

Value Chain Microfinance

Lorenzo Casaburi (University of Zurich) and Jack Willis (Columbia University)

Abstract: We study the provision of financial services to small firms, consumers, and workers in developing countries as part of value chain relationships: value chain microfinance (VCMF). We first explore how VCMF can both overcome barriers to financial access – including asymmetric information, enforcement, and behavioral biases – and strengthen value chains, but also how it can introduce new challenges. We then review a recent empirical literature at the intersection of value chains and microfinance studying the demand for and effects of VCMF in credit, insurance, and savings markets. We conclude by highlighting promising directions for future work.

Keywords: Microfinance, Value Chains, Credit, Insurance

JEL Classification: G20, L14, O16, O17, Q14

Acknowledgments: Lorenzo Casaburi, lorenzo.casaburi@econ.uzh.ch. Jack Willis, jack.willis@columbia.edu. This article was prepared for a forthcoming edition of the Oxford Review of Economic Policy on Microfinance. We wish to thank the editors of the edition, Simon Quinn and Muhammad Meki, for inviting our submission. We also wish to thank the discussant Jeremy Gray and an anonymous referee, both of whom provided exceptionally useful comments; and Muhammad Bashir and Maria Cedro, who provided excellent research assistance. Lorenzo Casaburi wishes to acknowledge funding from the Swiss National Science Foundation (grant 181127) and the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation programme (grant agreement No 851961). All errors are our own.

1. Introduction

Increasing participation in value chains is widely proposed as a way to increase productivity in developing countries. Yet financial barriers to participation can be acute, since the gap between when production costs are incurred and when the final consumer pays is often large, and risks can be substantial, compounding along the chain. While value chains thus present a real need for financing, they also provide an opportunity to relax traditional constraints to financing, such as informational and enforcement constraints. As such, finance is often provided within or tied to value chain relationships, implicitly or explicitly, and many financial products have been developed explicitly for value chain needs. At least since the seminal paper on trade credit by Petersen and Rajan (1997), such value chain finance (VCF) has spurred a substantial empirical literature in economics, yet its focus has tended to be on developed countries and on well-established formal firms (World Bank, 2019).

Microfinance focuses on a different setting: small consumers and micro or small enterprises in developing countries, where financial constraints may be more severe. Despite this financial need, however, and while highly valued, microfinance is rarely transformative in terms of spurring productive investment, at least for microcredit where we have the most evidence. Recent work points to constraints in the contract space, to ensure high repayment rates, as possible explanations, such as lack of flexibility, small loans, and a lack of information on who has high returns to capital (Cai et al., 2023).

This raises the natural and somewhat underappreciated point that linking microfinance to value chains has great promise. In particular, could participating in VCF enable Microfinance Institutions (MFIs) or traditional financial institutions to reach people with particularly large financing needs, in a manner that loosens the contracting constraints typically faced by MFIs? In this paper, we consider such “value chain microfinance” (VCMF).

We begin by defining value chain microfinance and discussing the value chain relationships where it can be employed and the microfinance products that can be offered. In VCMF, one (typically larger) party of the value chain contract provides or facilitates financing to the other (typically smaller) party. For the case of credit, examples of VCMF include credit flowing from: a buyer to a small producer, supply chain credit; a producer to a small retailer, trade credit; a retailer to a customer, retail credit; or an employer to their employee, a wage advance. While credit has been the focus of VCF and the related literature, as we will discuss, these same value chain relationships can equally be harnessed to provide microsavings, microinsurance, and microequity, and indeed this is where some of the most exciting opportunities for VCMF lie. Moreover, while in these examples the value chain partner is the party providing the financing – *internal* value chain financing – that need not be the case. *External* value chain financing is when a third party provides the financing, facilitated by the value chain partner, for example by bundling the financial and value chain contracts.

Why and when might bundling (micro)finance with value chain contracts offer an advantage over keeping them separate? There is a substantial literature on this question for value chain finance, which

we briefly review and discuss its relevance for microfinance. For the exposition, we distinguish between advantages of bundling in the financing domain versus in the value chain domain.

The classic financing benefits of VCF come from improvements in transaction costs, enforcement, and information (Petersen and Rajan 1997), all of which apply equally to VCMF. On transaction costs, the classic innovation of microfinance is to employ mobile agents who interact with groups, reducing transaction costs substantially relative to formal finance. However, transaction costs remain high, relatively speaking, resulting in high interest rates despite low default rates. Value chain partners are already in regular contact and thus may add on the financial administration at low marginal cost. On enforcement, value chain partners can have direct ways of enforcing contracts. Most obviously, they have direct control over revenue streams, from which they may deduct payments directly. But they often have other mechanisms, too, such as easy access to collateral, and harnessing the continuation value of the value chain relationship to encourage repayment. On information, value chain partners are often in longstanding relationships, and may have much better information than a third party on repayment risk, distinguishing strategic and non-strategic default, and the returns to financing among clients.

In addition to these classic financing benefits, recent work has also pointed to potential commitment benefits of value chain finance. Harnessing again the fact that income is regularly transferred through them, value chain relationships provide the opportunity for one party to dictate how their income is used without first receiving it, potentially easing commitment constraints or redistributive pressures. To give an example, an employer may pay a proportion of an employee's wages directly to a commitment savings account if the employee so desires, avoiding such pressures. Value chain partners can even make such behaviors the default, nudging people towards beneficial behaviors.

The benefits of VCF for the value chain arise from easing financial constraints which constrain output, quality, and reliability, and thus from increasing the surplus generated by the value chain. While these gains might accrue entirely to the financing recipient, they are typically shared with the other party, who is often a partial claimant on output gains or who may gain from new partners who enter the relationship due to the financing. These shared gains are an additional incentive for the partner to provide finance or facilitate its provision by a third party, beyond profits from the financing itself. Similarly, providing finance can reduce the risk of default on the value chain contract. It can reduce strategic default by enhancing the value of the relationship, and non-strategic default by equipping parties with the means to pay during challenging times. The resulting increase in the resilience and dependability of value chains can offer substantial benefits, as poor reliability is often a key barrier to accessing high-value international export markets.

Ultimately, we should consider both sets of gains together, and indeed the real benefits of value chain microfinance may only become apparent when we do so. For example, in the case of microcredit, since repayment rates are very high, one might argue there is little need to improve enforcement by bundling with value chains. But microcredit achieves such high repayment rates with loans which have little impact on productivity, at least on average. The promise of value chain microcredit is in enabling

microcredit to reach new types of clients, with new types of loans, so that loans may be used more productively without inducing substantial default.

While we largely focus on the potential benefits of VCMF, potential costs should not be ignored and can be substantial. First, while tying a financial contract to a value chain contract can help with enforcement, it can also undermine it. If a party wants to default on the financial contract and tying the financial contract with the value chain contract is not a sufficient disincentive to doing so, then tying the contracts will lead to default on both; and vice versa. The enforcement benefits of VCMF only exist if the value chain partner has an enforcement technology, or if the value chain relationship has a high continuation value; in many settings there is ample opportunity for renegeing. Moreover, harnessing strong relationships to provide other contracts is well known to lead to exploitation if it gives one party too much power. This has been argued extensively in the literature on the interlinking of agricultural contracts, for example, where the classic example is of a landowner lending to their tenant or worker, and then using the resulting debt to exploit them.

