets.

Flexibility in physical location is the third factor explaining the large share of high value, perishable products sold through traditional FVCs. In rural areas, market sizes are often too small to justify investments in modern supermarkets (Gómez et al. 2013; Cadilhon et al. 2006; Reardon et al. 2003). Not surprisingly, the market share of traditional FVCs in these communities is overwhelmingly high in perishable products rich in micronutrients (fruits, vegetables, livestock products) and in staples rich in calories. The circumstances for processed/packaged goods are different, as noted in the modern-to-traditional FVC section below.

In urban areas, the location of retail outlets is an important factor influencing store choice, which provides some advantages to traditional FVCs that target low income consumers (Zameer and Mukherjee 2011; Tschirley et al. 2009). Several studies have found that distance to retail outlet is a critical determinant to food shopping outlet choice in developing country urban areas (e.g., Tschirley et al. 2009; Neven et al. 2005; Jabbar and Admassu 2010). Wanyoike et al. (2010) found that the most frequently cited factor influencing choice of market outlet for camel milk products (a critical source for protein and nutrition in parts of Somali-ethnic Kenya) was proximity to the household. In this regard, traditional FVCs often have a critical advantage as they benefit from a network of retail outlets (e.g., wet markets, street vendors, corner stores) in urban areas. Moreover, Schipmann and Qaim (2011a) found that the majority of supermarkets are located on main streets or highways (85 and 100 percent, respectively), and limited customer access with narrower opening and closing times. In contrast, traditional FVC retailers tend to be located on neighborhoods (88 percent) to facilitate easy access and tend to operate more flexible hours. This observation suggests that traditional FVCs are oriented toward a consumer that lives in close (walking) proximity.

3.2 Post-harvest and distribution infrastructure and production seasonality

In general, the postharvest and distribution infrastructure requirements of perishable foods, including fruits, vegetables and livestock products, are more expensive and technologically advanced than for other food types (e.g. staples, shelf-stable packaged foods). This infrastructure is therefore typically lacking in developing countries and may imply higher price variability and limited year round availability in traditional FVCs (Gómez et al. 2011). Renkow et al. (2004), for example, estimated that lack of distribution infrastructure results in additional marketing costs to smallholder farmers, equivalent to about a 15 percent tax on sales to consumers. Post-harvest losses may also affect food access in traditional FVCs. Kader (2005) estimates developing country food losses in the range of 15 to 50 percent, which tend to disproportionately affect traditional FVCs (Gómez et al. 2011). Although interventions to effectively reduce such losses are known (e.g., small-scale post-harvest storage facilities, improved pre-harvest management, and/or increased food processing opportunities), little is known about the impacts of such initiatives on nutrition (Silva-Barbeau et al. 2005).

There is agreement that seasonality in crop/livestock production affects food retail prices in traditional FVCs (Kumar and Sharma, 2006). For example, seasonality of camel milk production in Kenya, an important source of micronutrients and proteins, implies extremely high prices during the dry season, when supply is limited (Wanyoike et al. 2010). While traditional FVCs typically go through periods of excess and scarcity, modern FVCs tend to offer a wide variety of foods year round, tapping a large network of domestic and international suppliers and stocking processed foods with long shelf lives (Humphrey 2005).

3.3 Synthesis: Traditional FVCs and nutrition

Our review suggests that food products rich in micronutrients, and staple foods rich in calories (which contribute to ameliorating micronutrient deficiency and undernourishment malnutrition, respectively), tend to be more affordable in traditional FVCs. We were unable to find studies that directly measured the nutritional status of consumers dependent primarily on food from traditional FVCs. However, it appears that these marketing channels deliver nutritional benefits to rural residents who are largely missed by modern FVCs. Additionally, important nutritional benefits accrue to low income people in urban areas, where traditional FVC retailers enjoy cost and location advantages. Moreover, our review suggests that, especially with respect to fruit, vegetable, and livestock products, traditional FVCs offer relatively more flexibility to target consumers willing to settle for lower food standards. This is reflected in significant retail price differences between modern and traditional FVCs. However, our review also suggests that lack of access to adequate post-harvest processing and distribution infrastructure may 1) limit the ability of traditional FVCs to contribute to year round availability of micronutrient-rich foods; and 2) result in high intermediation costs that may offset to some extent the cost advantages in retailing. Unfortunately, we know very little about the impacts of interventions to improve traditional FVC performance on food access and malnutrition for the people that purchase the majority of their food from these chains.

