Empirical Industrial Organization Economics to Analyze Developing Country Food Value Chains

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Abstract

Food value chains (FVCs) in developing countries are transforming rapidly, with some regions in the modern stage (led by supermarkets and large processors) and other regions in a transition stage (led by midstream small and medium enterprises). With transformation, however, come market-performance issues related to monopoly and monopsony power, vertical bargaining, contracting, and other issues addressed by empirical industrial organization (EIO) researchers. Although the concepts and methods of EIO are evolving rapidly, the two bodies of literature on EIO and FVC transformation as part of the food markets and food industries branches of development economics have not sufficiently cross-pollinated. Applying tools of modern EIO to FVCs in developing countries is now relevant because of the transformation that has occurred and possibly due to the increasing availability of data from surveys of farms, processors, and wholesalers, and for some retailers, from scanner data. We review the transformation trends, the EIO themes and tools relevant to them, and the emerging data sources.

Keywords: development, food value chains, empirical industrial organization, relational contracting, structural modeling

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1. INTRODUCTION

Food value chains (FVCs) in developing countries[1] have rapidly transformed from their initial, traditional stage to a transitional stage, then to a modern stage ([Reardon et al., 2012](#)).[2] As FVCs transform, they tend to experience a host of market-performance issues related to monopoly and monopsony power, asymmetries in bargaining power, adverse contract outcomes, and other issues typically addressed by empirical industrial organization (EIO) researchers. While the concepts and methods of EIO are evolving rapidly, we argue that the literature of FVC transformation typically addressed by development economics subdisciplines focused on trends in markets and food industries in developing regions, and the literature and thus the issues and concepts featured in EIO, have not sufficiently cross-pollinated. In this review, we do not intend to synthesize the development and EIO literatures, but rather to suggest examples of EIO tools and concepts that have the potential to contribute to our understanding of transforming FVCs.

On the one hand, EIO's relevance comes from its applicability to issues such as testing for the presence and impact of market power, understanding the locus of bargaining power, and the importance of asymmetric information in FVCs that plague food markets in developed countries that are emerging as pressing issues in developing countries. This relevance is most patent for countries that have entered the modern stage of FVC transformation, where supermarkets and large processors have become dominant, and are thus encountering situations similar to those of developed countries where EIO tools were largely developed. But, as we note below, EIO is also relevant to countries in the transition stage where there is a proliferation of the numbers and importance of midstream SMEs. The latter have been found to undertake practices that parallel, for example, the resource-provision contracts used by supermarkets toward small farms. This is further discussed in Section 2.

The applications need to be adapted and nuanced, taking into account institutional contexts

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[1]By developing countries, we mean low- and middle-income countries (LMICs); we do not distinguish low-income versus emerging market or middle-income countries.

[2]Some regions (Latin America, East and Southeast Asia, Central and Eastern Europe) are mainly in the modern stage of transformation (led by supermarkets downstream and large processors midstream). Other regions (Africa and South Asia) are mainly in a transition stage (led by proliferating midstream small and medium enterprises (SMEs); see [Reardon et al., 2003;](#) [Bronnenberg & Ellickson, 2015](#); [Reardon, 2015;](#) [Reardon et al., 2021;](#) [Barrett et al., 2022](#)). The characteristics of FVCs in these stages are outlined in Section 2 as context.

that are particularly salient in developing countries, for example, with respect to contracting problems, difficulties in accessing finance, and more limited competition (either due to smaller market size or generally weaker competition authorities, noted in Section 2).

On the other hand, EIO's increasing applicability to developing country FVCs comes from the rise of availability and granularity of survey data in the gamut of segments of developing country food systems, from farms to processors and wholesalers and logistics to retail—data that were lacking just a few decades ago, as we discuss further below. Data sources include surveys of farms, processors, and wholesalers, whereas a variant of modern scanner data is available for logistics and retail firms.

This review is meant to be a selectively illustrated proposal to the FVC/development economics discipline and the EIO discipline to talk to each other, to pay attention to each other's findings and approaches, and to cross-pollinate the two fields in ways that we think will greatly enrich each. To keep to that task within our space limits, our approach is twofold. First, for our treatment of FVCs in developing countries, we forego reviewing that literature in detail, as we believe it has been well reviewed in earlier work, e.g., by Swinnen (2007), Reardon & Timmer (2012), and Barrett et al. (2022). Instead, we lay out stylized facts about the stages of transformation from traditional to transitional to modern in Section 2 and note in general the expected interfaces of both these stages with the EIO literature.

Second, for our treatment of the EIO literature and in pursuit of our goal of tantalizing the reader with ways EIO can be applied to developing country FVCs, we start Section 3 with a broad-brush taxonomy of the 16 main strands or subliteratures of EIO, classified in five categories. The space here is far too small to review those 16 strands. We argue that it is sufficient to lay out an overview of EIO to set the stage for our approach, which is to select four strands (Nash bargaining models, structural estimation of markups from a production perspective, dynamic equilibria, and relational contracting) that reflect our own research interests. We offer these concepts as examples of how EIO methods can inform the substantive issues in developing country FVCs. We use the balance of Section 3 to introduce the main concepts and trends from those selected strands in ways that may help frame and analyze emerging food supply-chain issues in developing economies in both modern and transitional stages of transformation.

To extend our discussion into purely practical considerations, in Section 4 we briefly review some of the data gathering initiatives in retail, retailer-disaggregated consumption, and midstream enterprises that can be of use in EIO applications. We point to ongoing needs in this area. Section 5 offers some concluding remarks on an agenda for further applied EIO research in developing countries.

2. KEY CHARACTERISTICS OF LEAD ACTORS IN MODERN AND TRANSITION STAGE FOOD VALUE CHAINS

In this section we first present an overview of the stages of transition of developing country supply chains from traditional to transitional to modern. We then focus on key traits of main actors in these stages and relations between them and other actors and note how these are relevant to issues, concepts, and tools of EIO that we discuss in Section 3.

2.1. Food Value Chain Transformation Stages

Table 1 depicts the three stages of FVC transformation in developing countries. These stages (and their characteristics) also occurred in the United States, Western Europe, and other currently developed countries, happening over various periods of the past 100 years.

Table 1 Overview of the transformation stages of developing country food value chains (FVCs)

	Traditional	Transitional	Modern
Overall context			
Urban share	Low	Medium/high	High
Share of staples in consumption	High	Medium	Low
Purchased processed food in consumption	Low	High	High
Market administration/parastatals	High	Low/medium	Low
Contract enforcement capacity	Low	Low	Emerging
Share of imports in food consumption	Tiny	Low	Low
Share of exports in food output	Tiny	Low	Low
Structure of FVC			
Length of FVC	Short/local	Long/national	Long/national/international
Concentration	Fragmented (except parastatals)	Fragmented (SMEs)	Consolidated (large processors and supermarkets)
Intermediation	Low intermediation	High intermediation (many links)	Dis-intermediation
Value-added (share of post farmgate (wholesale, processing, logistics,	Low	Medium	High

retail))			
Product cycle	Local niche	Commoditization	Product differentiation
Conduct of FVC			
Contract relations	Low/spot	Informal	Emerging formal contracts
Standards	None	Public standards	Private standards
Technology	Labor intensive	Labor intensive	Capital intensive
Tied credit (labor, output)	High	Low	Low (except with contracts)

Table derived from Reardon et al. (2012) and Reardon and Minten (2021). Abbreviation: SMEs, small and medium enterprises.

First, the traditional stage has a very minor share of most developing countries today, persisting in the poorest countries in the hinterland rural zones. But this stage was dominant 50–70 years ago when the urban population share was small and thus most food supply chains were geographically short. Farmers mainly consumed their own produce or sold to small villages and towns and the few larger cities. Incomes were lower and, per Bennett's Law, consumption was more focused on starchy staples and less diversified into nonstaples such as meat, fish, and fresh produce. Consumption of purchased processed food was very limited. Apart from grain parastatals supplying part of the urban market, the great majority of processors and wholesalers and retailers were micro enterprises facing an overwhelmingly small-scale farm sector (Abbott, 1962).

Second, by contrast, the transitional stage is dominant today in most of Sub-Saharan Africa (SSA), South Asia, and the poorer countries of Southeast Asia and Latin America. Small-scale, traditional retailers with small shops, pushcarts, or hawker operations, or with produce or meat stalls in wet markets, by far dominate the retail segment in the transitional stage; the supermarket sector is still only emerging, with a small share of retail. SME retailers tend to be passive recipients of products and logistics and intermediation services from the midstream SMEs (and some large processors that start to emerge during the transitional stage).

Moreover, in the transitional stage there is a rapid proliferation of SMEs in the midstream segments, i.e., in processing, wholesale, and logistics (Reardon et al., 2021; 2012). Much of this proliferation was driven by rapid urbanization, income increases, and diet change toward nonstaples and processed foods in the 1990s to 2010s (Reardon, 2015) and food market liberalization in the 1990s (Barrett, 1997). Several examples from the 2010s show the dynamism of the development of the midstream SMEs in developing country FVCs. For example, in Nigeria,

there has been rapid growth in the domestic SME wholesale sector supplying maize to feed mills and feed to chicken farmers. There has been a parallel meteoric rise of 3PLS (third-party logistics) SMEs, to the extent that some three-quarters of the total volume of urban maize wholesale is transported by 3PLS. In Ethiopia, there was a tripling of the capacity of teff grain wholesale, 3PLS, and processing sectors via explosive growth of SMEs (Minten et al., 2016). In Bangladesh, there was a similar tripling of aquaculture value chain SMEs including hatcheries, wholesalers, and feed mills (Hernández et al., 2018). In India, there was rapid growth in potato cold storage SMEs in one of the poorest states, Bihar (Minten et al., 2014).

Third, the modern stage is dominant or becoming dominant in much of Southeast Asia, East Asia, and most of Latin America. The modern stage emerged rapidly in the past several decades, evidenced by the spread of supermarkets, large processors, fast food chains, and recently e-commerce. Modern stage food systems in developing countries are converging with developed country food systems in terms of their fundamental characteristics, including retail and processing consolidation, long supply chains, and quality differentiation. Modern FVCs in developing countries in this stage are vertical, dynamic, and increasingly composed of parties that bargain over contract terms that include compliance with private standards (Swinnen & Maertens, 2007; Swinnen et al., 2015).

Table 1 summarizes the transformation trends in terms of the structure and conduct of FVCs. In general, the context trends have been from low-urbanized to highly urbanized food economies, from diets focused on staples and low shares of purchase-processed foods, to diets diversified into nonstaples and processed food, and on average (over countries) from tiny shares of imports in consumption and exports in output, to small shares. Structure has gone from fragmented to consolidated, short to long, intermediated to disintermediated, and with a march along the product cycle from niche to commodity to differentiated products. Conduct has trended from labor to capital-intensive technologies, from nonstandardized to public standards and then to emerging private standards. Formal contractual relations have been all along from slight to emerging, and government control has gone from high to low (Reardon & Minten, 2021).

2.2. Focus on Key Actors Per Stage with a Preview of Issues and Concepts of Empirical Industrial Organization Relevant to Their Behavior

We simplify by focusing on a main actor in each of the modern and transitional stages. In the modern stage, the large retailers are leaders of change in the supply chain, as they are the primary point of contact between consumers and the rest of the supply chain, and along with large processors, have developed and concentrated. In the transitional stage, the midstream SMEs (in wholesale, logistics, and processing) are the leaders of change in the supply chain, as the retailers are still primarily traditional, small scale, and passive in the sense that they do not set standards or other requirements for the rest of the supply chain.