In the final section of the paper, we consider several recent empirical examples of value chain microfinance, which have considered saving and insurance, as well as credit. We focus on studies which either convincingly demonstrate benefits and costs of VCMF, in specific settings, or which highlight further financial innovations which are enabled by VCMF.

This review sits at the intersection of value chains, microfinance, and the interlinking of contracts in developing countries, and hence is related to several others. Antràs and Chor (2022) survey the academic literature on global value chains, which focuses mainly on larger and formal firms. The role of such value chains in development is well covered by Gereffi (2018) and World Bank (2019). Classic studies of value chain finance for large and formal firms include Petersen and Rajan (1997) and Antràs and Foley (2015). Shifting to the microfinance emphasis of this review, several recent reviews focus on value chain participation of smaller actors in developing countries and the associated challenges, including De Brauw and Bulte (2021) and Boudreau et al. (2023). Regarding value chain finance for such actors, numerous technical reports focus largely on the agricultural sector, including USAID (2009), KIT and IIRR (2010), and IFAD (2012). De Brauw and Swinnen (2023) is a notable recent review, and Breitbach (2017) is a PhD thesis on the topic. On microfinance, Cai et al (2023) provide a current snapshot of the directions the literature has taken since early evaluations of the basic microcredit model suggested limited impacts, which the rest of this edition of OxREP adds to. On the interlinking of contracts, Bell (1988) is a classic review.

Relative to reviews on value chain finance and on microfinance, our contribution is to focus specifically on tying *microfinance* contracts to value chain relationships. The gains of this focus come in part from the recent blossoming of empirical papers in this space, which demonstrate common themes in both the promise and the challenges of doing so. Relative to reviews on the interlinking of contracts in developing countries, we make two contributions. First, we hope to bring this body of work to the attention of the broader microfinance community. Second, equally importantly, many of the benefits and financial products of VCMF fall outside the framework of the enforcement of credit contracts within agriculture, which has been the focus of much of the interlinking literature. In

addition, while existing literature focuses mostly on credit interlinking, we cover other financial products, such as saving and formal insurance. Third, we highlight new benefits not discussed in previous reviews, for instance, those related to behavioral economics insights, such as commitment and default options.

2. What is value chain microfinance?

Value chain finance is the provision of finance within a value chain relationship --- the bundling of a financial contract with a value-chain contract. Supply-chain credit and trade credit are the most common examples, whereby the buyer provides the supplier with a portion of the payment upfront to finance production in the case of supply chain credit, while the supplier provides the good to the buyer on credit, only requiring payment at a later date, in the case of trade credit. But these are just two examples, and many other types of value chain finance exist, with savings, insurance, and equity also commonly being offered in value chains. Discussion of VCF typically focuses on contracting between formal firms in developed countries and thus is outside of the scope of microfinance. However, VCF in various guises is common and potentially has larger benefits in developing country settings in which at least one of the firms is small and informal, making it relevant for the microfinance community.

We adopt an unusually broad definition of value chain finance, to include any setting in which finance is bundled or interlinked with a non-financial contract – for example, we would include the classic interlinked contract of a landlord who leases land to a farmer also providing that farmer with credit. We also do not take a stance on the length of the chain – most of our arguments apply to chains containing just two actors, although many become more pertinent for longer / international chains, where risk and working capital demands are more problematic, and the gap in financial access between actors is more pronounced.

In this section, we begin with the types of value chains and settings in which value chain microfinance (VCMF) is prevalent or has promise. We then turn to the microfinance side, asking *which* microfinance products could be bundled with value chain contracts and *who* should provide them – do value chain actors have to provide microfinance themselves, or is there a role for third-party microfinance institutions?

2.1. Relevant value chains

The existing literature on value chain finance typically focuses on contracting between formal firms in developed countries. Instead, our focus is on settings where at least one of the two actors qualifies as a potential microfinance client. Typically, an asymmetry in size exists between the actors, with the financing going to the smaller actor and the larger actor either providing it or facilitating it. VCMF is

relevant in at least four different types of value chain relationships detailed below, where the arrow denotes the direction of the value chain and the underlining denotes the actor receiving the financing.

Small producer -> buyer. This is the most natural value chain relationship with which finance can be bundled. Small producers often lack access to credit and face substantial uninsured risk; in contrast, their buyers, who may themselves sell to larger buyers, often have much better access to finance. In agriculture, contract farming is a common example, whereby inputs may be provided to farmers on credit, and price insurance may be written into their contract (Bellemare and Bloem, 2018; Arouna et al. 2021). In small-scale manufacturing, buyers may provide working capital loans.

Producer -> small retailer. Global companies distributing their products in remote markets, or large-scale importers, face a last-mile problem. Commonly they work directly with networks of distributors or retailers, who often have little access to finance. In these relationships, the producer/importer often extends trade credit, and potentially insurance, to the small retailer, in the form of not requiring payment upfront for the products and taking back any unsold products. Often these relationships can be multi-level, with several tiers of the distribution network, and intermediaries who may themselves be financially constrained offering finance to the final retailers. Recently studied examples include the distribution of global goods such as soda and chewing gum (Cordaro et al. 2022) and of locally produced goods, such as agricultural produce (Karlan et al. 2019).

Retailer -> consumer. Small shops often provide informal credit to consumers. Specific products may also be offered on credit more formally, with various collateral relationships. For example, water tanks are supplied via self-collateralized loans (Jack et al. 2023), and solar lanterns via digitally collateralized loans (Gertler et al. 2021). Retailers may also provide consumers with bundled insurance, in the form of warranties or rainfall insurance bundled with hybrid seeds (Bulte et al. 2020).

Employee -> firm. Firms make regular payments to their employees and may choose to do so in ways that help employees overcome financial constraints. For example, for savings, firms may pay wages into private accounts, or even commitment accounts, if redistributive pressures or commitment problems prevent people from putting cash payments to their preferred use (Casaburi and Macchiavello 2019, Brune et al. 2021). For credit, firms may offer advances, or act as guarantors for loans from third-party lenders. For risk, firms often provide or even mandate health insurance, helping to reduce adverse selection and improving bargaining power in negotiations with health providers. Also, firms can simply encourage employees' financial integration, by helping them set up formal bank accounts and paying wages directly into them.

Platforms <-> users.¹ Digital platforms matching buyers and sellers have grown exponentially across multiple markets, from retail to wholesale, to agricultural outputs (Bergquist et al. 2021) and inputs, to transport. These digital platforms can play a critical role in enabling value chain coordination. Some already offer tied financial services. Large players often offer payment systems with credit and escrow features – Paypal for Ebay, for example, and Alipay for Alibaba. Transport platforms like Uber and Gojek offer credit to their drivers, both for financing vehicles and for personal loans. Such platforms

¹ We thank the discussant, Jeremy Gray, for drawing our attention to the promise of digital platforms for VCMF.

are particularly promising partners for microfinance companies to get involved in VCMF, as they have a large number of established relationships, with data readily available, and offer built-in digital payment mechanisms.