4. Modern Food Value Chains

Fueled by population growth, accelerating urbanization, a growing middle class, and rising income, the rapid expansion of modern supermarkets and wholesalers in developing countries has been well documented in the literature (Neven and Reardon 2009; Reardon and Berdegue 2002; Reardon et al. 2003; Ruben et al. 2006; Reardon et al. 2012). Recent research indicates that income growth, rapid urbanization, increased participation of women in the labor force, and trends toward more ‘westernized’ work schedules in developing countries are increasing the demand for food purchasing options offered by modern supermarkets (Hawkes 2008; Pingali 2007; Ma et al. 2006; Schipmann and Qaim 2011a; Delgado et al. 1999; Dixon et al. 2007; Ruel 2003). Time-strapped consumers in growing cities are increasingly demanding convenience in grocery shopping and access to a year round wide assortment of food products.

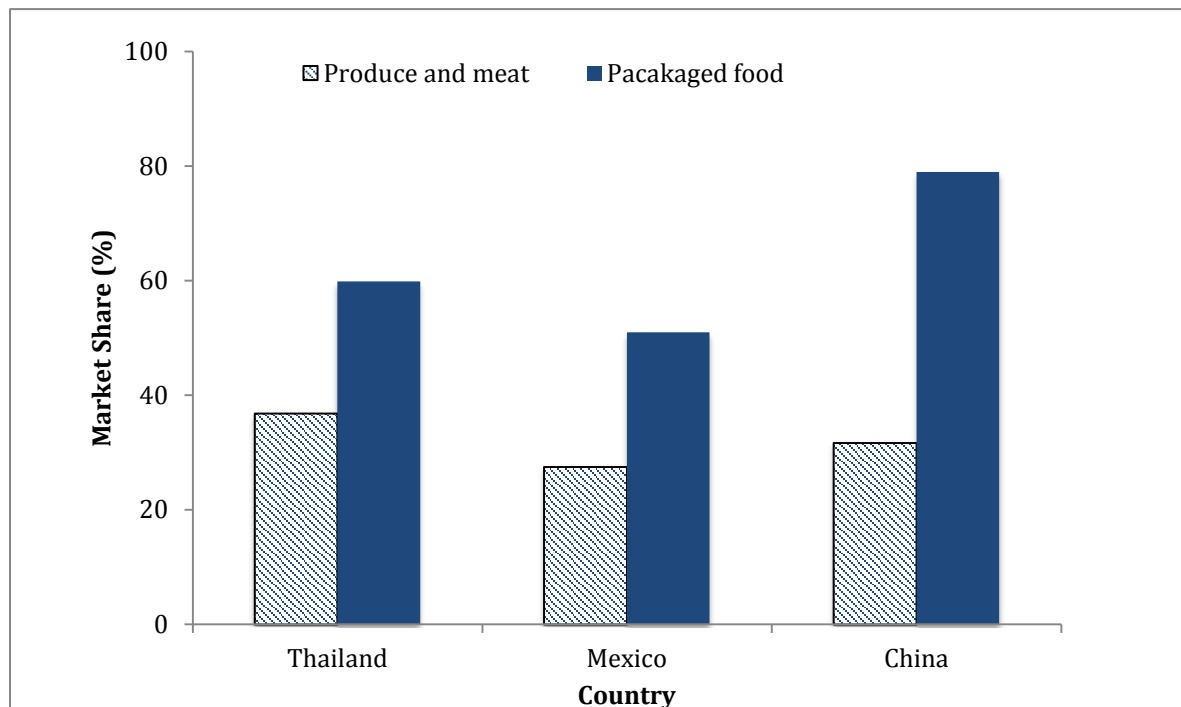
For modern supermarkets, year round procurement of a diverse array of food product categories (e.g., produce, meats, dairy, and packaged/processed) is critical to meet the demands of their increasing consumer base in developing countries (Reardon et al. 2003; Humphrey 2005; Reardon and Gulati 2008). For example, in Thailand, consumers purchasing the majority of their food at supermarkets place a relatively high value on product diversity (Gorton 2011). Supermarkets can meet this need by tapping into their network of domestic and global suppliers. Additionally, the growing interaction among medium/large food processing wholesaling firms, fueled by technological developments (e.g., barcode scanning, electronic point of sales, and efficient customer response), allow modern FVCs to cost-efficiently manage larger inventories, develop more attractive packaging, and offer a variety of products that meet modern supermarket standards (Hawkes 2008; Reardon et al. 2012). Supermarkets also offer a wide range of ready-to-cook and ready-to-eat frozen, preserved, or packaged items which offer convenience to consumers (Burch and Lawrence 2007).