2.2.1. Behavior of modern retailers.

In the modern stage, modern retailers are arguably the main source, or at least a main source, of much of the supply-chain innovation that occurs in either developed or developing economies. That innovation occurs either by them alone, such as the specification of private standards for perishable products quality and safety, or in a symbiotic relationship with large processors to coinnovate differentiated products to retail to consumers (Reardon et al., 2007). For example, supermarket chains such as Carrefour, large dairy processors such as Nestlé, and Tetrapak, a Swedish multinational packaging company, collaborated to create and retail ultrahigh temperature packaged milk in Brazil in the 1990s (Farina, 2002). Whether driven by the entry of foreign modern retailers or by the expansion of domestic modern retailers,[3] the modern retail sector's pace of consolidation and the level of sophistication among modern retailers in many developing countries appear to be converging to something approximating the modern retailing model in the developed world (Reardon et al., 2003; Atkin et al., 2018; Barrett et al., 2022). Although the institutional features of each developing country market differ, sometimes radically, the general framework is often similar: Modern retailers serve as intermediaries between the ultimate source of value (consumers), and a heterogeneous supply sector, usually bimodal with a set of scores or hundreds of large processors (packaged food manufacturers and low-processed food firms such as milling firms) and a set of thousands or millions of SMEs in processing, wholesale, and farming.

The implication of this context is that any empirical model of supply-chain behavior in the

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[3]Barrett et al. (2022) note that much if not most of the modern food retail sector in LMICs is domestic (locally owned): 52%, 64%, and 38% of modern food retail sales in Africa, Asia, and Latin America, respectively, are by locally owned chains.

modern stage in developing countries has to take into account four features toward which modern retail trends as its share goes from minor to dominant.

First, modern retailers interact as oligopoly sellers in primarily domestic markets for processed and semiprocessed food products (Gutman, 2002; Sexton & Xia, 2018). This position has been reinforced over time as the share of traditional retail has waned and concentration has occurred in the modern retail sector. Concentration and oligopoly power have developed in parallel in the large-scale food processing sector, such as in dairy in China (Dai & Wang, 2014).

Second, most modern retail decisions are conditioned by the fact that modern retailers interact with their customers, and suppliers, repeatedly in a dynamic environment in which habit and loyalty dominate, and reputation for quality, consistency, and food safety assume important roles. In developing regions this is particularly the case for processed and semiprocessed products (Hoffmann et al., 2019).

Third, modern retailers interact vertically as oligopsonistic buyers of consumer packaged goods, or often as oligopsonistic or monopsonistic buyers of fresh agricultural products, especially if the latter are quality differentiated. Modern retailers use vertical coordination via private standards and contracts (including resource provision contracts) between retailers and processors, as well as between retailers and processors and farmers (Berdegué et al., 2005; Swinnen & Maertens, 2007; Reardon et al., 2009).

Fourth, consumers rarely buy foods one item at a time, and usually prefer to buy their food from sellers that offer thousands of products at the same time. This observation means that usual, demand-side models may not be well suited to study firm-level problems of market power, market structure, and markups (Sexton & Xia, 2018).

2.2.3. Behavior of midstream small and medium enterprises in the transitional stage.

Midstream SMEs are the primary point of contact between farmers and downstream retailers and consumers, and they are arguably the source of most of the supply-chain innovation that occurs in developing economies in the transitional stage.

The transition stage has been as dynamic as the modern food system revolution. But it is less noticed and researched because perceptions have persisted that the food systems in developing regions, especially in lower-middle- and low-income countries, are dominated by the traditional

stage, interspersed with modern sector enclaves linked to export agriculture. Recent survey research has shown that while retail and the midstream have not yet consolidated into large-scale firms and are still largely dominated by SMEs, there are nevertheless substantial changes afoot in the structure and conduct of these segments.

First, the structure of the midstream SME segments is transforming rapidly. On the one hand, the limited literature on developing country wholesale SMEs has tended to emphasize the generally uncoordinated and fragmented nature of traditional agricultural markets (Fafchamps, 2003; Dillon & Dambro, 2017). The exception noted in the literature has been long-haul trade requiring threshold investments and yielding economies of scale and localized market power, especially in hinterland areas (Barrett, 1997; Minten & Kyle, 1999; Dillon & Dambro, 2017).

On the other hand, recent studies have highlighted the rapid development of spontaneous clusters [not managed by governments or started by large firms or nongovernmental organizations or donor projects] of midstream SMEs in domestic agrifood value chains (Reardon et al., 2021). Prior literature on agrifood clusters appears to have mainly focused on export clusters (such as fruit in Brazil and fish in Chile, e.g., in Pietrobelli & Rabellotti, 2006). But with the rapid development in the past few decades of urban markets in developing countries, spontaneous clusters focused on supplying domestic urban markets have emerged and appear to have become important. Examples in horticultural and animal products and local processed foods are interesting, as they are responding to rapid change in urban diets. For example, large numbers of cold storages and wholesale SMEs have formed clusters near the potato farming areas of Bihar, India (Minten et al., 2014) and in Gansu Province in China (Zhang & Hu, 2011). Hatcheries, input and output wholesalers, 3PLS firms, feed mills, and ice-making SMEs have formed clusters in aquaculture areas of Bangladesh (Hernández et al., 2018). Fish drying and smoking SMEs along with wholesale and 3PLS SMEs have formed clusters in aquaculture and river fishing areas of Kebbi, Nigeria (Gona et al., 2018).

An untested hypothesis is that these clusters enjoy economies of agglomeration, where they use collective fixed and quasi-fixed capital to exploit economies of scale. The clusters tend to be either spontaneous arrangements in non-managed spaces (such as large numbers of grain processing and logistics SMEs near wholesale markets and transport nodes) or spontaneous

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clusters in managed spaces, such as SMEs in wholesale markets. It is possible (but has not been formally tested) that these clusters exercise market power in aggregate, either from internal collusion or merely through more informal means of sharing information and other means of generating aggregate purchasing power. Agglomeration economies from modern retail diffusion have been explored (Holmes, 2011) but this has not yet been applied to clusters of midstream SMEs. This may be a fruitful avenue for the extension of EIO analysis of market power.

Second, the conduct of the midstream SME segments is transforming. The literature has traditionally tended to characterize wholesale and processing SMEs in two ways. On the one hand, in areas close to towns where there is intense local competition and the costs and risks of contracting are high, wholesalers are limited to spot market interactions with farmers (Minten & Kyle, 1999). On the other hand, in hinterland settings where farmers are distant from towns and traders have to incur high search and transaction costs to reach them (Barrett, 1997), traders may have local market power. Traders have long been characterized as engaging in tied output credit arrangements with farmers that exploited farmers with high implicit interest rates on the advances (Bardhan, 1980; Bell, 1988).

However, two sorts of evidence are emerging to challenge the above characterizations. For example, surveys of farmers and traders in Asia and Africa are pointing to the rarity of wholesaler advances to farmers as tied output credit market arrangements. Reardon et al. (2012) show this with farm and trader survey data for potatoes and rice in Bangladesh, China, and India; Adjognon et al. (2017) show this with farm survey data in Malawi, Nigeria, Tanzania, and Uganda; and Liverpool-Tasie et al. (2017) show this with maize trader survey data in Nigeria.

In contrast, most of the development literature's attention to resource provision contracts has been paid to large processors and supermarkets procuring from small farms (Liverpool-Tasie et al., 2020). However, it appears that no sharp dividing line exists between SMEs' repeated informal relations with farmers and large food industry firms' formal contracts with farmers. A recent review of the evidence (Liverpool-Tasie et al., 2020) has shown that midstream SMEs use relational contracts with small farms in ways that are analogous to farmers' contracts with large firms. That is, midstream SMEs appear to often resolve idiosyncratic market failures of small farms with respect to the logistics market (by providing pickup and delivery), the credit market

(by providing advances but especially from input dealers and in selective cases for SME processors and output traders), or the information market (by providing private extension such as for input use), or by lending or renting needed equipment. This suggests the applicability of relational contracting analysis and the relevance of contracting problems discussed in Section 4.

Third, rather than interacting only in spot relations and with undifferentiated products, midstream SMEs appear to form linkages with retailers based on the same traits noted above in relations among large processors, modern retailers, and consumers. Those traits include long-term repeated relations, habits, loyalty, and reputation (including with respect to brands). For a treatment of the development of brands in processed food SMEs, see, for example, the study by Minten et al. (2013) on India.

Although there is emerging descriptive analysis of these characteristics of both modern retailers (reviewed by Barrett et al., 2022; Reardon & Timmer, 2012) and midstream SMEs (reviewed by Reardon et al., 2021), we contend that there is much room to increase the systematic application of EIO concepts and tools to these phenomena. The abovementioned trends in transformation of structure and conduct of the midstream SME segment, and the interesting parallels with modern firms' behavior, suggest that there are exciting opportunities for creative and adaptive applications of EIO to this segment.

3. EMPIRICAL INDUSTRIAL ORGANIZATION AND TRANSFORMING FOOD VALUE CHAINS

We first present a taxonomy of EIO tools and concepts that are usually, with relatively few exceptions, applied in the study of developed-country supply chains. For a subset of the strands of EIO literature, we discuss past studies and potential future directions of analysis to illustrate how the FVC/markets subfield of development economics can fruitfully cross-pollinate with the vast and rich EIO field.

Our consideration of the relevance of modern methods in EIO for supply chains in developing economies is necessarily selective. As in other areas of applied economics, EIO has spawned subfields, and those subfields also have subfields. We provide a taxonomy of many of these subfields in **Table 2**, and examples of the key papers in each case, but caution the reader that the

list of concepts and models in this table is not exhaustive, as there are many important areas that are not included (e.g., auction theory and mechanism design). In **Figure** 1, we show how the tools and concepts listed in **Table 2** refer to the problems we intend for researchers to address. Although a list of ideas and studies such as the one in the table may suggest that models and tools are ends in themselves, we hope readers will use our insights as they are intended: To help solve problems emerging from industry that are experienced by firms in modern and transitional economies. In this section, we provide examples from four of the methods listed in **Table 2** as tools that are likely to be valuable in addressing the big issues in FVCs in developing countries: (*a*) vertical relationships and bargaining, (*b*) dynamic industry equilibria, (*c*) structural models of firm markups, and (*d*) relational contracting.

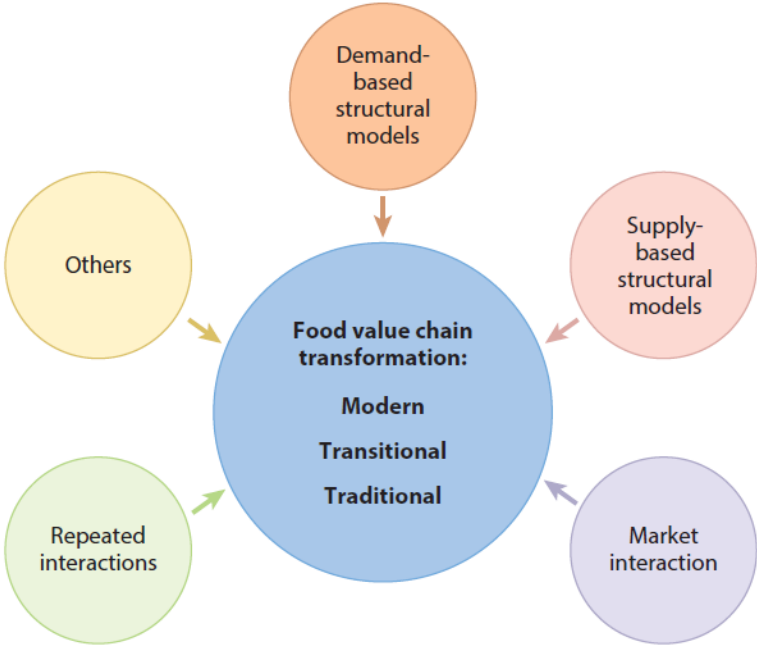Figure 1 Taxonomy of empirical industrial organization models.