2.2. Relevant microfinance products: credit, savings, equity, and insurance

Value chain finance is typically associated with credit. One of the actors requires working capital, or capital for investment, and the other actor can access it more cheaply. For example, if the producer has upfront costs but is capital constrained, the buyer may provide a loan; or, if the retailer lacks the working capital to pay for the produce upfront, the producer may supply it on credit. Such relationships are extremely common and, as detailed in Section 3, supplying credit in this way can overcome multiple constraints faced by traditional microfinance loans. Such relationships include:

- Trade credit, where a supplier extends a line of credit to its buyer. Rather than making immediate cash payments for the goods and services bought, the buyer is granted a deferred payment period, which is effectively a loan from the supplier to the firm. Trade credit agreements often include cash discounts for settling the invoice prior to the due date, which serve as incentives for timely payment.
- Supply chain financing, also known as reverse factoring or supplier financing, enables suppliers to access finance by means of a receivables purchase. The arrangement often involves a financial institution, typically a bank or a third-party financier, offering early payments to suppliers on behalf of their buyers. Within the agreement, the buyer's approved invoices or accounts payable are assigned to the financial institution. The supplier, upon receiving the invoice's approval, has the option to request early payment from the financial institution at a discounted rate. The financial institution then pays the supplier on behalf of the buyer, deducting a fee for providing the early payment service. For instance, in typical transactions financed with a letter of credit, a bank commits to paying for goods on behalf of the importer provided that the goods are shipped as specified, and this commitment is made before goods are shipped. For a discussion of how these arrangements vary with the enforcement levels of the countries of the transacting parties see Antràs and Foley (2015).
- Factoring and prefinancing agreements, where a company sells its account receivables (outstanding invoices) to a third party, called a *factor*, in exchange for immediate funds. The factor typically purchases the account receivables at a discounted rate and assumes responsibility for collecting the invoice payments from the customers. An alternative to factoring is *account receivables financing*, in which the company uses its account receivables as collateral for a loan. In this case, the company retains ownership of its account receivables, and the lender advances a percentage of the value of such accounts to the company, which remains responsible for collecting the due payments from its customers and paying back the loan with interest. Such agreements have recently flourished in both developed and developing countries (Udell et al. 2004). For example, the non-profit Root Capital uses factoring

agreements, or signed purchase contracts between micro agribusinesses and their buyers, for both short-term and long-term loans. The purchase agreement serves as a substitute for traditional collateral as it represents a discrete, future revenue stream that can be pledged to repay the loan (Tinsley and Agapitova 2018). Klapper (2006) finds evidence that factoring is more prevalent in countries with weak contract enforcement, suggesting that factoring may substitute for collateralized lending.

- Consumer credit, where credit is granted to individuals for personal use, allowing them to borrow money or access credit facilities. It enables consumers to make purchases, pay for services, or meet their financial obligations over a specified period.

VCMF, however, extends beyond just credit. Savings can also be offered in this way. Traditional barriers to saving such as transaction costs, redistributive pressures, and temptation may be overcome if payment is made directly into an account explicitly set up for the transaction. This could simply be a mobile money account (Riley 2022), a formal bank account (Brune et al. 2021), or simply in the form of lower frequency payments (Casaburi and Macchiavello 2019). Additionally, these savings accounts can feature various forms of soft or hard commitment (Ashraf et al. 2006).

Tying finance to a value chain relationship can also be used to substantially alter the risk exposure of one or both agents. It can make microequity viable, as the agent may be much better informed about performance and effort than a third-party microfinance company (Cordaro et al., 2022). This may enable better sharing of upside risk, and hence allow covered parties to make productive but risky investments. It can also facilitate the provision of microinsurance, in multiple forms:

- Production/input insurance, where producers within a value chain are offered financial protection against losses incurred during the production cycle. In the farming context, crop insurance protects farmers and agricultural producers against potential losses or damages to their crops or livestock during the production phase, typically covering a portion of either the lost output (Casaburi and Willis 2018) or the input costs (Deutschmann et al. 2022).
- Price insurance, where a minimum (or fixed) price is guaranteed for a contract-specified quantity. In agriculture, commodity price insurance offers protection to farmers or agricultural producers by providing a payout if the price of the insured agricultural commodity falls below a predetermined threshold, and price guarantees by buyers enable farmers to base production decisions on output prices but can lead to default when market prices are high (Blouin and Macchiavello 2019).
- Trade insurance, an insurance product designed to cover payment risks that are generated from the delivery of goods and services along a value chain. It provides coverage from trade-related risks specific to value chain transactions, such as buyer insolvency, payment delays, and contract breaches.
- Consumer insurance/warranties, where consumers or individuals are offered protection against specific risks and losses related to their personal lives. Consumer insurance provides coverage for a wide range of risks, including health-related expenses, property damage, liability claims, life events, and other unforeseen circumstances.

- Health insurance to employees, when mandated, is a classic example of bundling contracts to reduce adverse selection and improve bargaining power and is widespread and highly valued by employees in the United States.

2.3. Internal vs external value chain finance

Either implicitly or explicitly, financing is often a component of value chain contracts (Petersen and Rajan 1997). Why the financing is tied within the contracts, rather than contracted independently with a third-party financial institution, is a question we return to in the next section. However, even when it is tied to a value chain contract between two parties, the actual financing need not be provided by one of them. “Internal” value chain finance is when it is. “External” value chain finance, in contrast, is when financing is tied to a value chain contract, but the financing itself is supplied by a third party (IFAD, 2012). It can leverage the benefits that a value chain partner may have in contracting with the recipient of the financing --- informational, enforcement, or otherwise --- without they themselves having to carry the financial burden, which they may not have the resources nor expertise for.

External value chain financing is particularly relevant to this article, both because it provides a potential market for microfinance institutions, and because in many of the settings we will discuss, both sides of the value chain contract are financially constrained, limiting the scope for internal value chain finance and making external financing essential for the development and subsequent resilience of the value chain. Settings in which there is a contracting benefit to providing value chain microfinance (or at least no contracting barrier), but the larger actor faces a financing constraint, are particularly promising for involving MFIs. Such financing constraints can be endogenous to the value chain relationship – the value chain itself makes the larger actor financially constrained, even if it makes them well placed to facilitate the financial contract. Two give two examples: in the case of production insurance, the times when payouts are due are likely to be times of financial stress for both parties of the value chain; more generally, value chains are often long, with multiple links, so the larger party themselves can face similar financing needs as the smaller party.