The benefits from increased micronutrient intakes associated with the dietary diversity offered by modern FVCs, however, are unlikely to reach all consumers. In particular, recent evidence suggests that modern FVCs provide mostly to urban, higher income households (Dixon et al. 2007; Randolph et al. 2007). Tschirley et al. (2009) Dixon et al. (2007) found that in Zambia and Kenya, modern supermarkets rely mostly on households on the top 20 percent of income distribution. The diverse product assortment offered in supermarkets is too costly for most households. The available evidence suggests that lower income households buy processed and packaged foods in supermarkets, but not fresh produce, dairy and meats (Cadilhon et al. 2006; Goldman et al. 2002; Guarin 2011). Two primary reasons explain this behavior. First, supermarket product standards for fresh produce and livestock tend to elevate prices for these products, making micronutrient-rich foods available in supermarkets less affordable for the poor (Dolan and Humphrey 2000; Schipmann and Qaim 2011b; Reddy et al. 2010). In contrast, as explained earlier, supermarkets are able to offer processed/packaged foods at attractive prices to low income consumers. Second, contrary to their high income counterparts (which are willing to pay for the convenience of one-stop shopping), the opportunity cost of time for lower income consumers is lower. Therefore, lower income households are more likely to engage in ‘cherry-picking’ food shopping behavior, where consumers enjoy lower prices by searching out small amounts of product on a frequent basis (Tschirley and Hichaambwa 2010; Marsden et al. 2000; Goldman et al. 2002; Cadilhon et al. 2006).

4.1 Modern FVCs and over-nutrition

Modern FVCs have been most successful at increasing their market share of the processed/packaged foods category (Hawkes et al. 2010; Gorton 2011). For example, between 50 and 80 percent of packaged/processed foods are purchased in supermarkets in Thailand, Mexico and China (Figure 2). In contrast, the market share of modern supermarkets in fruits and vegetables is much lower, about 37, 27 and 32 percent in Thailand, Mexico and China, respectively (Gorton 2011; Euromonitor 2012a; Goldman and Vanhonaker 2006). The expansion of processed/packed foods reflects the ability of modern FVCs to set low prices by capitalizing on economies of size in processing and distribution (Hawkes et al. 2010). Even in sub-Saharan Africa, processed/packaged food sales are growing rapidly. In Cameroon, where individuals are largely dependent on traditional ‘mom and pop’ retailers for their food, anticipated annual growth of packaged foods in the next decade is expected be about 6 percent (Euromonitor 2012b).

Figure 2: Modern Food Value Chains retail market share in processed/packaged foods and in fresh foods (fruits, vegetables, meats) in selected countries



Source: Euromonitor (2012a), Gorton et al. (2012), Goldman and Vanhonaker (2006).

A ten-country analysis by Minten and Reardon (2008) examined evidence from ten developing countries and showed that supermarkets initially gain market share in packaged/processed foods and later try to expand market share in perishable high value fruit, vegetable, dairy and meat product categories. Reardon and Timmer (2007) describe this phenomenon as the waves of supermarket diffusion, where supermarkets expand in developing countries in different stages across product categories (processed/packaged foods first), geographies (urban areas first), and socio-economic segments (high income consumers first).

Synthesis: Modern FVCs and nutrition

Modern FVCs are changing the dietary landscape in the developing world. Overall, the evidence suggests that modern FVCs help alleviate micronutrient deficiencies by offering a wide assortment of products year-round for a diverse diet, but often only for urban households with relatively high incomes. Higher retail prices of foods rich in micronutrients (produce, dairy, meats) resulting from stricter product standards may limit the ability of lower income consumers to afford a diet with the adequate micronutrient intake.

Our review also suggests that the expansion of modern FVCs is associated with increases for the market for processed/packaged foods, with at least two implications for nutrition. First, modern FVCs may be contributing to obesity/overweight malnutrition by expanding the reach of inexpensive, calorie-dense processed/packaged foods, primarily in urban areas. There is evidence that dietary changes in developing countries, along with other factors (e.g., change in lifestyles, reduced manual labor), are associated with the emergent global epidemic of obesity, particularly among younger people (Harris and Graff 2012; Garde 2008; Caballero 2007). Although there are no studies showing causality between expansion of processed/packaged food categories and obesity, it is plausible that this is a primary contributing factor driving the increase in the number of overweight and obese people in developing countries. Second, there may be demand substitution effects, such that low priced packaged/processed foods substitute for fresh produce and livestock products. However, the existence of these substitution effects has not been addressed in the literature.