Table 2 Taxonomy of empirical industrial organization concept

Concept	Insight	Potential application	Key citation(s)
Demand			
1. Differentiated product pricing	Prices are strategic outcomes of Nash equilibria	How competitive is a product market?	Nevo (2001)
2. Price discrimination	Firms can use quality differences to price discriminate among consumers	How important is quality in developing country fresh food markets?	Verboven (2002)
3. Consumer search theory	Consumers search for lower prices until the marginal benefit of better price equals the cost of searching	How important are search costs in driving price dispersion in fresh produce markets?	de Los Santos et al. (2012)
4. Hedonic pricing models	Price indices should control for product attributes and market competitiveness to be true indices	How do quality improvements affect consumer welfare in emerging markets?	Feenstra (1995)
Supply			
5. Production function estimation	Provides techniques to estimate production functions and productivity	How do productivity dynamics of SMEs look in agricultural value chains?	Olley & Pakes (1996)
6. Production markup estimation	Price markup over marginal cost can be estimated with production (input and output) data	How competitive are SME vendors in transitioning economy?	De Loecker & Warzynski (2012)
7. Endogenous sunk costs	Fixed costs can be endogenous as firms invest to foreclose rival entry	Do large retailers overinvest in developing countries to keep rivals out?	Ellickson (2007)
Market interactions			
8. Strategic entry/location	Geographic or product location is endogenous as firms seek to soften price competition	Do processors differentiate new products in developing markets to raise prices?	Seim (2006), Eizenberg (2014)
9. Nash bargaining	Trade surplus between vertical parties is allocated according to relative bargaining power in axiomatic Nash (1951) framework	What is the allocation of trade surplus between buyer and seller?	Collard-Wexler et al. (2019)
10. Vertical relationships and mergers	Wholesale prices reflect Nash equilibria with suppliers	How can we test for oligopsony pricing in vertical markets?	Villas-Boas (2007), Crawford et al. (2018)
11. Horizontal mergers	Firms that merge can either raise or lower prices	What are the market effects of mergers in food value chains?	Nevo (2000)
12. Dynamic equilibria	Markov perfect equilibria can be very different from static equilibria	When consumer demand or production is state dependent, can imperfectly competitive markets look more competitive?	Bajari et al. (2007)
13. Semi-collusive equilibria	Firms can compete in variables other than price to avoid competition	What is the role of product line proliferation as retail markets become more sophisticated?	Slade (1995)
14. Spatial competition	Local competition is inherently spatial, and estimating competitiveness requires spatial econometric methods.	How do middlemen compete in space for fresh food procurement?	Pinkse et al. (2002)
Repeated interactions			
15. Relational contracting	The future value of the relationship is necessary to deter short-term opportunism	How valuable are relationships are in agricultural chains? Which underlying contracting problem do they solve?	Baker et al. (1994, 2002), Macchiavello & Morjaria (2015)
16. Collusion and cartels	Prisoner's Dilemma is broken if firms follow punishment/trigger strategies	Are seemingly competitive markets in developing countries less so in repeated interaction?	Green & Porter (1984), Igami & Sugaya (2021)

Abbreviation: SMEs, small and medium enterprises.

Most of our review concerns structural modeling or modeling that is grounded in theoretical models of vertical interaction, dynamic equilibrium, or firm-level markups. Although there is a large empirical literature that uses reduced-form or treatment-effect models in perhaps valuable natural experiments or events, our interest in this section is more on uncovering microeconomic mechanisms that underlie firm behavior, rather than analyzing data to establish stylized facts.

3.1. Vertical Relationships and Bargaining

Much of the literature regarding vertical relationships in developing-country supply chains refers to the traditional notions of concentration and market power, with more or less traditional concerns regarding the connection between the two. However, bargaining power may be a more relevant concept in vertical markets. Swinnen & Vandeplas (2010) outline several reasons why concentration, per se, may not be a primary concern in developing country supply chains. They believe that concentration may be associated with greater production efficiency, lower transactions costs, higher levels of research, development, and innovation, and fewer vertical issues that are typically resolved through integrating backward in the supply chain. Perhaps most importantly, they argue that concentration among modern retail buyers may imply greater bargaining power in upstream markets, reducing procurement prices that can be passed on to downstream consumers (Dobson & Waterson, 1997).

More generally, as foreign retailers enter and expand in developing country markets, sometimes competing with domestic banners, store-level differentiation becomes increasingly important (Iacovone et al., 2015; Atkin et al., 2018). Individual modern retailers need to bargain with individual suppliers, whether in packaged or fresh goods, and the allocation of the trade surplus between buyer and seller in an axiomatic Nash bargaining framework is determined by the interplay of bargaining power (exogenous) and bargaining position (endogenous) (Nash, 1951; Muthoo, 1999; Collard-Wexler et al., 2019).

Though bargaining power is generally determined by attributes of the negotiator, bargaining position depends upon the disagreement profit of each party to the negotiation, or the profitability of their position should negotiations break down. Disagreement profit is the value of the next-best

alternative to each player in the event the negotiations fail, so it is endogenous to the items sold by both parties and their prices. For example, in the retailing context of Draganska et al. (2010), if negotiations between Jacobs, a large coffee manufacturer in Germany, and Metro, a major retailer, break down, then the profit earned by each in that relationship is clearly zero. However, Metro can substitute other brands and even its store brand for the lost Jacobs sales, so the disagreement profit is the difference in profit between selling the two brands. The more profitable the next-best alternative is, the stronger is Metro's bargaining position.

Greater disagreement profit implies a more advantageous bargaining position and, all else equal, a greater share of the transaction surplus (modern retail price less production cost). Equilibrium outcomes may differ in fundamental ways if bargaining power is taken into account. For example, Horn & Wolinsky (1988) show that the implications for each party of a vertical merger are very different when bargaining power is taken into account, relative to our expectations using more traditional, market power–based arguments. They find one remarkable result: An upstream monopolist's bargaining power is weaker relative to an independent supplier when two downstream firms sell complementary goods, because a lower price to one downstream firm can benefit the other. That is, when downstream firms sell substitute goods, then monopoly upstream suppliers are more profitable, whereas when downstream firms sell complementary goods, upstream suppliers would rather be separate entities.

There are few examples of monopoly suppliers in the food industry, but the Coca-Cola example of Richards et al. (2018) is instructive. Coca-Cola sells many types of beverages, from soda to water and fruit juices, so it benefits from the substitute nature of these items within the larger beverage category. Not only does Coca-Cola not sell snack foods, a clear complement to soda, its main rival Pepsico operates its Frito-Lay division as a completely separate entity for negotiation purposes. This is just one example of the type of insight provided by formally considering vertical relationships through a dyad-based, bargaining framework instead of the more usual market power–based lens. We believe there are many other issues, specifically in a developing-economy context, where this framework likely applies.[4]

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[4]Indeed, the Nash equilibrium in Nash bargains proposed by Horn & Wolinsky (1988) has become the workhorse model in empirical work on bargaining in bilateral oligopoly (see Collard-Wexler et al. (2019) for microfoundations and a discussion of their study's applications in empirical work).

In an empirical example involving German coffee sales, Draganska et al. (2010) show how axiomatic Nash bargaining models reveal why some modern retailing strategies may evolve as equilibrium outcomes between modern retailers and suppliers. For example, they show that retailer bargaining power rises with the introduction of private label brands, so the evolution of the relative bargaining power between suppliers and retailers partially explains the rise of private labels. By allowing retailer and supplier bargaining power to depend on various attributes of each firm, they find that retailers' private label brand positioning strategies are the clearest determinant of bargaining power and how the parties allocate total transaction surplus. In a developing country context, similar questions regarding vertical relationships between suppliers and retailers arise. Important problems such as the role of modern retailer quality standards on bargaining power (Gereffi & Lee, 2012; Berdegué et al., 2005), how foreign direct investment affects relative margin shares (Dries & Swinnen, 2004), or how contract relationships impact the bargaining power of each party (Meemken & Bellemare, 2020) are all candidates.

This type of model can also be applied to illuminate aspects at other stages of the chain that characterize transitional FVCs, e.g., between farmers and SMEs/processors and between SMEs/processors and exporters. Leone et al. (2022) develop a structural model of a multistage FVC to evaluate common regulations observed in developing countries. The model, estimated using detailed transaction-level data from the Costa Rica coffee chain, consists of three interlocked EIO blocks: (*a*) a discrete choice framework to model atomistic small farmers' sales to horizontally differentiated coffee mills [along the lines of Berry (1994)]; (*b*) mills' discrete entry choices across different local markets [along the lines of Eizenberg (2014)]; and (*c*) a bargaining in bilateral oligopoly model between mills and downstream exporters [along the lines of Collard-Wexler et al. (2019)]. Estimates and a counterfactual analysis reveal the critical role played by vertically integrated FVCs. Holding farm-gate prices constant, farmers' choices reveal substantial value derived from selling to mills owned by downstream buyers. Banning vertical integration, a policy not uncommon in export-oriented agricultural value chains, reduces farmers' welfare, despite the larger scale (and, arguably, greater market power) of these intermediaries.

Regardless of the application, considering vertical relationships in terms of a Nash bargaining framework, instead of as simple market power, has the potential to change how we think of vertical

relationships between growers and modern retailers in developing countries.

3.2. Dynamic Industry Equilibria

Static, competitive models of supply-chain interaction among food manufacturers, processors, farmers, modern retailers, and consumers are insufficient to address some interesting and important questions in agricultural value chains (see **Table 2**). For example, whether small or large retailers dominate a local market, how quality standards evolve in fresh produce markets, or how new products arrive and spread in a market are all dynamic processes that require dynamic models to explain. Our perspective is based on the observation that the rapid evolution of food markets in developing countries is driven to a large degree by the conduct of modern retailers and large processors, especially in FVCs in the modern stage of transformation (Reardon et al., 2003; Bronnenberg & Ellickson, 2015; Barrett et al., 2022).

Modern retail business models are inherently dynamic for a number of reasons. Consumers tend to be loyal to a particular store (Keane, 1997; Richards & Liaukonyte, 2022), they will purchase to inventory (stockpile) when offered items at a discount (Hendel & Nevo, 2006; Ching et al., 2014; Ching & Osborne, 2020), or they simply take time to learn about alternatives when prices change (Ching et al., 2013; 2014). When agents are subject to a dynamic evolution of market demand, interact with rivals as oligopolists, and vertically coordinate with strategic suppliers, then we argue that structural dynamic empirical models may be able to explain some of the evolutionary trends that have previously gone unexplained (Aguirregabiria et al., 2007; Bajari et al., 2007; Beresteanu et al., 2010; Ellickson et al., 2012; Aguirregabiria & Vincentini, 2016; Arcidiacono et al., 2016).

For example, in a US context, Arcidiacono et al. (2016) address the issue of whether Walmart is responsible for the demise of small, local modern retailers, as commonly believed to be the case. Rather, by recognizing that Walmart enters the market with the intent of competing with larger, more sophisticated modern retailers in a dynamic model of modern retail competition, they find instead that traditional supermarkets, like Kroger and Albertsons, are more likely to lose market share than smaller stores. More generally, this type of model can show that while the structure of a modern retail market may be understood through the lens of a static model at one point in time, explaining changes over time requires a model that includes dynamic responses by rivals. These

rivals not only respond strategically but will adopt practices and policies that are more likely to make these decisions profitable.