External value chain financing can manifest in various forms, catering to both financial institutions equipped to transact directly with small agents and traditional institutions that primarily deal with larger firms. Suppose we aim to finance the (small) agent A, with agent B being the other party in the value chain, and F denoting the third-party financing institution. If F provides finance directly to agent A (for instance, if F is an MFI), there are several scenarios for B’s involvement. B might assist F with screening and subsequent monitoring. Alternatively, B could agree to formally tie the contracts, aiding F with enforcement. B also might simply assist administering the financing, reducing transaction costs. Alternatively, if F is a traditional financial institution, it may provide financing to B with the explicit or implicit understanding that this financing will be channeled, at least partially, through to agent A. Indeed, financial constraints of the larger party, who may themselves supply to another agent C as part of the same value chain, can often be the downfall of value chains. In these scenarios, financing provided to C may subsequently trickle down through the value chain to agent A. In long, global value

chains this can potentially enable financial institutions in countries with developed financial markets to reach clients in settings with less developed markets.

3. When and why bundle microfinance with value chains?

Why bundle a financial contract with a value chain contract? There are many classic theories for value chain finance, most focusing on credit (Schwartz 1974; Petersen and Rajan 1997; Klapper et al. 2012). The benefits of bundling may accrue to the value chain activity, or to the financing, or to both. There may also be associated costs and potential pitfalls. In this section we consider these benefits and costs on the two aspects of the bundled contract. We categorize them into several components: transaction costs (Ferris 1981), information (Smith 1987), enforcement (Mian and Smith 1992), commitment (Casaburi and Macchiavello 2019), return, and price discrimination (Meltzer 1960). Many are well known but require a different interpretation in the microfinance context and when thinking beyond credit. Some are more recent and innovative, being related to recent advances in behavioral economics and value chain and financial services technologies.

3.1. Simple conceptual framework for value chain credit

In this section, we introduce a very simple conceptual framework to illustrate the classic rationales for value chain credit. In subsequent sections we then use this basic framework to consider VCF in microfinance settings specifically, both for credit and for other financial services more broadly.

Consider the decision of a lender, who will issue a loan of size L at interest rate r if the expected returns of doing so are higher than the opportunity cost of the capital, ρL :

$$p(\theta, a(V))(1 + r)L + (1 - p(\theta, a(V)))c - t - m \geq (1 + \rho)L,$$

The probability of repayment, p , depends on the borrower's type, θ , and on his actions, a . In this simple framework, a includes both project choice (e.g., safe vs. risky project, ex-ante moral hazard) and strategic default (ex-post moral hazard), which may depend on the continuation value of the relationship with the lender, V . If the loan is not repaid, the lender obtains a salvage value c . In addition, the lender incurs a transaction cost, t , when offering the loan and a monitoring cost during it, m , both of which may depend on the value of the loan, but also be fixed costs (e.g., Banerjee, 2001).²

²This is a simple conceptual framework to outline terminology. Most of the equations required for a full model are omitted, for example the incentive compatibility and participation constraints of the small firm. For such models see, for example, Schwartz (1974) and Petersen and Rajan (1997) for classic treatments, and Chapter 14.4 "Interlinking Transactions" of Ray (1998) for conceptual treatments of various benefits in a development setting.

Below, we discuss how value-chain financing arrangements may differ from other financial contracts in terms of information about borrower type, θ , continuation value of the relationship, V , transaction costs, t , and monitoring costs, m . Different values of these parameters may result in different loan amounts and interest rates between value-chain and non-value chain financial arrangements.

This set of parameters also shapes the decision to take other financial services, like saving products and insurance. In these products, it is again the case that one agent transfers an amount in exchange for future benefits, but it is now the user of the financial product who does so, not the supplier. We highlight several important distinctions from the credit case, which are particularly important for microfinance settings, whereby a small agent interacts with a larger institution.

First, the (perceived) return from the product – the interest earned or the payout from the insurance in a bad state of the world – now depends on the likelihood that the financial provider makes the payment, p . Value chain arrangements may alter the incentives for the financial provider to do so or the extent to which users trust that a payment will be made.

Second, returns to saving products, r , depend on the user's ability to accumulate savings and on the ability to use such savings productively. Value-chain finance arrangements may change the returns, for instance by providing stronger forms of commitment in saving behavior and utilization.

3.2. Benefits and costs for financing

Transaction costs

One of the big innovations of microfinance which made offering credit to the poor commercially viable was reducing transaction costs, through employing networks of agents who interacted with microfinance groups, rather than formal bank tellers interacting with individuals (Morduch 1999). However, almost inevitably given the small loan sizes, transaction costs remain high in relative terms. These are reflected in interest rates, which often remain high despite default rates which are close to zero and substantial competition in the sector. High transaction costs are also a constraint for microsavings accounts, whereby negative interest rates are common, and are especially problematic for microinsurance products, whereby a transaction cost is paid each period the premium is collected, even if the insurance only covers catastrophic risk and hence payouts are very rare.

A substantial potential benefit of VCMF is reducing these transaction costs. Since the two agents are already in regular contact, incorporating loan repayments, insurance premium payments, or direct deposits into savings accounts may entail negligible additional transaction costs. For example, in contract farming, the buyer often has a physical presence close to the farmers and employs its own set of agents to regularly visit them. During such visits, these agents could perform tasks that a microfinance agent would typically do, at minimal additional cost. For producers working with small retailers, their frequent meetings for stock deliveries and payments can integrate microfinance

transactions. Of course, the added burden of managing these financial transactions would vary based on the specific setting. Understanding what is required and incentivizing agents accordingly would be key for successful implementation.

Information

Asymmetric information – about creditworthiness and the ability to repay, about actions taken during the financing period, and about exposure to risk – is a central and classic friction in financial markets. A value chain partner may be much better informed than a third-party financial institution about these and other important determinants of credit and insurance risk. Microcredit addresses these issues in part through officers, but more importantly through harnessing group-based information to screen potential borrowers (Morduch 1999). These increase transaction costs and reduce financial access to socially isolated individuals, respectively. Moreover, there is little incentive for the group to reveal those who have particularly high returns to capital, on which they can have accurate information (Hussam et al. 2022). The value chain partner is not only more likely to know about clients' returns to capital and whether it is misused, but also about what financial products clients need and want, and can tailor offerings accordingly.

To provide examples, a contract farming company may know farmers' exact yields and hence ability to repay a loan, and have a good idea of whether a low yield was due to a negative weather shock or pests or simply due to low effort. An optimal credit contract would condition repayment on both pieces of information, and microfinance institutions may have much less of an idea. Similarly, insurance products could be based on the yield data of the company, either for the individual farmer or for the local area. Agrofinanzas in Mexico is one such example. They specialize in lending to small farmers who do not have prior formal borrowing experience, by partnering with large buyers and using their information to reduce default (Tinsley and Agapitova, 2018).