5. Modern-to-Traditional Food Value Chains

The market for processed/packaged foods is growing substantially faster in developing countries than in developed countries. Hawkes et al. (2010) point to a 28.0 and 11.9 percent growth in per capita consumption of processed/packaged foods between 1996 and 2002 in low-middle and low income countries, respectively. These growth rates are substantially higher than the modest 2.5 percent per capita growth of processed/packaged foods in high income countries for the same period. This market expansion has been accompanied by substantial increases in foreign direct investment into developing countries. For instance, capital movements into developing country food industries from the United States alone almost doubled between 2000 and 2006 (Hawkes and Murphy 2010).

Much of the growth in developing countries is being fueled by food manufacturers selling products through traditional FVC retailers in urban and rural areas. For example, in India, small independent grocers called 'kirana' stores are ubiquitous in urban and rural areas and represent over 53 percent of processed/packaged food retail sales in that country in 2010 (Euromonitor

2011a). Similarly in Brazil, small corner stores referred to as ‘mercadinhos’ represented over 21 percent of processed/package food retailing in 2010 (Euromonitor 2011a).

A primary force driving this growth is the interest of food and beverage manufacturers in developing business models targeting the poor, or ‘bottom of the economic pyramid’ (BoP), as a viable, often ignored consumer segment in developing countries (Simanis 2011; Prahalad and Hammond 2002). Premised on the notion that profits can be unleashed through low-margin, high-volume business models, proponents of the BoP approach suggest that the sector represents a large, attractive market for consumer goods, including food and beverages (World Economic Forum 2009; Simanis 2011). Economies of size, which are often present in food manufacturing (Hawkes et al. 2010), have attracted firms to this approach. As a result, food manufacturers are establishing distribution channels that include traditional FVC retailers (street vendors, wet markets and ‘mom and pop’ stores) oriented to low income consumers in urban areas (who are increasingly demanding convenience) as well as smaller markets in remote, rural areas (Pitta et al. 2008; Simanis et al. 2008; Karnani 2007).

5.1 Modern-to-traditional FVCs and caloric intake

Intensive distribution of processed/package foods through traditional FVC retailers in developing countries is likely to influence diets and nutrition in several ways, depending on the location (urban or rural) and income level (high or low) of consumers. We posit that processed/package foods sold through modern-to-traditional FVCs may help alleviate (and prevent) undernourishment in remote rural areas. These products can be made available to consumers year round at stable prices in remote rural areas which often experience high food price variability due to production seasonality and production risk (e.g., adverse weather during the cropping cycle). Moreover, in extreme cases of food shortages, these processed/package foods may become a critical source of calories necessary to meet the near-term minimum intake requirements of consumers.

We note that the low-margin, high-volume business models characteristic of modern-to-traditional FVCs may be harder to transfer to perishable products such as fruits and vegetables. Developing country supply chains for fruits and vegetables tend to be highly fragmented with little possibility to benefit from size economies. In addition, seasonal production patterns together with the perishable nature of these products make it difficult for businesses to ensure a predictable, year round supply, which is critical to a low-margin strategy. Moreover, these products can require energy-intensive distribution infrastructure (e.g., controlled atmosphere and/or cold storage) which is typically lacking in most developing countries.

Contrary to rural remote markets, the influence of modern-to-traditional FVCs’ on urban consumers’ nutrition with relatively low incomes appears to be negative. Similar to the case of modern FVCs, the ongoing market expansion of processed/package foods through modern-to-traditional FVCs may be associated with excess weight and obesity, mirroring long-lived over-nutrition trends in developed countries (Wang et al. 2002; Mendez et al. 2005). Recent food marketing research indicates that shopping convenience, which is one of the advantages of traditional FVC retailers, is the principal factor affecting food choices among urban consumers in developing countries (Deloitte 2012). In Nigeria, for example, corner stores are responding by expanding the assortment of processed/package foods and soft drinks, relative to fresh items (Euromonitor 2012b). As a result, the convenience advantage of ‘mom and pop’ stores and other

traditional FVCs retailers makes them the fastest growing distribution channel for processed/packaged foods in the developing world (Euromonitor 2011b).