Modern retailing involves large, irreversible investments in distribution, physical facilities, and establishing a brand presence through advertising and promotion (Ellickson, 2007). In high fixed-cost settings, industry equilibrium must occur where all players' expectations are consistent and reflect the common, underlying dynamics of the industry (Bajari et al., 2007). Bajari et al. (2007) define this Markov perfect equilibrium as one in which a firm's strategy depends only on the state of the system, for example, their own set of loyal customers and the firm's own private shock. A Markov perfect equilibrium is a set of strategies that maximizes the present value of the firm, given the expected evolution of the state of the system, and the choices from all its rivals.

Such Markov perfect equilibria can explain many other phenomena than the Walmart example above and sometimes lead to findings that are counter to conventional thinking. For example, although orthodox theory maintains that switching costs, or the cost a consumer bears from moving from one vendor to another, must be anticompetitive, Cabral (2009), Rhodes (2014), and Arie & Grieco (2014) each present theoretical support for the notion that switching costs can instead reduce prices and lead to more competitive industry outcomes. Cabral (2009) and Rhodes (2014) explain this observation as a possible result of price discrimination—retailers attract switchers through lower prices. Arie & Grieco (2014), in contrast, show that lower prices may result from firms compensating consumers for the fixed costs associated with switching. Regardless of the exact mechanism, it is at least plausible that switching costs may be associated with lower prices in a dynamic equilibrium.

In a food retailing context, for example, Richards & Liaukonyte (2022) estimate Markov perfect pricing strategies for competing retailers that see only their own set of loyal customers and their own store-traffic (or demand shock) each period. They use this equilibrium concept to explain how switching costs, or the cost of changing loyalties from one store to another, can increase the competitiveness of a market rather than decrease competitiveness. Framed in terms of a dynamically competitive market in which retail stores essentially buy consumer loyalty through low prices, a seemingly counterintuitive result becomes very intuitive. In this sense, they provide an empirical test of the theoretical possibility that switching costs can be procompetitive.

There is a growing body of empirical evidence that the procompetitive effect of switching costs is more than a theoretical curiosity. For example, using an empirical Markov perfect equilibrium approach based on the work of Bajari et al. (2007), Dube et al. (2009) show that prices are lower for consumers who are more loyal to certain brands of either margarine or orange juice. Loyalty-induced switching costs, however, are likely to be relatively low for individual brands, compared to the cost of switching among stores, or even between stores under the same ownership group. Regardless, they show that even small switching costs can generate competitive responses.

In a developing-country context, therefore, the implication is that the spread of large-scale modern retailing, and the chain-based loyalty that this typically implies, should not necessarily be feared as a clear threat to consumer welfare, as dynamically competing modern retailers contain their own mechanisms that ensure competition and low prices. Specifically, as retailers become more sophisticated and compete for customers using frequent shopper programs, loss leaders, and everyday low pricing (used by Walmart in the United States), the spread of large retail chains may result in lower consumer prices as stores compete for traffic, not higher prices. More generally, if models of dynamic rivalry explain modern retailer conduct in developing country settings, then our conclusions regarding how industries will look based on static models of consumer behavior are likely to be wrong in important ways.

More generally, strategic motives are more likely to become important as modern retailers increasingly compete in tighter, local oligopoly markets where each firm is likely to prefer competition along any other dimension than price (e.g., assortment, private brands, location, or quality). Competing in these complementary areas of consumer preference is a well-understood means of softening price competition (Beresteanu et al., 2010; Iacovone et al., 2015; Arcidiacono et al., 2016). As modern retailers in developing countries become more sophisticated, they are likely to adopt practices similar to modern retailers in developed countries, with important implications for FVCs. For example, if modern retailers compete on quality, and national brands are essentially undifferentiated across modern retailers, fresh food procurement systems will need to respond accordingly in order to provide quality levels modern retailers seek to provide competitive advantage (Reardon et al., 2003). By competing on quality, consumer prices will rise, generating more surplus that can be passed upstream to growers and shippers.

Careful, structural consideration of the dynamic nature of modern retailer behavior may also help explain other outcomes in vertical (procurement) markets. Procurement decisions are likely to be part of the same dynamic, strategic decision to secure supplies in the upstream market and coordinate fresh food supplies among key members in the value chain (Reardon & Timmer, 2012; Bronnenberg & Ellickson, 2015; Lagakos, 2016; Barrett et al. 2022). That is, competition on quality in downstream markets is likely to force competition for high-quality fresh products in upstream markets, and modern retail buyers will have incentives to foreclose others from these markets in settings where contracting entails negotiation frictions and where contracts are relatively long term and involve substantial relationship-specific sunk costs. Outcomes like this are easily explained as Markov perfect equilibria among oligopsonistic buyers, but not as easily in a static, competitive environment.

Two outcomes are possible. First, foreclosure may lead to higher market prices downstream and lower prices upstream if the modern retailer is able to exclude others from the market. Alternatively, a similar procompetitive effect may arise to what we described above: Modern retailers may compete for the available pool of rents in the upstream market and raise grower prices accordingly. Others frame similar considerations in terms of static models of supply-chain interaction in which procurement contracts must be incentive compatible and meet suppliers' participation constraints (Swinnen & Vandeplas, 2010; Sexton, 2013; Adjemian et al., 2016). In this case, even highly concentrated industries can produce upstream prices that show no evidence that buyers exercise potential market power, nor downstream prices that show downstream monopoly power. In general, when supplying modern retailers involves high fixed costs (Sexton, 2013) or involves imperfect factor markets and contracts are unenforceable (Swinnen & Vandeplas, 2010), buyers have no incentive to force suppliers out of the market, so a near-competitive result ensues.

We argue that this finding may also be an example of a Markov perfect equilibrium between modern retail buyers downstream and suppliers upstream. In a dynamic model in which oligopsonistic retail buyers have market power, sellers incur high fixed costs, and customers are loyal to specific stores, retailers will compete over the potential pool of rents by paying relatively high upstream prices, duplicating the findings of Sexton (2013) and others. These conditions can

come close to matching the quality of traditional wet markets ([Reardon et al., 2003](); [Barrett et al., 2022]()). In realistic developing-country settings, therefore, market power in the traditional sense may not be as meaningful as once thought.

3.3. Structural Estimation of Firm Markups

Studying modern food retailing, and FVCs more generally, through the lens of EIO is inherently difficult due to dimensionality issues that are intrinsic to modern retailing. That is, modern retailers are, somewhat by definition, multiproduct sellers in which each product is potentially related in demand to all others. Researchers traditionally avoid this issue by estimating either single-category demand models ([Villas-Boas, 2007]()) or hierarchical models of store choice that do not capture the demand for most products in the store ([Bell & Lattin, 1998](); [Briesch et al., 2009](); [Thomassen et al., 2017](); [Richards & Hamilton, 2018]()). However, recent developments in estimating firm-level markups provide an alternative way of testing for the competitiveness of stores that sell thousands of products.

Indeed, if the goal is to estimate firm-level markups, then starting from a highly disaggregate set of products is not necessarily the most efficient way to begin and is a very restrictive one. [De Loecker (2011)](), [De Loecker & Warzynski (2012)](), [Traina (2018)](), and many others approach the problem of markup estimation instead from the production side, applying the insight of [Hall (1988)]() that markups can be estimated from a simple condition on the output elasticity of a variable input and input-expenditure shares of that input. While most applications are in trade ([De Loecker, 2007]()) and macroeconomic markup estimation ([De Loecker et al., 2020](); [Traina, 2018]()), this approach is also useful in uncovering markup patterns among food modern retailers. Inevitably, questions of firm-level market power will rise to prominence in developing countries, just as they have in developed countries, whether downstream or upstream ([Sexton, 2013](); [Swinnen & Vandeplas, 2010]()). For example, [Atkin et al. (2018)]() consider the case of Walmart's arrival in Mexico and use a rich data set of local prices and incomes to examine the net effect on consumer welfare. Although there is a potential for Walmart to foreclose the local competition, the net effect is unambiguously positive, as lower prices appear to dominate any anticompetitive effects. More generally, an efficient method of estimating markups and market power in both channels will be very useful once adequate firm-level production data become available.

Econometrically, estimating markups from a production perspective exploits recent advances in the empirical production-economics literature that avoids the usual endogeneity problems associated with estimating input-based production functions (Olley & Pakes, 1996; Levinsohn & Petrin, 2003; Wooldridge, 2009; Ackerberg et al., 2015). For example, Rubens (2021) provides an application of state-of-the-art empirical industrial organization techniques to study the impact of lower competition between processing plants on markdowns and farmers' welfare in the Chinese tobacco industry.

Several applications to modern retailing provide some context on how this approach may be used. For example, Lowrey et al. (2022) examine whether retailers' donations to food banks serve as a quality-based price-discrimination mechanism, thereby allowing the retailer's parent firm to earn more profit. By removing perishable food that is near its expiry date, retailers are able to increase the average quality of food on the shelf, improve their reputation for quality among consumers, and charge higher prices. Because each sample retailer sells thousands of perishable items, a product-level approach is neither tractable nor informative. Instead, they use store-level attribute data, including sales revenue, number of employees, square footage, and other variables provided by the Nielsen company (called TDLinx; https://nielseniq.com/global/en/solutions/tdlinx/) to test their price discrimination hypothesis. They find strong support among donating retailers and conclude that food bank donations allow retailers to price discriminate among consumers with a strong preference for quality and those that are more price sensitive. While promising, however, this approach is not likely to be able to examine the welfare implications of broader changes in supply-chain relationships, such as contracting.[5]

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[5]In many contexts, however, it is important to estimate markups at a more disaggregated level than the firm. For example, multiproduct firms might respond differentially across product lines in response to changes in market conditions. Empirically, this poses a challenge to the approach because the allocation of variable inputs to specific output is typically not observed in the data (see De Loecker et al. 2016 for a discussion and an approach). Cajal-Grossi et al. (2022) provide a rare example in which utilization of a variable input is observed for different output shipments.

3.4. Relational Contracting

Food supply chains are plagued by contracting problems. For example, the typical transaction between a small farmer and a buyer is informal and its scale is small relative to the costs of using any kind of formal contract enforcement. Similarly, traders and intermediaries often sell downstream to larger buyers. Although contracting problems are ubiquitous, they might be particularly pronounced in developing countries due to, e.g., poorer contract enforcement and lower trust, lack of formalization, and the greater need for interlinked transactions to obviate poorly functioning markets such as credit and insurance.

As a result of contracting imperfections, and as already noted above, the governance of transactions along FVCs often departs from the standard, perfectly competitive market. Relational contracting (and various forms of quasi-vertical integration) become a key governance form, as illustrated in **Figure 1**. Standard EIO tools might then need to be extended or adapted to take into account problems in contract enforcement and the resulting widespread use of relational contracting.

Relational contracting is likely a pervasive governance form across all three transformation stages (see **Table 1**), albeit with rather different characteristics and roles. Many important aspects (such as reliable delivery, stable demand, quality standards, etc.) are often difficult to contract upon, regardless of the stage. Furthermore, as the chain consolidates and legal enforcement becomes available, the characteristics of what needs to be contracted upon evolves, e.g., different forms of standards emerge throughout the transformation trajectory. In the traditional stage markets are fragmented, firms and transactions are small, trade mostly occurs on a spot basis and, almost by definition, very limited formal contract enforcement is available. Informal relationships might thus be the only way to support the exchange of very basic services, e.g., trade credit, along those chains. In the transitional stage, even though SMEs proliferate and informal relationships

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This allows one to uncover substantial heterogeneity in markups across buyers within seller-product-time combinations. In principle, multiproduct retail stores provide an ideal canvas to apply the methodology as data on physical units and unit prices of both sales and wholesale sourcing become available.

become more stable, the size and type of transactions rarely justify the use of formal enforcement. Finally, in the modern stage, formal contracting emerges but forms of relational adaptation in the shadow of the formal contract remain an important governance form.