Information held by the smaller partner regarding the larger party is also relevant. In the case of microinsurance, a product plagued with trust issues (Cole et al. 2013), the small agent may trust their value chain partner more than a third-party microfinance institution, overcoming this barrier to the demand for insurance. On the other hand, the agent may trust their value chain partner less than a third party, in which case bringing in such a party in the form of external value chain microfinance might be beneficial. For example, in the dairy market in Kenya, farmers valued monthly payments in addition to daily payments, as it provides a form of savings (Casaburi and Macchiavello 2019). However, they only trusted one buyer to actually make them, leading to a lower price in equilibrium. If the other buyers teamed up with a reliable savings account provider, they could potentially increase competition in this segment of the market, increasing prices for farmers.³

³ Casaburi and Macchiavello (2019) is a good example of the importance of fieldwork in the study of value chain microfinance. The researchers developed a partnership with a large dairy cooperative to examine its competitiveness. Initially, they hypothesized that more frequent payments may encourage more farmers to join the

While the value chain partners will have better information about each other than a third-party MFI, they will also have less experience and expertise in offering financial services, and hence risk misinterpreting this information when deciding which services to supply and to whom. This provides an additional benefit to involving MFIs via *external/VCMF*. In such cases, ideally, the MFI would spend time understanding the setting and provide its expertise in tailoring the financial offerings accordingly. However, it is important to note that this is not the standard model of MFIs, and to consider the cost-effectiveness of doing so. Typically, MFIs offer a small number of products and offer them widely, to keep operating costs low. Highly tailored products are only likely to be cost-effective for large value chain providers. For smaller providers, MFIs expertise could still be used, but through tying their more standard products with the value chain.

Enforcement

A value chain relationship can directly reduce the cost of monitoring and enforcing a financial contract. Most directly, if a buyer purchases a product from a supplier, they can enforce repayment on the financial contract by deducting it directly from payments for the purchase. Similarly, a supplier may enforce repayment on a financial contract by withholding delivery of an order. These costs are likely lower than those of sending an enforcement agent or other methods of monitoring and enforcement that a third-party financial provider may have to resort to. This is especially useful in contexts and countries with poor a legal infrastructure, as is demonstrated by firms' use of trade credit being higher relative to bank debt in such countries (Demirguc-Kunt and Maksimovic 2001, Fisman and Love 2013). In addition, even without deductions or withholding, value chain partners may have lower monitoring costs: for example, if a buyer regularly visits a supplier to monitor production or make purchases, she may also conduct monitoring activities related to the financial service (e.g., akin to the ones a loan officer would conduct).

Collateral is a classic mechanism to aid enforcement, which can be more effective in VCMF than in regular microfinance, as the value chain firm may value collateral more highly than a third-party financial institution, making it possible to offer more credit and a lower interest rate. This could be because it is simpler for them to seize it. Or alternatively because, conditional on having seized it, they can salvage value from it more easily. Financial institutions can also reclaim the firm's assets to pay off the firm's loan. However, if the supplier already has a network for selling its goods, its costs of repossession and resale will be lower than those of the institution.

Relational contracting, in which agents value the contracting relationship, with this value acting as an enforcement mechanism, is widespread in value chains in the developing world (Boudreau et al 2023). In such settings, tying a financial contract to a value chain contract can harness the value of the latter,

cooperative, but initial fieldwork suggested instead that the ability to pay at a lower frequency was an important source of competitive advantage for the cooperative compared to other smaller players. This insight radically changed the research question and the study design.

potentially increasing the cost to defaulting on the financial contract, as doing so will lead to the loss of both the financial and value chain relationships. This threat will be more credible the higher the value of the value chain relationship, for example if there are few alternative partners, or if the relationship has been active over many years (Macchiavello and Morjaria 2021). Indeed, the need to establish such relationship value is at the heart of one of commonly cited constraints on MFI loans generating transformational change: as they must start small in order to harness dynamic incentives for enforcement ---- the value of the promise of future larger loans upon repayment --- especially when there is competition from other microfinance institutions (De Quidt et al. 2018).

Two potential costs of VCMF are worth mentioning here. First, since the two contracts are tied, if either of the value chain partners wants to default on the value chain contract, then they will also default on the financial contract. Casaburi and Willis (2018) demonstrates such an example, where financial difficulties led a contract farming company who had offered insurance to its farmers defaulting on both the purchasing agreement and then insurance contract. Second, for external value chain finance, there may be a risk of collusion between the partners, at the expense of the financial institution.

Addressing behavioral biases: commitment and default options

Agents may value financial products that provide commitment toward the desired use of resources. *Commitment saving products*, in which agents either cannot access their savings until a certain date or goal is reached, or incur a penalty to do so, provide a classic example (Ashraf et al. 2006). Value chain arrangements can provide higher commitment values for three reasons. First, in seller-buyer or employer-employee relationships, payers may alter the frequency of payments, thus providing an implicit form of commitment when this is low. Second, the *mode* of payment may provide another source of commitment: for instance, employers may help workers set up bank accounts or mobile money accounts or set up non-cash mode of payments as default options (Blumenstock et al. 2018; Breza et al, 2020), Third, value-chain financial arrangements can provide an increase in the *cost* of deviating from commitment: punishment can concern the domain of the value chain (e.g. a threat to no longer purchase from the supplier), as well as the financing domain (Casaburi and Macchiavello, 2019).

Value chain finance can also be used to default recipients into beneficial actions. The classic example, championed by Richard Thaler, is of employers defaulting their new employees into saving for retirement in the United States, by setting up such contributions automatically at hiring. Such “nudging” is widely employed by government policy teams, as well as by firms themselves (both to the gain and to the detriment of the consumer). Given their control of the revenue stream, such nudges could be used by value chain partners to encourage various potentially beneficial behaviors, such as saving, spending on preventative health services.

Trust

Trust is a fundamental factor in the decision to adopt a financial service. For instance, Cole and Xiong (2017) highlight its importance in the context of agricultural insurance: farmers may be skeptical about new products, which feature a lot of details they may not fully understand, and which place a lot of moral hazard temptation on the side of the financial service provider. Value chain relationships may help assuage these trust concerns. New consumers may be more likely to take up a financial service if their value chain partner provides it, or at least endorses it. For example, Casaburi and Macchiavello (2019) discuss why large, established milk buyers can provide infrequent payments to small dairy farmers: due to reputational concerns, they can resist the temptation to run away with the payments they are holding. In contrast, small, itinerant traders would not resist such temptation and thus cannot be trusted.

3.3. Benefits and costs for value chains

The above subsection considered the benefits of value chain microfinance for financing, which, if partially internalized, could explain why a value chain partner might wish to provide it or help facilitate it. The other class of reasons is that the financing might directly increase the surplus generated from the value chain relationship, which the partner might be able to partially internalize. We also consider potential costs that the provision of financial services may introduce.

First, offering financial services to potential value-chain partners (e.g., offering crop insurance in a contract farming scheme) may raise their surplus from joining the value chain and thus expand the volume of relationships. It may also increase the resilience of existing value chain relationships – including the onwards relationship, with the ability of the buyer to honor their onwards contracts often a key failing point – by enabling partners to weather episodes of financial distress which might otherwise have forced them to exit or default on the relationship. As emphasized in the trade credit literature, providing financial services with different terms may also represent a form of price discrimination, thus inducing a redistribution of surplus across the parts, and, possibly, an increase in efficiency. Under imperfect contract enforcement, however, the provision of additional financial services may also have important drawbacks. For instance, if a crop buyer increases the amount of credit provided to producers at the beginning of the crop seasons, the temptation to default (side-sell) at harvest time will be larger (see, e.g., Barrett et al., 2012). Blouin and Macchiavello (2019) consider a similar trade-off when considering whether to provide price insurance.