The carbonated drinks category growth in Africa illustrates the influence of modern-to-traditional FVCs on diets. Carbonated drinks manufacturers provide substantial marketing support (e.g. signage, free equipment, in-store promotions) to traditional retailers (e.g. ‘duka’ stores in Kenya). The price of carbonated drinks in these retail outlets is affordable due to economies of size in carbonated drink production and distribution with many small stores served by the same truck. As a result, per capita consumption of carbonated drinks in Africa has increased dramatically in the past decade. Wojcicki et al. (2010), for example, found that carbonated drink consumption among children in Africa is on the rise, ranking third in beverage consumption among South Africans aged 12-24 and much higher than micronutrient-rich products such as fluid milk. In Nigeria, the authors estimate that about 16 percent of children between 6 and 18 months of age are given a carbonated drink at least one time per day as a weaning drink; and nearly 45 percent of mothers provide infants with a chocolate beverage (in water) or fruit juice daily.

5.2 Fortification of packaged/processed foods

While expanded sales of processed/packaged foods may lead to over-nutrition in urban areas, fortification of these foods may provide an avenue for alleviating micronutrient deficiencies with modern-to-traditional FVCs. The World Economic Forum (2009) suggests that innovative public-private partnerships can create incentives to develop business models targeting nutrition concerns among the poor. Table 3 shows that these partnerships are being established at three distinct levels: 1) investing in new product development of fortified foods; 2) expanding distribution networks for existing fortified foods; and 3) strengthening consumer demand for micronutrient-rich processed/packaged foods. These private-public partnerships necessarily include the network of traditional FVC retailers and traders because these entities offer the primary point of sales employed by the poor to access food.

Table 3: Types of public-private FVC partnerships that have nutritional goals

Partnership Goal	Value Chain Focus Nutrition Impacts	Examples
Development of new products	Design modify existing food products to address specific micronutrient deficiencies	<ul style="list-style-type: none"> • Iodine Network: working with local processors and developing ‘best practices’ for iodine fortification. • Vitamin-fortified yogurt from Grameen Danone Foods for the Asian market.
Expansion of distribution networks	Make existing micronutrient-fortified products available in remote areas	<ul style="list-style-type: none"> • Coalition in Mozambique (CONFAM) to expand production and distribution of fortified foods. • Scale UP Nutrition Network partners with food manufacturers with strong distribution networks to distribute fortified foods.
Strengthen consumer demand	Expand local and regional preferences for purchasing packaged foods rich in micronutrients.	<ul style="list-style-type: none"> • <i>Future Fortified</i> campaign by the Global Alliance for Improved Nutrition (GAIN) to encourage expectant mothers to consume nutrient packets that have micro and macro nutrients. • Helen Keller International partners with edible oil processors in West Africa to market Vitamin A-fortified cooking oil.

Source: Authors creation based on the World Economic Forum (2009).

The first partnership type focuses on the development of new fortified foods to improve nutrition among the poor. This includes fortification with micronutrients such as iron, zinc, vitamin A, iodine, and other important elements routinely deficient in diets in the developing world. Public-private partnerships create incentives and galvanize funding for research and development in the face of the often weak or non-existent evidence of demand for these products from poor consumers (Siro et al. 2008; Burch and Lawrence 2007). The Iodine Network, for example, is a global network of public and private partners aiming to eradicate iodine deficiency worldwide. Other initiatives include nutritious yogurt fortified with essential micronutrients distributed by Grameen-Ladies at affordable prices to address vitamin A deficiency in Bangladesh and elsewhere in South Asia, where over 8 million children are affected (Singh and West 2004).

The second partnership type focuses on reaching out to consumers located in remote rural areas through the establishment of new distribution networks to enhance the availability of micronutrient-fortified foods. This is perhaps the partnership type where modern-to-traditional FVCs can make the greatest contribution, because modern supermarkets are practically nonexistent in rural areas. For example, in Mozambique, the National Committee for Food Fortification is a government-food industry partnership aiming at expanding distribution of fortified products such as vegetable oil with vitamin A, and wheat flour with zinc, iron, B-complex vitamins, and folic acid (CONFAM 2012). Other initiatives exist through the Global Alliance for Improved Nutrition (GAIN) and the Scale Up Nutrition Movement, which includes participation of the food industry (manufacturers, distributors, and retailers) interested in entering public-private partnerships to enhance the distribution of foods fortified with micronutrients (GAIN 2012).