Regardless of their shape and functions, relational contracts are thus likely to be an important governance form across the three stages of transformation. In this perspective, several new questions emerge (see **Table 2**): What is the value of relational contracts and their source; i.e., which market failure or contracting problem is the relational contract alleviating? And do relationships hinder competition, including in contexts in which the presence of many small players might give the impression of a highly competitive market structure?

We now briefly review an emerging body of empirical work on relational contracting, confining ourselves to a few selected contributions most directly connected to the theme of this review. Despite the existence of a vast body of theoretical work, rigorous empirical testing of relational contract theory is still in its infancy and the literature is quite fragmented. Michler & Wu (2020) provide an excellent review of the nascent empirical literature, with a particular emphasis on themes and applications directly relevant to agricultural economists. Macchiavello (2022) offers a complementary review emphasizing methodological issues and implications for developing countries. We suggest that interested readers read these reviews.[6] We first introduce an empirical framework to study relational contracting and then explore how relational contracting interacts with market structure. We cover examples from a wide range of methodologies (from experimental approaches to structural estimation). Explicitly integrating relational contracting into structural models in the EIO tradition is a promising area for work.

3.4.1. Relational contracting: an empirical framework.

Consider a simple, infinitely repeated prisoner dilemma played between two symmetric players. Let δ be the per period discount factor and C, D, and P the stage payoffs from cooperation, unilateral defection, and mutual defection, respectively. In a trigger-strategy subgame perfect equilibrium, a player cooperates if

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[6]Relatedly, Otsuka et al. (2016) and Bellemare & Bloem (2018) review the evidence on contract farming.

$$C + \frac{\delta}{1-\delta} C \geq D + \frac{\delta}{1-\delta} P,$$

which can be rearranged into the dynamic incentive compatibility constraint (henceforth DICC)

$$\frac{\delta}{1-\delta}(C - P) \equiv V \geq D - C \frac{\delta}{1-\delta} P.$$

The left-hand side of this inequality, defined by V, is the value of the relationship: the net present value of the difference in payoffs along the equilibrium path in which the player cooperates and the (typically off-equilibrium) path following a defection. The right-hand side is the temptation to deviate: the difference in current payoffs from defection relative to cooperation.

Although theoretical models differ in many aspects (e.g., equilibrium concepts, information, and payoff structures), a version of the DICC underpins essentially all of the theoretical work. Besides standard challenges in the empirical study of contractual forms (see Chiappori & Salanié 2003), the DICC highlights two additional challenges. First, relational contracts are meant to be informal and rooted in the parties' specific circumstances. Data are thus hard to come by. Second, data will typically reveal on-the-equilibrium path behavior (i.e., C) but not off-the-equilibrium path behavior (P and D). That is a highly incomplete window onto the relationship.

Macchiavello & Morjaria (2015) provide one of the first empirical analyses of informal relationships that explicitly takes into account the structure of the DICC. The key insight is that knowledge of the temptation to deviate, D, can be very informative about the value and nature of informal arrangements. The context is exports of roses from Kenya. Due to both the perishable nature of roses and standard difficulties in enforcing contracts across borders, direct supply relationships coexist alongside a market that sets reference prices—the Dutch auctions. Prices at the auction offer a handle onto the temptation to deviate, D: If the seller delivers a rose at a certain price p to the buyer instead of selling it at the auctions for a higher price p^*, it must be that the value of the relationship with the buyer is sufficiently large to compensate for the price difference. Knowledge of the temptation to deviate D thus provides a lower bound to the value of the relationship V for the seller. Under certain conditions, DICCs can be aggregated across parties. The study develops a structural test for whether the DICC is binding, in which case the lower bound is tight and the overall value of the relationship can be directly computed from the data.

Macchiavello & Morjaria (2015) find that the constraint is binding. This implies that the amount traded in the relationships is constrained by a lack of enforcement. Furthermore, they find that the value of the typical relationship is large. This implies that many valuable transactions in the market do not take place because they do not generate sufficient rents to overcome temptations to deviate.

Contractual defaults are typically not directly observed in the data. Using the rose example: If a seller does not deliver roses to a regular buyer, is it a default or is it that parties agreed to cancel the order? And, if it is a default, was it caused by force majeure, or was it strategic, in the sense that the seller deliberately decided to default even when contractual performance was feasible? Empirically distinguishing these scenarios is potentially important but challenging. Rewards from such a test potentially include quantifying departures from the theoretical implication that parties stick to on-the-equilibrium path behavior, ability to design better risk assessment tools, and a more nuanced understanding of welfare implications. The main challenges are that defaults are rarely observed in the data and, when they are, their underlying motives are difficult to tease out. Blouin & Macchiavello (2019) build on the DICC empirical framework to test for, and quantitatively assess the importance of, strategic default. The intuition builds upon a key insight in the theoretical literature on contracts: Strategic default occurs when market conditions change sufficiently to place a business relationship outside its self-enforcing range (see Klein, 1996; Hart,2009). This suggests that large, unanticipated shocks to market conditions can be used to test for strategic default.

The context is forward sales contracts in the international coffee market, in which exporters promise to deliver certain volumes of coffee several months in advance. In these arrangements, parties face a trade-off between price risk and counterparty risk. Parties could fix the price in advance: This provides price stability, but should market conditions change between the signing and the delivery date, either party on the deal would potentially gain from a default. Parties could instead sign a price-indexed contract in which the final price tracks market conditions. Blouin & Macchiavello (2019) construct a contract-specific measure of price surprise and show that positive price surprises are associated with a higher likelihood of default. Their estimates reveal that around half of the observed defaults in the data are strategic. A structural exercise based on the DICC

suggests that the possibility of strategic default imposes large costs on weaker business relationships and causes sizeable distortions in the market.[7]

Taking the DICC to the data provides a powerful lens to identify the nature of, and quantify the distortions associated with, contracting failures in specific contexts. Although the exact implementation ought to be rooted in the context under study, a few general lessons emerge: (*a*) measuring, or at least proxying for, temptations to deviate is crucial, (*b*) information on defaults and parties' expectations is also important, and (*c*) different types of shocks are useful to uncover different properties of the relationships.

The two papers reviewed above exploit administrative records of transactions between large, formal, firms. These data are becoming increasingly common, and we anticipate a flourishing literature. Empirical tests based on the DICC, however, can be applied borrowing from different methodological approaches. Observational studies that rely on administrative data have the advantage of drawing lessons from transactions that occur despite underlying contracting problems. They are less suitable to understand transactions that do not happen due to contracting problems. Yet knowing about such marginal transactions can be important to understand the likely impact of policies that could remove or attenuate contracting problems. This is an area in which randomized controlled trials (RCTs) can be particularly powerful.

For example, RCTs could evaluate the impact of subsidies that expand the set of existing trades.[8] Bubb et al. (2016) provide a vivid illustration of the approach by experimentally testing for limited enforcement in water transactions between neighboring farmers in rural India. The researchers subsidize water transactions between neighbors, randomly varying the identity of the party that received the subsidy. In the absence of contracting problems, parties should be able to bargain over the surplus generated by the subsidy and the identity of the receiving party should not matter for whether or not the transaction takes place. In contrast, the authors find that subsidizing the seller leads to much more trade than subsidizing the buyer. Lack of contract enforcement causes significant output losses, despite the fact that neighboring farmers have plenty

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[7]Macchiavello & Miquel-Florensa (2018) apply the same test in the Costa Rica coffee market and argue that the possibility of strategic default is a driver of vertical integration because long-term relationships are constrained in the amounts of coffee, they can trade forward without risking a strategic default.

[8]A further advantage is that the field surveys can be used to directly elicit expectations and contractual defaults.

of opportunities to interact repeatedly and assuage, if not totally overcome, contracting problems.

Casaburi & Macchiavello (2019) provide another example in the context of Kenya dairy farmers. Through a set of experimental designs conducted in partnership with a local dairy cooperative, they document that, owing to saving constraints, farmers have a significant demand for deferred, lumpy payments. Deferred lumpy payments require that farmers trust that buyers will not default on deferred promised payments for past deliveries. Through lab-in-the-field experiments, the study establishes that small, itinerant traders indeed lack the credibility to offer such delayed payments. As a result, farmers are paid significantly lower prices from the only buyer who can credibly offer the deferred payments (the local cooperative). The study implicitly illustrates how limited contract enforcement might create an entry barrier in the deferred payment market.

Credible buyers are also needed to provide farmers incentives to undertake costly investments for quality upgrading. This might create barriers to entry and uncompetitive market structures in the intermediation of quality products, thus limiting pass-through of quality premia to farmers and quality upgrading in the first place. Macchiavello & Miquel-Florensa (2018) study this issue in the Colombia coffee chain. The study estimates a dynamic discrete choice model of farmers' upgrading decisions to underpin a calibration of the underlying DICCs between the foreign buyers and the exporter and between the exporter and the farmers. This allows them to perform counterfactuals on whether alternative contracting scenarios would be sufficiently credible to induce quality upgrading.

Deploying structural techniques to estimate contracting problems, and integrating them into analysis typical in EIO, are promising areas for future work. The literature provides a few examples, e.g., Ryan's (2020) analysis of contract renegotiation in procurement auctions, Galenianos & Gavazza's (2017) empirical model of a market with moral hazard and search problems that borrows from the structural literature in labor economics, and Igami & Sugaya's (2021) application of DICCs to the empirical study of a cartel. Much remains to be done at the intersection of (relational) contracting and EIO.

3.4.2. Relational contracting and market structure.

The small size of many markets and high transport costs in developing countries tend to create relatively uncompetitive market structures that allow persistent large price gaps across space and seasons (Burke et al., 2019). Understanding imperfect competition among intermediaries is thus an important area for research. For example, Bergquist & Dinerstein (2020) implement theory-driven RCTs in Kenya maize markets. The experimental designs build on recent advances in the theory on cost pass-through and welfare (see, e.g., Weyl & Fabinger, 2013; Atkin & Donaldson, 2015). The authors interpret the experimental results through the lens of a structural model and thus provide an example of how different methodologies can be combined.[9] The evidence rules out Cournot competition but cannot rule out a cartel that is able to replicate the monopoly outcome. The results offer the best evidence to date on uncompetitive market structures, likely supported by (informal) collusive arrangements between traders. Policies that improve competition in these markets would yield sizable welfare gains.

In the maize markets studied by Bergquist & Dinerstein (2020), transactions are conducted in cash and thus contracting problems play no significant role. In other contexts, however, contracting problems are more salient. In another experimental study of the cocoa supply chain in Sierra Leone, Casaburi & Reed (2020) offer an experimental subsidy to traders per unit of cocoa purchased from farmers. They find relatively small pass-through in terms of price but larger pass-through on credit offered to farmers. In the presence of interlinked transactions, limited pass-through rates might hide other margins through which intermediaries compete. This aspect is formally developed by Emran et al. (2020). The authors develop a model of price pass-through in an imperfectly competitive supply chain in which intermediaries also provide trade credit. They show that credit rationing reverses standard predictions on pass-through rates. They test the model exploiting a ban on intermediaries in the Bangladesh's edible oils supply chain and, through a

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[9]The first experiment provides a month-long subsidy per kilogram sold to all traders in randomly selected markets. This treatment is intended to mimic an exogenous reduction in traders' marginal costs. A second experiment identifies the (curvature of) the demand. Information on the pass-through rate and the curvature of demand can be leveraged to estimate a model of competition that nests Cournot and monopoly (i.e., joint profit maximization) as special cases. The approach rests on the literature identifying deviations from perfect competition from pass-through rates (see, e.g., Goldberg, 1995; Goldberg & Knetter, 1999) and the one testing between different models of conduct (see, e.g., Nevo, 2001).

difference-in-difference methodology, find that the ban raised consumer prices. The study illustrates how market structure and limited contract enforcement considerations interact in subtle ways.