Second, if the value chain microfinance increases the output of the recipient, and the partner firm is a partial claimant on that output, then they will also gain from that increase in productivity. For example, if suppliers are severely credit constrained, and buyers have some market power, then supplying credit to farmers may increase production, generating additional profits for those buyers/lenders. Buyers' provision of inputs on credit, e.g., seeds or fertilizers, may also allow them to have tighter control over

the quality and quantity of inputs used by the farmers (Bold et al., 2017), generating further benefits. Indeed, such financing may be essential for small producers to upgrade their quality to meet the standards required to enter global value chains (Ashraf et al. 2009). Working with groundnut producers in Senegal, Bernard et al., (2023) introduced a bundled contract – offering credit, price premium certainty, and training – which enabled farmers to achieve international quality standards.

Third, when value chain partners are trying to break into new markets, the existing networks and social capital of MFIs can be invaluable. For instance, Barefoot Power, which sold solar lanterns to villagers in Uganda, faced low repayment rates when offering lanterns on credit. However, repayment rates improved significantly when they collaborated with locally owned savings and credit cooperatives (SACCO) to finance solar lighting projects in villages. The sales force works with the village leadership to secure funding from the SACCO, the manufacturer receives immediate payment upon installation, the village receives much-needed lighting, and the SACCOs generate profits. Because of the SACCO's community tie-in, repayment issues were in large part mitigated (Breitbach 2017). Therefore, this relationship is two-way, sometimes value chain actors help MFIs in enforcement while in other scenarios MFIs bring in contextual knowledge and expertise to better design and enforce the financial part of the transaction.

One potential cost of tying financial and value chain contracts is important to highlight. While tying the contracts can harness the bargaining power a partner has over one domain to help enforce a contract on the other domain, there is a risk that they develop too much power in the relationship, leading to exploitation. This is a theme in the literature on the interlinking of agricultural contracts (Bhaduri 1983; Bardhan, 1984), where the classic example is of a landowner lending to their tenant or worker, at high interest rates, and then using the tenant's resulting indebtedness to exploit them. Given the power asymmetries that often exist between large buyers and small suppliers in global value chains (Abdulsamad 2015), with large buyers often delaying payments and holding up small producers, this is a risk to be taken seriously.

4. Recent empirical examples of value chain microfinance

In this section, we highlight papers that speak to the promise and potential pitfalls of value chain microfinance and the financial innovations that it can enable. This literature has recently flourished due to multiple factors, including: an increase in fieldwork with firms in developing countries and an associated appreciation of their complex contracting arrangements; a proliferation of value chains and an understanding of their importance for increasing productivity; and a rapid expansion in digital services and platforms which open new possibilities for tying financing to value chain contracts. The specific settings studied by the highlighted papers span the value chain relationships outlined in Section 2.1 and many of the financial products outlined in Section 2.2. They also cover multiple sectors, including agriculture, manufacturing, and retail.

4.1. Credit and equity

Credit is arguably the most common financial service provided along the value chain.⁴ In the agricultural context, a large literature has investigated contract farming, defined as “an agreement between one or more farmer(s) and a contractor for the production and supply of agricultural products under forward agreements, frequently at predetermined prices” (Eaton and Shepherd, 2001). Bellemare and Bloem (2018) provide a recent review, which highlights that most published studies find a positive impact on productivity and income, but also raises important caveats. Credit provision between the contract and the farmer is a common feature in these arrangements. Arouna et al. (2021) finds a large effect of being offered a contract farming contract in the Benin rice value chain, but finds little effect of whether it has a loan bundled with it. Related to the insurance discussion below, they argue that the price insurance inherent in their contract (fixed price) was an important part of the effect. Relatedly, Deutschmann et al. (2022) find a large effect of One Acre Fund’s bundled input credit, insurance, and training package on the yields and productivity of maize farmers in Kenya but cannot isolate the importance of the financing. Demonstrating both the productivity benefits of value chain credit but also the challenges it can face, Macchiavello and Morjaria (2021) consider the coffee value chain in Rwanda. They show that when mills face competition, and hence farmers face the temptation to default on relational contracts, mills offer less credit to farmers and farmers are in turn less productive.

Value-chain financing also often takes place between producers and farm-gate traders or small-scale buyers. For instance, Casaburi and Reed (2022) suggests that, in response to an experimental increase in the resale price, farmgate traders in the Sierra Leone cocoa sector use advance payments (i.e., loans provided before harvest) as a competition device. Ghani and Reed (2022) shows that, in Sierra Leone, companies providing inputs and purchasing from fishing firms use trade credit as a tool to prevent entry of new competitors. Emran *et al.* (2021) shows that a ban on financing intermediaries in the edible oil value chain in India led to increases in downstream prices.

Asset financing has seen substantial recent innovation. Cordaro et al. (2022) considers a case in which a producer offers asset financing to its micro-distributors for them to purchase a productive asset. Crucially, since the producer knows the sales of its distributors, the asymmetric information problem which typically plagues performance-linked repayments can be overcome. The producer they partner with is a large chewing gum producer in Kenya, who wishes to help their micro-distributors finance a bicycle to increase their distribution activities relative to traveling on foot. The producer partners with an MFI that offers the actual financing – external value chain finance – using data shared by the producer to operationalize the performance-based contracts.

The authors run a randomized controlled trial to compare a traditional debt contract to three alternatives: an equity-like contract, a hybrid contract, and an index insurance contract. They find that

⁴ While we focus on developing countries, value chain finance is a major source of finance for small firms in industrialized countries, too. For example, in the United States, trade credit represented 60% of external finance for small businesses (Mach and Wolken, 2006)

the two performance-contingent contracts (equity and hybrid) outperform the debt contract in several key respects. First, they find no evidence that individuals assigned to performance-contingent payments move away from the activity in which they are being taxed; to the contrary, they actually find that they *increase* the proportion of their selling activities in chewing gum compared to individuals assigned to the debt contract. Further, there are large positive impacts of the performance-contingent contracts on micro-distributor profits. Specifically, in intent-to-treat terms, they found an increase in monthly profits of US\$34 for individuals assigned to the hybrid contract, on a control mean of US\$11. The producers presumably also benefit from this large increase in sales, pointing towards another justification for the financial and value chain contracts to be related.