The third partnership type emphasizes changing consumer preferences and strengthening demand for fortified products. For food manufacturers, this is an important component of the marketing strategy, so that consumers link positive health messages and better nutrition with company branding strategies. An example of public-private collaborations expanding education and distribution of fortified foods include a partnership between GAIN and nutrition/supplement companies like *Herbalife*. Additionally, private voluntary organizations such as Helen Keller International are working closely with industry groups like the Association of Edible Oil Producing Industries, aiming to educate West Africans about the benefits of Vitamin-A (a micronutrient deficiency thought to affect 70 percent of the populace in the Region); that effort centers on fortified cooking oil (Helen Keller International 2012). These promotional and education campaigns include strong in-store support for corner stores, wet markets and other traditional FVC retailers.

All these partnerships are promising in terms of reducing micronutrient deficiencies in developing countries. They are receiving substantial attention from donors and policymakers as a means to reduce micronutrient deficiencies worldwide. Unfortunately the empirical literature does not offer impact estimates, perhaps because most of these initiatives are relatively new.

5.3 Synthesis, modern-to-traditional FVCs and nutrition

Increasing business partnerships between large food manufacturers and traditional retailers is (and will continue) expanding the affordability and availability of processed/packaged foods in developing countries. These products are often rich in calories but poor in important micronutrients. Our review of the literature suggests that modern-to-traditional FVCs may have

mixed influence on nutrition, depending on the population segment targeted. For example, they can assist in efforts to prevent or at least reduce undernourishment in some rural, remote areas; but, they can also create problems associated with over-nutrition in urban areas for patrons of traditional FVC retail outlets. Our review also reveals substantial enthusiasm for public-private partnerships that link food manufacturers to the network of traditional retailers to alleviate micronutrient deficiencies through fortification. It is important to rigorously evaluate the impact of such emerging partnerships on nutrition to guide donor, government and food industry actions.

6. Traditional-to-Modern Food Value Chains

Traditional-to-modern FVCs are characterized by developing country smallholder farmers and traders selling food to the expanding modern supermarket and food manufacturer sectors. We recognize that exports of certain products based on comparative advantage (e.g. coffee, cocoa) provide significant income opportunities for some smallholder farmers. However, in this review, we focus solely on participation in domestic markets because developing country FVCs are primarily domestically oriented, with in-country sales representing about 95 percent of the volume of developing country food production (Gómez et al. 2011). Additionally, we focus here on nutritional implications for smallholder farmers and traders in rural areas only (not for end consumers, which are addressed in the other three FVC categories), given that the great majority of these FVC participants are net food buyers (Barrett 2008).

There is ample empirical evidence that farmers who participate in supermarket supply chains enjoy higher income opportunities (Bellemare 2012; Miyata et al. 2009), even when facing stricter product safety and product standards established by supermarkets (Minten et al. 2009; Berdegue et al. 2005). Nevertheless, Michelson et al. (2012) examine supermarket supply chains in Nicaragua and show that these benefits may only reach farmers with advantageous endowments (access to water and privileged geographic location). Moreover, Neven and Reardon (2009) show that the majority of farmers supplying supermarkets directly are the better educated, who run medium-size commercial operations; they generate employment that benefits poor smallholder farmers via the labor market.

This evidence suggests that traditional-to-modern FVCs may work for relatively better-off farmers, whereas the poorest smallholder farmers and traders may not be able to benefit from participation. Nevertheless, recent research suggests that the poorest farmers and traders may benefit indirectly by linking with modern FVCs (Gómez et al. 2011). Maertens and Swinnen (2009) examine vegetable FVCs in Senegal to demonstrate that poor households benefit from participation through labor markets (i.e. off-farm employment in commercial agriculture and post-harvest processing) instead of product markets (i.e., selling directly to modern supermarkets and to food manufacturers).

The literature shows that increased income opportunities reduce the risk of insufficient caloric intakes in developing country rural areas (e.g., Ndhleve et al. 2012; Smith et al. 2005; Pal 1999; Ruel et al. 1999; Bhuiya et al. 1986; Popkin 1998). These studies focus primarily on undernourishment alleviation, particularly among children in rural areas, highlighting differences between urban and rural areas. In contrast, the literature is silent regarding of the effects of increased income opportunities on diet diversification and the corresponding influence on micronutrient deficiencies among smallholder farmers and traders.