Macchiavello & Morjaria (2021) offer another illustration in the context of washing mills (processors) in the Rwanda coffee chain. Owing to imperfect input and financial markets, a mill's efficiency requires well-functioning relationships with farmers in which the sale of coffee cherries at harvest is bundled together with the exchange of services before, during, and after harvest in both directions. They use an engineering model to determine suitability for mill placement across localities and, conditional on the suitability for the mill's placement within a mill's catchment area, they instrument for competition faced by the mill with the suitability for mill placement around the mill's catchment area. They find that competition between mills erodes relationships with farmers and is detrimental to the mill's efficiency. Furthermore, they also find that competition does not translate into higher prices paid to farmers and that, in fact, farmers' overall profits and proxies for welfare are lowered by the entry of an additional mill. The results suggest the possibility of socially excessive entry when contracts are hard to enforce (and thus a potential role for policy). Embedding relational contracting into models of market structure to study FVCs in developing countries is a promising area for work.

4. DATA SOURCES FOR EMPRICAL INDUSTRIAL ORGANIZATION ANALYSIS OF DEVELOPING FOOD VALUE CHAINS

4.1. Data Sources on Modern Retailers and Their Relations with the Supply Chain

Answering the problems presented above generally requires highly granular data appropriate for the nature of the problem at hand. In the modern food industry, questions of strategic market interaction and vertical relationships are generally addressed using store level, data, or data that has been collected from modern retail point-of-sale and syndicated via one of the major data aggregators (e.g., Nielsen and IRI).[10] These data, and methods for analyzing them, are relatively

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[10]The term syndication refers to the type of business relationship between the modern retail stores that generate the data and the aggregators that collect it. Modern retailers submit their point-of-sale data to firms like Nielsen and IRI on the condition that they receive aggregated market-level data in return. Walmart, for one, did not participate in data syndication until 2011.

well understood and have become something of a workhorse in the empirical industrial organization field for the last 20 years (Berry, 1995; Nevo, 2001; Draganska et al., 2010; Allcott et al., 2019; DellaVigna & Gentzkow, 2019; Derdenger & Kumar, 2019).

When market conduct is instead contingent on more detailed models of consumer behavior, such as the case when loyalty, inventory accumulation, or other dynamic household behavior drives the underlying mechanism, then household-panel data are required (Dube et al., 2009; Bronnenberg & Dube, 2017; Ching et al., 2020). All of the major data-market firms offer household-panel products, which track all modern retail purchases from panel households, often over a period of several years. Household panel data offer the advantage of allowing researchers to test models that not only rely on dynamic behavior but also allow the researcher to incorporate rich measures of each household's demographic and socioeconomic background and multichannel purchase behavior.

In general, similar data have not been available to study strategic store- and product-level problems in developing countries. However, most data vendors are now beginning to offer data products that at least approximate those used by researchers in developed countries. Nielsen, for example, uses a system of store audits and surveys to generate market intelligence to consumer-packaged goods clients in over 100 different countries. Relative to the point-of-sale and syndication approaches used to gather modern retail scanner data in developed countries, audits and surveys are both labor intensive and subject to error.

Regardless, as these data-gathering methods become more sophisticated, they may be able to provide data that can be used to study many issues that are of interest to food processors, vendors, modern retailers, and development agencies in developing countries. In Nielsen's case, field researchers collect movement data by conducting store audits. Drawing a sample of stores in a given market each week, field auditors use handheld scanning devices to count the number of specific items (stock-keeping units), both on shelves, and in storage. Audit teams then return to the same store the following week and count the same stock-keeping units again. Subtracting purchases made during the week yields an inferred level of movement. Auditors also record shelf prices and any promotional activity associated with each item. Although this approach is far more labor intensive than the point-of-sale method used in developed economies, this method may be

the most accurate, efficient means of providing consumer packaged goods firms with the mission-critical data they need. As in developed countries, researchers will happily piggyback on their data needs for very different purposes.

Household-level panel data are similarly scarce; an exception is the set of panel surveys called the LSMS (Living Standard Measurement Surveys) of the World Bank in some African, Asian, and Eastern European countries. However, the LSMS data are typically not adequate for most of the EIO analytical approaches we have outlined. They usually do not have a sufficient disaggregation of food products, nor do they distinguish the type of retailers that consumers buy from or the type of intermediary farmers sell to. They usually have little detail on the terms of relations between households as buyers or sellers in the food system, such as terms of contracts or the occurrence and terms of consumer or farmer credit.

As in the modern retail-scanner data case, some firms are trying to replicate their data-gathering efforts in developing economies. For example, Kantar (https://www.kantar.com/) collects household panel data similar in nature to their European panel and to equivalent offerings from Nielsen (Homescan) and IRI (Consumer Network). Collecting consumer panel data, however, is again highly labor intensive, as it also relies on field agents visiting individual households rather than on households themselves to submit data via handheld scanners. Kantar collects their household panel data using a three-step, purchase-auditing process. Although labor-intensive data gathering processes such as this are as accurate as possible, the cost of data collection is so high that sample sizes are typically much smaller than similar data services in developed countries. For example, the Kantar-Kenya panel consists of only 200 households, and the panel extends over a period of only 3–6 months. Therefore, both the household data quality and quantity are substantially below that typical of similar household panels in the United States or Europe. Nonetheless, as technology improves and as the demand for high-quality, granular data improves, the quality of these panel data systems is likely to improve as well.

4.2. Surveys of Midstream Small and Medium Enterprises in Developing Countries

The great majority of household and firm survey work in developing countries has focused on three groups in rapidly descending order: (*a*) farms, (*b*) consumers, and (*c*) midstream and downstream SMEs, primarily those that are registered and thus in the formal sector. There has

traditionally been an extreme dearth of data on informal sector midstream SMEs. Because most of these SMEs are informal, there is a large gap in knowledge. It has been common in food supply chain studies to use key informant case studies using small samples of the midstream segments. These are not statistically representative and do not usually feature even sufficient samples for statistical analysis; moreover, they are sometimes found to differ strongly from survey findings in the same regions (Reardon et al., 2021).

In general, surveys with substantial samples of midstream SMEs have not been available until recently in many developing countries and still are rare. An exception is the set of stacked surveys featuring substantial samples from each segment of the value chain for a given product, such as from the main production regions to capital cities. This allows triangulation over segments of key findings and statistical tests of these hypotheses. The surveys also allow in-depth analysis of firm behavior. Reardon et al. (2021) review a set of 37 surveys totaling 33,000 observations (of which half are midstream) in Africa and Asia done mainly in the 2010s.

Moreover, the stacked surveys provide a microeconomic view but in themselves do not allow an understanding of processes of spatial agglomeration, concentration, and other EIO measures. To partially address the latter, in the face of a near vacuum of official data on the midstream SMEs, researchers have conducted meso inventories per segment of a value chain, over districts, and over scales of firms, with recall over ten years (see, e.g., Hernandez et al., 2018 for the aquaculture value chain in Bangladesh). This necessarily was done with district key informants and was costly and time consuming but provided unique insights into rapid change in the midstream over ten years that were not obtainable by any alternative method. For an example from the aquaculture supply chain in Bangladesh, see Hernández et al. (2018).

5. CONCLUSIONS

FVCs in developing countries are transforming rapidly, with some regions in the modern stage (led by supermarkets downstream and large processors midstream) and other regions in a transition stage (led by proliferating midstream SMEs). With transformation, however, comes a host of market-performance issues related to monopoly and monopsony power, vertical bargaining, contracting, and other issues typically addressed by EIO researchers.

Although the concepts and methods of EIO are evolving rapidly, we argue in this review that these two trends have not sufficiently cross-pollinated: EIO concepts and tools are now highly relevant and applicable to developing countries' food systems. In this article, we review the characteristics of modern and transitional stage transformations of FVCs in developing countries, driven by modern retailers and midstream SMEs. We then present a general taxonomy of the EIO literature and, for a selected subset of literature strands, discuss issues and methods used in the EIO literature that are relevant to the analysis of those transformations. These strands included (*a*) vertical relationships and contracting; (*b*) dynamic industry equilibria; (*c*) market performance, defined in terms of the markups generated by players at each stage in the food supply chain; (*d*) the emerging literature on relational contracting. Finally, we contend that applying tools of modern EIO to food systems in developing countries is now possible due to increasing availability of appropriate data sources.

There are many examples of how our proposed synthesis of EIO tools and methods might add to the substantive literature in development, so we highlight only a few. First, Atkin et al. (2018) provide a comprehensive and rigorous econometric analysis of welfare effects of modern retail entry (foreign direct investment) in a developing economy, using Walmart's entry into Mexico as a case study. They adopt an event study approach to provide causal estimates of Walmart's entry into Mexico on welfare, including lower prices, higher incomes, and business destruction effects. While their analysis is exhaustive, they implicitly assume that foreign direct investment is exogenous, at least conditional on factors that can be controlled for. Future research should consider the fact that Walmart's entry is in fact endogenous in a broader historical context. Researchers may want to consider other examples of retail entry in terms of the sort of Markov perfect equilibria we describe here. Such work should recognize that the procompetitive effects of entry found by Atkin et al. (2018) are to be expected in a conceptual framework (EIO) that is designed to explain strategic motives for entry.

Second, given the pervasiveness of contracting problems, agricultural value chains in developing countries provide an ideal canvas to integrate the tools developed in EIO with insights from the relational contracting literature. For example, the empirical literature on bilateral oligopoly builds on the Nash-in-Nash model and assumes efficient bargaining. Bringing in insights

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from the relational contract literature would allow for a more realistic and nuanced modeling of the bargaining problem. First, the bargaining outcome needs to take into account the constraints imposed by dynamic incentive compatibility constraints. Second, if such constraints limit the quantity or the prices that parties can negotiate, estimated bargaining weights will be at best very reduced form and at worst biased and misleading. Third, taking into account relational contracting considerations, particularly when informed by survey evidence, can also lead to more accurate modeling of outside options in the bargaining model. These are just examples, as relational contracting considerations can also be taken on board to better understand drivers of markups, entry, etc. Much remains to be done in this fruitful area of research.

Third, although there is great scope for application and adaptation of EIO tools and concepts, which were conceived as a means of solving problems in developed economies, we believe there are also exciting opportunities to apply EIO methods to conceptually similar problems in lower-middle-income and lower-income countries. In these countries, the traditional food economy is now a minor part of the overall food system and the transitional stage of FVC transformation has become the dominant stage. In lower-income countries, there has been enormous dynamism in the proliferation of SME firms, a scale differentiation over the strata of SMEs, the formation of spontaneous clusters with economies of agglomeration and potential market power over small farmers and competing microenterprises, and the role of informal relationships that have the characteristics of resource provision contracts. All of these emerging institutions represent market-based industrial structures that may or may not be welfare reducing to either consumers or the firms themselves, depending on whether they pose a threat to market competitiveness. There is also scope for the adaptation of EIO to the SME sector, either as individual firms or considering clusters of firms. We believe the field of EIO will see important applications to these entities' bargaining relations with small farmers, as well as in their competition with emerging modern firms, in their exclusion impacts on traditional micro enterprises, and in their use of relational contracts.