In another instance of supply chain microfinancing, this time in the dairy industry in Kenya, recent work by Jack et al. (2023) has shown the promise of self-collateralized asset loans. While self-collateralized loans are common in developed economies for the acquisition of large assets, including houses, vehicles, and business equipment, they are less common in developing countries. Working in the context of a credit program in which a dairy cooperative in central Kenya offered smallholder dairy farmers loans to purchase rainwater harvesting tanks, Jack et al. (2023) randomly assigned farmers to receive loan offers that had differing security features, but otherwise identical loan amounts and interest rates. The status quo group was offered the standard loan traditionally offered by the dairy cooperative, which required borrowers to secure one-third of the loan with security deposits and find guarantors to co-sign for the remaining two-thirds and to back this with cash or shares in the cooperative (joint liability). Among this first group, only 2.4% took a loan for a tank. In the other groups, the loans were either partially (75%) or fully (96%) collateralized with the tank itself. Take-up was much higher in these self-collateralized groups, increasing to 44.3% in the fully collateralized group, with little evidence of meaningful differences in repayment.

In related work, Carney et al. (2022) provide further rationale for self-collateralized loans. They argue that the endowment effect—the phenomenon whereby owning a good increases one’s valuation of it— inhibits demand for loans which use a borrower’s existing assets as collateral. Self-collateralized loans, however, do not suffer from this constraint on demand, as at the time of purchase the borrower has not yet formed an attachment to the good. This argument relies on a form of naivete: borrowers initially perceive that they have little to lose when offered a self-collateralized loan, but subsequently come to develop an attachment to the new asset, resulting in high repayment effort. In a field experiment in Kenya, the authors find evidence for such naivete, and find that borrowers are willing to pay 9% per month higher interest for self-collateralized loans compared to loans collateralized with otherwise equivalent assets, despite subsequent default rates being the same in the two cases.

In another innovation in the collateralization of asset-based loans, Gertler et al. (2021) study “digital collateral”, a technology which relies on lockout technology to allow the lender to temporarily disable the flow value of the collateral to the borrower without physically repossessing it. They partner with Fenix International, the largest solar-home system (SHS) provider in Uganda. The SHS provides a household with access to a modest amount of electricity without being connected to the grid. Fenix sells most of its units through a pay-as-you-go model, under which customers make a small down

payment, less than 10 US dollars, to take possession of the SHS, and subsequently make small (usually daily or weekly) payments using mobile money until they have paid off the loan. If a customer does not make a payment on time, the SHS will lock remotely (i.e., the battery will not discharge electricity) until the next payment is made – akin to “repossessing” the self-collateral, but temporarily and at essentially zero cost.

Fenix uses this lockout technology not only for the original financing of the SHS but also for follow-up loans they offer to good payers, where the SHS is re-used as digital collateral to secure the loan. The sale of their SHS system gives Fenix a permanent technological advantage relative to third-party MFI providers. In their study, Gertler et al. (2021) focus on their most popular follow-up product, a cash loan that is offered to customers near the beginning of each school term when school fees are due. They conduct an RCT comparing a loan using this digital collateral to an uncollateralized loan and find it results in slightly lower take up (45% vs 51%) but substantially higher repayment rates (an increase of 11p.p.), with one-third of this effect due to adverse selection and two thirds moral hazard. As a result, it increased the (annualized) internal rate of return on the loans by 38 pp. M-COPA, a firm in Kenya, uses a similar digital collateral model with solar lanterns. Fenix also piloted bundling health insurance from a firm called Turaco with their basic product. The pilot demonstrated promise in terms of increasing enrollment in health insurance, but also the challenge of aligning incentives and expectations of the value chain partner and the financial institution (CENFRI 2021)

4.2. Savings

Value chain relationships may also be harnessed to facilitate or encourage saving. Recent work provides several examples, highlighting different channels through which VCMF could help savings.

Most obviously, directing payments from one partner to the other into a formal account may give access to and encourage usage of formal accounts, which has proved challenging across multiple settings (Dupas et al., 2018). Such a shift from cash into digital payments may allow the recipient to circumvent sharing norms which have been shown to be a key constraint on enterprise growth. Riley (2023) shows, in the case of microfinance loans to female entrepreneurs, disbursing loans on mobile money rather than in cash improved the performance of female-owned enterprises, leading to 11% higher levels of business capital, 15% higher business profits, and higher income and consumption eight months later. Breza et al. (2020) evaluates experimentally the introduction of payroll accounts for garment workers in Bangladesh and finds that the treatment increases savings and workers’ ability to cope with adverse shocks. Blumenstock et al. (2018) shows large effects of *defaulting* Afghan workers into salary-linked saving accounts on the likelihood that workers use such accounts.

Value chain relationships provide income flows which often do not match income and consumption needs. As such, they can necessitate consumer financing. One such financial need is that of financing lumpy expenditures. Historically, many labor-market institutions may have helped workers achieve

saving goals, like saving for special occasions. Examples include Thirteenth Salaries, which employers pay in December, shortly before end-of-year festivities, and Eid Bonuses, paid ahead of Eid-al-Fitr. In the context of employer-employee relationships, Brune et al. (2021) shows that deferring part of the wage for three months allows workers of a large agricultural employer in Malawi to increase savings and, two years later, to increase durable consumption (home improvements). Casaburi and Macchiavello (2019) focuses on buyer-seller relationships in the Kenyan milk industry. The paper finds evidence that small dairy producers prefer to receive payments for their milk at low frequencies (once a month) and they are willing to incur a sizable price reduction when doing so. Demand for “tying their hands” at substantial costs suggests that farmers value the commitment that infrequent payments offer.

Casaburi and Macchiavello (2019) also emphasizes two other reasons why VCMF may facilitate savings. First, workers and sellers will be able to accept payment deferrals only from trusted counterparts, like in long-standing value-chain relationships. On the flip side, under poor contract enforcement, only a small number of players may be able to credibly provide deferred or infrequent payments, potentially limiting competition on these margins and generating rents. First, bundling output-market (or labor-market) contracts with financial relations may increase the commitment property of the saving provision: if a seller deviates from the agreed monthly payments and starts selling to other buyers against daily payments, a buyer can threaten not only to stop paying on a monthly basis in the future but also to stop buying the seller’s product at all.

4.3. Insurance

Selling insurance to smallholder farmers is notoriously difficult (Cole et al. 2013), yet recent papers have shown how value chain relationships can be exploited for this purpose. Casaburi and Willis (2018) argue that farmers value the risk reduction of insurance, but the standard timing of crop insurance – under which the premium is paid at planting, and any payout at harvest – undermines demand for it. Working with a contract farming company with sugarcane farmers in Kenya, they compare demand for standard crop insurance to demand for pay-at-harvest insurance, in which the premium is not due until harvest time, finding demand increases from 5% to 72%.

Of course, changing the premium payment until harvest time introduces default risk – the risk that the farmer refuses to pay in the good state of the world. Here they exploit the contract farming value chain, bundling the insurance contract with the contract farming contract to deduct the premium from farmers revenues at harvest time, as the company already does with input loans. In ongoing work, the authors are hoping to adapt the pay-at-harvest model to settings where enforcement remains a challenge - for example because of side-selling concerns - by tying the insurance product with other enforcement mechanisms such as digital collateral (Gertler and Wolfram 2021), or by allowing farmers to pay for premiums directly from revenues from the previous harvest.