6.1 Synthesis, traditional-modern FVCs and nutrition

Our review suggests a positive correlation between smallholder farmer and trader participation in traditional-to-modern FVCs and reduction in undernourishment. Most of these benefits appear to occur indirectly, particularly for the poorest farmers, in the form of off-farm employment opportunities in commercial farms and post-harvest businesses. Nevertheless, we found no support to the hypothesis that these income-generating opportunities influence diet diversification and micronutrient deficiencies in rural areas.

7. Conclusions

In this review article, we examine the relationship between emerging developing country FVCs and malnutrition. We first developed a typology reflecting the evolving FVCs in developing countries, depending on the participants and their interactions, the markets targeted, and the products sold to end consumers. We label these FVCs as modern, traditional, modern-to-traditional, and traditional-to-modern. Subsequently, we developed a set of hypotheses to explore the relationship between each FVC category and the triple malnutrition burden in developing countries (undernourishment, micronutrient deficiencies, and over-nutrition). We focus on evidence showing how each FVC category influences food access (availability and affordability).

Developing country FVCs are changing rapidly, fueled by the expansion of modern food retailers, wholesalers and manufacturers, which coexist and interact with firms in traditional FVCs. As a result, the structure of FVCs is being shaped in ways that have no precedent in developed countries, where the transition from a traditional to a primarily modern system occurred at a slower pace Reardon et al. (2003). Our FVC typology offers a useful framework to review empirical evidence on how the structure and relationships among participating firms, the types of products and the needs of the consumer segments targeted, influence elements of the triple malnutrition burden.

Our review of the literature shows that it is difficult to make generalizations regarding the influence of emerging value chains on nutrition. For instance, modern FVCs may promote over-nutrition and, at the same time, reduce micronutrient deficiencies among urban emerging middle and high income individuals. However, these effects may be nonexistent for the urban poor and rural residents. Traditional FVCs, for their part, appear to play a key role in facilitating access to foods rich in micronutrients for urban low income people and for the majority of rural people. However, lack of post-harvest and distribution infrastructure may limit the ability of traditional FVCs to assist in micronutrient deficiency reduction year round; and may result in higher intermediation costs that offset the cost advantage of traditional FVC retailers. Given that micronutrient deficiencies is the type of malnutrition that affects more people today, interventions to improve the efficiency of traditional FVCs can be effective in improving access to micronutrients, particularly among urban and rural poor people.

Our analysis of the literature highlights the relevance of interactions between traditional and modern FVC participants, suggesting the need for a more nuanced view of the links between food chains and nutrition. For example, intensive processed/package food distribution strategies by modern manufacturers through traditional retailers (modern-to-traditional FVCs) may contribute to over-nutrition in urban areas, but may prevent or reduce undernourishment in remote rural areas. Moreover, the distribution networks established in these chains may offer

opportunities to form partnerships between firms, governments and donors to use food fortification as a strategy to reduce micronutrient deficiencies targeting the poor. We also considered the nutrition implications for smallholder farmers and traders that connect with modern supermarkets (traditional-to-modern FVCs). Our review suggests that important nutritional benefits occur indirectly, through elevated incomes, and primarily generated by off-farm employment in farm and post-harvest activities.

Our study of the empirical literature reveals two issues that warrant rigorous investigation to further understand the influence of the evolving developing country FVCs on nutrition. First, the literature focuses overwhelmingly on the relationship between FVCs and caloric intake: undernourishment of low income people in urban and rural areas, and over-nutrition of the growing middle and high income people in urban centers. However, we found very little empirical evidence about the links between FVC transformation and micronutrient deficiencies. This is surprising, given that the burden of micronutrient deficiency affects many more people than undernourishment and over-nutrition do in the developing world. Second, we still know very little about demand substitution effects among process/packaged foods, staples, fruits and vegetables, and livestock products, and how consumers respond to changes in relative prices of these product categories. Additionally, there is little empirical evidence illustrating how food purchasing patterns and dietary outcomes change when smallholder farmers and rural participants are linked to higher-value market opportunities. Future research examining individual- or household-level consumption patterns over time can shed light on how the changes in product assortments offered to end consumers affect malnutrition. As developing country FVCs continue evolving in a globalized food system, the need for rigorous research on how they influence diets will grow.

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