We do not propose a specific future research agenda. Instead, we believe that our identification of the structural trends and behavioral traits of lead actors in the FVC transformation in developing countries and of the breadth and richness of EIO tools and concepts mainly hitherto applied to

developed country food systems point to a diverse and exciting agenda for cross-pollination between these two literatures. Only a limited set of studies have so far taken advantage of this great opportunity. We believe that there can be dynamic collaborations and intersections in the future, fueled by a burgeoning supply of new kinds of appropriate data sets.

LITERATURE CITED

Abbott JC. 1962. The role of marketing in the development of backward agricultural economies. *J. Farm Econ.* 44:349–62

Ackerberg DA, Caves K, Frazer G. 2015. Identification properties of recent production function estimators. *Econometrica* 83(6):2411–51

Adjemian MK, Saitone TL, Sexton RJ. 2016. A framework to analyze the performance of thinly traded agricultural commodity markets. *Am. J. Agric. Econ.* 98(2):581–96

Adjognon SG, Liverpool-Tasie, LSO, Reardon T. 2017. Agricultural input credit in Sub-Saharan Africa: telling myth from facts. *Food Policy* 67:93–105

Aguirregabiria V, Mira P, Roman H. 2007. An estimate dynamic model of entry, exit, and growth in oligopoly modern retail markets. *Am. Econ. Rev.* 97(2):449–54

Aguirregabiria V, Vicentini G. 2016. Dynamic spatial competition between multi-store modern retailers. *J. Ind. Econ.* 64(4):710–54

Allcott H, Diamond R, Dube JP, Handbury J, Rahkovsky I, Schnell M. 2019. Food deserts and the causes of nutritional inequality. *Q. J. Econ.* 134(4):1793–44

Arcidiacono P, Bayer P, Blevins JR, Ellickson PB. 2016. Estimation of dynamic discrete choice models in continuous time with an application to modern retail competition. *Rev. Econ. Stud.* 83(3):889–931

Arie G, Grieco PL. 2014. Who pays for switching costs? *Quant. Mark. Econ.* 12(4):379–419

Atkin D, Donaldson D. 2015. *Who's getting globalized? The size and implications of intra-national trade costs*. NBER Work. Pap. 21439

Atkin D, Faber B, Gonzalez- Navarro M. 2018. Modern retail globalization and household welfare: evidence from Mexico. *J. Political Econ.* 126(1):1–73

Bajari P, Benkard CL, Levin J. 2007. Estimating dynamic models of imperfect competition. *Econometrica* 75(5):1331–70

Baker G, Gibbons R, Murphy KJ. 1994. Subjective performance measures in optimal incentive contracts. *Q. J. Econ.* 109(4):1125–56

Baker G, Gibbons R, Murphy KJ. 2002. Relational contracts and the theory of the firm. *Q. J. Econ.* 117(1):39–84

Bardhan PK. 1980. Interlocking factor markets and agrarian development: a review of issues. *Oxf. Econ. Pap.* 32(1):82–98

Barrett CB. 1997. Food marketing liberalization and trader entry: evidence from Madagascar. *World Dev.* 25(5):763–77

Barrett CB, Reardon T, Swinnen J, Zilberman D. 2022. Structural transformation and economic development: insights from the agri-food value chain revolution. *J. Econ. Lit.* https://www.aeaweb.org/content/file?id=13546

Bell C. 1988. Credit markets and interlinked transactions. In *Handbook of Development Economics*, Vol. 1, pp. 763–830. Amsterdam: Elsevier

Bell DR, Lattin JM. 1998. Shopping behavior and consumer preference for store price format: Why "large basket" shoppers prefer EDLP. *Mark. Sci.* 17:66–88

Bellemare MF, Bloem JM. 2018. Does contract farming improve welfare? A review. *World Dev.* 112:259–71

Berdegué, JA, Balsevich F, Flores L, Reardon T. 2005. Central American supermarkets' private standards of quality and safety in procurement of fresh fruits and vegetables. *Food Policy* 30(3):254–69

Beresteanu A, Ellickson P, Misra S. 2010. *The dynamics of modern retail oligopoly*. Work. Pap., Dep. Econ., Univ. Pittsburgh. https://sites.pitt.edu/~arie/PDFs/SMdynamics.pdf

Bergquist LF, Dinerstein M. 2020. Competition and entry in agricultural markets: experimental evidence from Kenya. *Am. Econ. Rev.*110:3705–47

Berry LL. 1995. Relationship marketing of services—growing interest, emerging perspectives. *J. Acad. Mark. Sci.* 23(4):236–45

Berry S. 1994. Estimating discrete-choice models of product differentiation. *RAND J. Econ.* 25(2):242–62

Blouin A, Macchiavello R. 2019. Strategic default in the Int. coffee market. *Q. J. Econ.* 134:895–951

Briesch RA, Chintagunta PK, Fox EJ. 2009. How does assortment affect grocery store choice? *J. Mark. Res.* 46(2):176–89

Bronnenberg BJ, Dube JP. 2017. The formation of consumer brand preferences. *Annu. Rev. Econ.*

9:353–82

Bronnenberg BJ, Ellickson PB. 2015. Adolescence and the path to maturity in global modern retail. *J. Econ. Perspect.* 29(4):113–34

Bubb R, Kaur S, Mullainathan S. 2016. *Barriers to contracting in village economies: A test for enforcement constraints*. Work. Pap., Sch. Law, NYU. https://bfi.uchicago.edu/wp-content/uploads/EnforcementConstraints.pdf

Burke M, Bergquist LF, Miguel E. 2019. Sell low and buy high: arbitrage and local price effects in Kenyan markets. *Q. J. Econ.* 134(2):785–842

Cabral L. 2009. Small switching costs lead to lower prices. *J. Mark. Res.* 46(4):449–51

Cajal-Grossi J, Macchiavello R, Noguera G. 2022. *Buyers' Sourcing Strategies and Suppliers' Markups in Bangladeshi Garments*, https://drive.google.com/file/d/1SH7F5abyP8vUbhWamdbYU6N9c_Oyp2Ms/view

Casaburi L, Macchiavello R. 2019. Demand and supply of infrequent payments as a commitment device: evidence from Kenya. *Am. Econ. Rev.*109:523–55

Casaburi L, Reed T. 2020. *Interlinked transactions and competition: experimental evidence from cocoa markets*. Work. Pap., Dep. Econ., Univ. Zurich. https://cega.berkeley.edu/wp-content/uploads/2021/03/Interlinked-Transactions-and-Competition-Experimental-Evidence-from-Cocoa-Markets.pdf

Chiappori, P.-A., Salanié B. 2003. Testing Contract Theory: A Survey of Some Recent Work. Advances in Economics and Econometrics: Theory and Applications, Eighth World Congress, Vol. 1, ed. by M. Dewatripont, L.P. Hansen, and S.J. Turnovsky. Cambridge, MA: Cambridge University Press, 115–149.

Ching AT, Erdem T, Keane MP. 2013. Learning models: an assessment of progress, challenges, and new developments. *Mark. Sci.* 32(6):913–38

Ching AT, Erdem T, Keane MP. 2014. A simple method to estimate the roles of learning, inventories and category consideration in consumer choice. *J. Choice Model.* 13:60–72

Ching AT, Erdem T, Keane MP. 2020. How much do consumers know about the quality of products? Evidence from the diaper market. *Jpn. Econ. Rev.* 71:541–69

Ching AT, Osborne M. 2020. Identification and estimation of forward-looking behavior: the case

of consumer stockpiling. *Mark. Sci.* 39(4):707–26

Collard-Wexler A, Gowrisankaran G, Lee RS. 2019. "Nash-in-Nash" bargaining: a microfoundation for applied work. *J. Political Econ.* 127(1):163–95

Crawford GS, Lee RS, Whinston MD, Yurukoglu A. 2018. The welfare effects of vertical integration in multichannel television markets. *Econometrica* 86(3):891–954

Dai J, Wang X. 2014. Is China's dairy processing industry oligopolistic and/or oligopsonistic? *China Agric. Econ. Rev.* 6:644–53

De Loecker J. 2007. Do exports generate higher productivity? Evidence from Slovenia. *J. Int. Econ.* 73(1):69–98

De Loecker J. 2011. Recovering markups from production data. *Int. J. Ind. Organ.* 29(3):350–55

De Loecker J, Goldberg PK, Khandelwal AK, Pavcnik N. 2016. Prices, markups, and trade reform. *Econometrica* 84(2):445–510

De Loecker J, Eeckhout J, Unger G. 2020. The rise of market power and the macroeconomic implications. *Q. J. Econ.* 135 (2):561–664

De Loecker J, Warzynski F. 2012. Markups and firm-level export status. *Am. Econ. Rev.* 102(6):2437–71

De los Santos B, Hortaçsu A, Wildenbeest MR. 2012. Testing models of consumer search using data on web browsing and purchasing behavior. *Am. Econ. Rev.* 102(6):2955–80

DellaVigna S, Gentzkow M. 2019. Uniform pricing in us modern retail chains. *Q. J. Econ.* 134(4):2011–84

Derdenger T, Kumar V. 2019. Estimating dynamic discrete choice models with aggregate data: properties of the inclusive value approximation. *Quant. Mark. Econ.* 17(4):359–84

Dillon B, Dambro C. 2017. How competitive are crop markets in Sub-Saharan Africa? *Am. J. Agric. Econ.* 99(5):1344–61

Dobson PW, Waterson M. 1997. Countervailing power and consumer prices. *Econ. J.* 107(441):418–30

Draganska M, Klapper D, Villas-Boas SB. 2010. A larger slice or a larger pie? An empirical investigation of bargaining power in the distribution channel. *Mark. Sci.* 29(1):57–74

Dries L, Swinnen JF. 2004. Foreign direct investment, vertical integration, and local suppliers:

evidence from the Polish dairy sector. *World Dev.* 32(9):1525–44

Dube JP, Hitsch GJ, Rossi PE. 2009. Do switching costs make markets less competitive? *J. Mark. Res.* 46(4):435–45

Eizenberg A. 2014. Upstream innovation and product variety in the U.S. home PC market. *Rev. Econ. Stud.* 81(3):1003–45

Ellickson PB. 2007. Does Sutton apply to supermarkets? *RAND J. Econ.* 38(1):43–59

Ellickson PB, Misra S, Nair HS. 2012. Repositioning dynamics and pricing strategy. *J. Mark. Res*. 49(6):750–72

Emran MS, Mookherjee D, Shilpi F, Uddin MH. 2020. Credit rationing and pass-through in supply chains: theory and evidence from Bangladesh. *Am. Econ. J. Applied Econ.* 13(3):202–36

Fafchamps M. 2003. *Market Institutions in Sub-Saharan Africa: Theory and Evidence*. Cambridge, MA: MIT Press

Farina EMMQ. 2002. Consolidation, multinationalisation, and competition in Brazil: impacts on horticulture and dairy products systems. *Dev. Policy Rev.* 20(4):441–57

Feenstra RC. 1995. Exact hedonic price indexes. *Rev. Econ. Stat.* 77(4):634–53

Fox EJ, Postrel S, Semple JH. 2009. Optimal category pricing with endogenous store traffic. *Mark. Sci.* 28(4):709–20

Galenianos M, Gavazza A. 2017. A structural model of the retail market for illicit drugs. *Am. Econ. Rev.*107:858–96

Gereffi G, Lee J. 2012. Why the world suddenly cares about global supply chains. *J. Supply Chain Manag.* 48(3):24–32

Goldberg PK. 1995. Product differentiation and oligopoly in international markets: the case of the US automobile industry. *Econometrica* 63(4):891–951

Goldberg PK, Knetter MM. 1999. Measuring the intensity of competition in export markets. *J. Int. Econ.* 47(1):27–60

Gona A, Woji G, Norbert S, Muhammad H, Liverpool-Tasie LSO, et al. 2018. *The rapid transformation of the fish value chain in Nigeria: evidence from Kebbi State*. Res. Pap. 115, Feed Fut. Innov. Lab Food Secur. Policy, Mich. State Univ., Lansing

Green EJ, Porter RH. 1984. Noncooperative collusion under imperfect price information.

Econometrica 52(1):87–100

Gutman G. 2002. Argentine supermarkets and dairy products chain. *Dev. Policy Rev.* 20(4):409–27

Hall RE. 1988. The relation between price and marginal cost in U.S. industry. *J. Political Econ.* 96(5):921–47

Hart O. 2009. Hold-up, asset ownership, and reference points. *Q. J. Econ.* 124(1):267–300

Hendel I, Nevo A. 2006. Sales and consumer inventory. *Rand J. Econ.* 37(3):543–61

Hernández RA, Belton B, Reardon T, Hu C, Zhang X, Ahmed A. 2018. The 'quiet revolution' in the aquaculture value chain in Bangladesh. *Aquaculture* 493:456–68

Hoffmann V, Moser C, Saak A. 2019. Food safety in low and middle-income countries: the evidence through an economic lens. *World Dev.* 123:104611

Holmes TJ. 2011. The diffusion of Wal-Mart and economies of density. *Econometrica* 79(1):253–302

Horn H, Wolinsky A. 1988. Bilateral monopolies and incentives for merger. *RAND J. Econ.* 19(3):408–19

Iacovone L, Javorcik B, Keller W, Tybout J. 2015. Supplier responses to Wal-Mart's invasion in Mexico. *J. Int. Econ.* 95(1):1–15

Igami M, Sugaya T. 2021. Measuring the incentive to collude: the vitamin cartels, 1990–99. *Rev. Econ. Stud.* In press. https://doi.org/10.1093/restud/rdab052

Keane MP. 1997. Modeling heterogeneity and state dependence in consumer choice behavior. *J. Bus. Econ. Stat.* 15(3):310–27

Klein B. 1996. Why hold-ups occur: the self-enforcing range of contractual relationships. *Econ. Inq.* 34:444–63

Lagakos D. 2016. Explaining cross-country productivity differences in modern retail trade. *J. Political Econ.* 124(2):579–620

Leone F, Macchiavello R, Miquel-Florensa J, Pavanini N. 2022. *Market structure, vertical integration and farmers welfare in the Costa Rica coffee chain*. Working Paper

Levinsohn J, Petrin A. 2003. Estimating production functions using inputs to control for unobservables. *Rev. Econ. Stud.* 70(2):317–41

Liverpool-Tasie LSO, Reardon T, Sanou A, Ogunleye W, Ogunbayo I, Omonona BT. 2017. *The transformation of value chains in Africa: evidence from the first large survey of maize traders in Nigeria*. Res. Pap. 91, Feed Fut. Innov. Lab Food Secur. Policy, Mich. State Univ., Lansing

Liverpool-Tasie LSO, Wineman A, Young S, Tambo J, Vargas C, et al. 2020. A scoping review of market links between value chain actors and small-scale producers in developing regions. *Nat. Sustain.* 3(10):799–808

Lowrey J, Richards TJ, Hamilton SF. 2022. Food banks and retail markups. *Eur. Rev. Agric. Econ.* In press.

Macchiavello R. 2022. Relational contracts and development. *Annu. Rev. Econ.* 14. In press

Macchiavello R, Miquel-Florensa J. 2018. *Vertical integration and relational contracts: evidence from the Costa Rica coffee chain*. Working paper, https://drive.google.com/file/d/10NnjB56f4R1ru45dI6Qzdt-I5OcNw3Oz/view

Macchiavello R, Miquel-Florensa J. 2019. *Buyer-driven upgrading in GVCs: the sustainable quality program in Colombia*. Work. Pap., London Sch. Econ.https://papers.ssrn.com/sol3/papers .cfm?abstract_id=3464455

Macchiavello R, Morjaria A. 2015. The value of relationships: evidence from a supply shock to Kenyan rose exports. *Am. Econ. Rev.* 105:2911–45

Macchiavello R, Morjaria A. 2021. Competition and relational contracts: evidence from Rwanda's coffee mills. *Q. J. of Econ.* 136(2):1089–43

Meemken EM, Bellemare MF. 2020. Smallholder farmers and contract farming in developing countries. *PNAS* 117(1):259–64

Michler JD, Wu SY. 2020. Relational contracts in agriculture: theory and evidence. *Annu. Rev. Resour. Econ.* 12:111–27

Minten B, Kyle S. 1999. The effect of distance and road quality on food collection, marketing margins, and traders' wages: evidence from the former Zaire. *J. Dev. Econ.* 60(2):467–95

Minten B, Reardon T, Singh KM, Sutradhar R. 2014. The new and changing roles of cold storages in the potato supply chain in Bihar. *Econ. Political Wkly.* 49(52):27:98–108

Minten B, Singh KM, Sutradhar R. 2013. Branding and agricultural value chains in developing countries: insights from Bihar (India). *Food Policy* 38:23–34

Minten B, Tamru S, Engida E, Kuma T. 2016. Transforming staple food value chains in Africa: the case of teff in Ethiopia. *J. Dev. Stud.* 52 (5):627–45

Muthoo A. 1999. *Bargaining Theory with Applications*. Cambridge Univ. Press

Nash J. 1951. Non-cooperative games. *Ann. Math.* 54(2):286–95

Nevo A. 2000. Mergers with differentiated products: the case of the ready-to-eat cereal industry. *Rand J. Econ.* 31(3):395–421

Nevo A. 2001. Measuring market power in the ready-to-eat cereal industry. *Econometrica* 69(2):307–42

Olley S, Pakes A. 1996. Market share, market value and innovation in a panel of British manufacturing firms. *Econometrica* 64(6):1263–97

Otsuka K, Nakano Y, Takahashi K. 2016. Contract farming in developed and developing countries. *Annu. Rev. Resour. Econ.* 8:353–76

Pietrobelli C, Rabellotti R., eds.. 2006. *Upgrading to Compete: Global Value Chains, Clusters, and SMEs in Latin America*. Washington, DC: Inter-Am. Dev. Bank

Pinkse J, Slade ME, Brett C. 2002. Spatial price competition: a semiparametric approach. *Econometrica* 70(3):1111–53

Reardon T. 2015. The hidden middle: the quiet revolution in the midstream of agrifood value chains in developing countries. *Oxf. Rev. Econ. Policy* 31(1):45–63

Reardon T, Barrett CB, Berdegué JA, Swinnen JF. 2009. Agrifood industry transformation and small farmers in developing countries. *World Dev.* 37(11):717–1727

Reardon T, Chen KZ, Minten B, Adriano L. 2012. *The Quiet Revolution in Staple food value chains in Asia: Enter the Dragon, the Elephant, and the Tiger*. Asian Development Bank and IFPRI, December, https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/127312/filename/127523.pdf

Reardon T, Henson S, Berdegué JA. 2007. 'Proactive fast-tracking' diffusion of supermarkets in developing countries: implications for market institutions and trade. *J. Econ. Geogr.* 7(4):1–33

Reardon T, Liverpool-Tasie LSO, Minten B. 2021. Quiet revolution by SMEs in the midstream of value chains in developing regions: wholesale markets, wholesalers, logistics, and processing.

Food Secur. 13:1577–94

Reardon T, Minten B. 2021. Food value chain transformation in developing regions. In *Agricultural Development: New Perspectives in a Changing World*, ed. K Otsuka, S Fan, pp. 397–43. Washington, DC: IFPRIReardon T, Timmer CP. 2012. The economics of the food system revolution. *Annu. Rev. Resour. Econ.* 4:225–64

Reardon T, Timmer CP, Barrett CB, Berdegué, J. 2003. The rise of supermarkets in Africa, Asia, and Latin America. *Am. J. Agric. Econ.* 85(5):1140–46

Rhodes A. 2014. Re-examining the effects of switching costs. *Econ. Theory* 57(1):161–94

Richards T. J., Hamilton S. 2018. Modern retail market power in a shopping basket model of supermarket competition. *J. Retail.* 94(3):328–42

Richards, T. J., Bonnet, C., Bouamra-Mechemache, Z. 2018. Complementarity and bargaining power. *European Review of Agricultural Economics 45*(3): 297-331.

Richards TJ, Liaukonyte J. 2022. Switching costs and store choice. *Am. J. Agric. Econ.* In press

Rubens M. 2021. *Market structure, oligopsony power and productivity*. Work. Pap., KU Leuven, Belg. http://cesi.econ.cuhk.edu.hk/wp-content/uploads/RUBENS-Michael_Market-structure-oligopsony-power-and-productivity.pdf

Ryan N. 2020. Contract enforcement and productive efficiency: evidence from the bidding and renegotiation of power procurement contracts in India. *Econometrica* 88:383–424

Seim K. 2006. An empirical model of firm entry with endogenous product-type choices. *Rand J. Econ.* 37(3):619–40

Sexton RJ. 2013. Market power, misconceptions, and modern agricultural markets. *Am. J. Agric. Econ.* 95(2):209–19

Sexton RJ, Xia T. 2018. Increasing concentration in the agricultural supply chain: implications for market power and sector performance. *Annu. Rev. Resour. Econ.* 10:229–51

Slade ME. 1995. Product rivalry with multiple strategic weapons: An analysis of price and advertising competition. *J. Econ. Manag. Strategy* 4(3):445–76

Swinnen JFM, ed. 2007. *Global Supply Chains, Standards and the Poor: How the Globalization of Food Systems and Standards Affects Rural Development and Poverty*. Wallingford, UK: CABI

Swinnen, JFM, Deconinck K, Vandemoortele T, Vandeplas A. 2015. *Quality Standards, Value Chains, and International Development: Economic and Political Theory*. New York: Cambridge Univ. Press

Swinnen, JFM, Maertens M. 2007. Globalization, privatization, and vertical coordination in value chains in developing and transition countries. *Agric. Econ.* 37:89–102

Swinnen, JFM, Vandeplas A. 2010. Market power and rents in global supply chains. *Agric. Econ.* 41:109–20

Thomassen O , Smith H, Seiler S, Schiraldi P. 2017. Multi-category competition and market power: a model of supermarket pricing. *Am. Econ. Rev.* 107(8):2308–51

Traina J. 2018. *Is aggregate market power increasing? Production trends using financial statements*. Work. Pap., Booth Sch. Bus., Univ. Chicago. https://promarket.org/wp-content/uploads/2018/03/Traina-WITH-COVER.pdf

Verboven F. 2002. Quality-based price discrimination and tax incidence: evidence from gasoline and diesel cars. *RAND J. Econ.* 33(2):275–97

Villas-Boas SB. 2007. Vertical relationships between manufacturers and retailers: inference with limited data. *Rev. Econ. Stud*. 74(2):625–52

Weyl EG, Fabinger M. 2013. Pass-through as an economic tool: principles of incidence under imperfect competition. *J. Political Econ.* 121(3):528–83

Wooldridge JM. 2009. On estimating firm-level production functions using proxy variables to control for unobservables. *Econ. Lett.* 10(3):112–14

Zhang X, Hu D. 2011. Overcoming successive bottlenecks: the evolution of a potato cluster in China. *World Dev.* 63:102–12