The insurance product offered in Casaburi and Willis (2018) was based upon both an area-yield index and farmers' own yields, which the contract farming company knows as part of its normal operations, pointing to an informational advantage in addition to the enforcement advantage, relative to third party financiers. However, the contract farming company is likely at a disadvantage relative to third parties in terms of risk exposure, making it a compelling setting for external value chain finance – insurance payouts are made when yields are low, which is precisely when the company themselves may have cash flow problems. Indeed, the paper highlights the implications of the company defaulting when contracts are tied: if the company defaults on the value chain agreement, as it effectively did for half the farmers in the sample (for reasons unrelated to the insurance product), then it also defaults on the insurance.

Contract farming companies often also implicitly provide price insurance to their farmers, by signing fixed-price contracts at planting time. Arouna et al. (2021), who ran an experiment in Benin to measure the impact of contract farming on rice farmers, argue that this price insurance is very valuable for farmers, and that reduction in price risk is the main driver of the substantial increases in areas cultivated and yields that they find. However, Blouin and Macchiavello (2019) study a potential cost of tying price insurance to a contract farming contract, which also applies to the pay-at-harvest product discussed above. Namely, if there is a risk of side-selling – farmers not honoring the contract at harvest time and instead selling to other buyers – then such forward sales contracts can be vulnerable to strategic default: farmers sell to the buyer when the agreed price is higher than the market price, and side sell when it is lower.

5. Conclusion and future directions of value chain microfinance

In this paper, we have considered the relevance of value chain finance, which is typically discussed in formal value chains in developed countries, for common microfinance settings. We considered the rationales for the emergence of such value chain microfinance, and discussed several VCMF services—including credit, savings, insurance, and equity – covering a wide range of relationships – including buyer-producer, retailer-consumer, and employer-employee.

A recent body of empirical research has used experimental and quasi-experimental methods to study the demand for and impacts of VCMF. This expanding collection of work has delivered important insights on VCMF, including demonstrating the promise of new financial products that academics have helped to conceive and design. Yet, in our assessment this literature is still at an early stage. For example, many of the novel VCMF products discussed in the review were rigorously evaluated in only one or few countries, and at limited geographic scale and time horizon. Therefore, a first important avenue for future work is replication and scaling up.

In addition, there are many important areas of VCMF that have received little attention in academic work. We highlight three that we find particularly exciting. First, the establishment of VCMF

arrangements is likely to generate important general equilibrium effects. For example, if a buyer provides credit or insurance to producers, enabling them to buy inputs and expand production, this may affect not only input and output market prices, but also other (non-value chain) financial institutions operating in the region, possibly reducing demand for their services and thus affecting interest rates and other financial terms. As such VCMF arrangements may generate indirect effects on players who do not enter such arrangements, but who are operating in the same market, with implications for poverty and inequality. Illustrating such equilibrium effects would need experimental designs “at scale” (Muralidharan and Niehaus, 2017).

Second, many stakeholders are excited about the role of blockchains in the agricultural sector of developing countries (FAO, 2019; UNDP, 2021). The use of blockchains – or even simply the proliferation of digital platform services that do not rely on blockchains – may have transformative effects on agricultural value chains, for example by enabling traceability, credit provision, and the emergence of more advanced financial services along the value chain (e.g., escrow services). However, to the best of our knowledge, rigorous evaluations of blockchain and/or platform innovations related to VCMF are scant.

Third, recent work has studied the impact of land misallocation on aggregate agricultural productivity (see, e.g., Restuccia and Santaaulalia-Llopis, 2023; Gollin and Udry, 2021; Acampora et al., 2022). Several results in this literature suggest that land market frictions often hinder reallocation of land toward more productive farmers. Financing constraints are an important example of such frictions. Productive farmers may not be able to expand their farm size, through land purchases or rentals, if they cannot secure credit to make upfront payments to other landowners. VCMF may play a role in overcoming such frictions. Crop buyers (e.g., contract farming companies) have arguably better information than many on farm size, technology adoption, and productivity of farmers in their catchment area. These buyers could therefore provide credit to those farmers who can make the most from expanding cultivation, and they would benefit from favoring such land reallocation.

References

- Abdulsamad, A., Frederick, S., Guinn, A., & Gereffi, G. (2015). Pro-Poor Development and Power Asymmetries in Global Value Chains. Technical report.
- Acampora, M., Casaburi, L., & Willis, J. (2022). Land rental markets: Experimental evidence from Kenya. NBER working paper.
- Antras, Pol, and Davin Chor. 2022. “Global Value Chains.” Handbook of International Economics. Vol. 5. Elsevier.
- Antràs, P., & Foley, C. F. (2015). Poultry in Motion: A Study of International Trade Finance Practices. *Journal of Political Economy*, 123(4), 809–852.
- Arouna, A., Michler, J. D., & Lokossou, J. C. (2021). Contract farming and rural transformation: Evidence from a field experiment in Benin. *Journal of Development Economics*, 151, 102626.
- Ashraf, N., Karlan, D., & Yin, W. (2006). Tying Odysseus to the Mast: Evidence From a Commitment Savings Product in the Philippines. *The Quarterly Journal of Economics*, 121(2), 635–672.
- Ashraf, N., Giné, X., & Karlan, D. (2009). Finding Missing Markets (And a Disturbing Epilogue): Evidence from an Export Crop Adoption and Marketing Intervention in Kenya. *American Journal of Agricultural Economics*, 91(4), 973–990.
- Banerjee, A. V. (2001). Contracting constraints, credit markets and economic development. *Credit Markets and Economic Development*.
- Bardhan, P.K., 1984. *Land, labor, and rural poverty: Essays in development economics*. Columbia University Press.
- Barrett, C.B., Bachke, M.E., Bellemare, M.F., Michelson, H.C., Narayanan, S. and Walker, T.F., 2012. Smallholder participation in contract farming: comparative evidence from five countries. *World development*, 40(4), pp.715-730.
- Bell, C. (1988). Credit markets and interlinked transactions. *Handbook of Development Economics*, 1, 763–830.
- Bellemare, M. F., & Bloem, J. R. (2018). Does contract farming improve welfare? A review. *World Development*, 112, 259–271.
- Bergquist, L. F., McIntosh, C., & Startz, M. (2021). Search cost, intermediation, and trade: Experimental evidence from Ugandan agricultural markets. Working paper.
- Bernard, T., Deutschmann, J. W., & Yameogo, O. (2023). Contracting and quality upgrading: Evidence from an experiment in Senegal. Working Paper.
- Bhaduri, A., 1983. The economic structure of backward agriculture.

- Blouin, A., & Macchiavello, R. (2019). Strategic default in the international coffee market. *The Quarterly Journal of Economics*, 134, 895–951.
- Blumenstock, J., Callen, M., & Ghani, T. (2018). Why Do Defaults Affect Behavior? Experimental Evidence from Afghanistan. *American Economic Review*, 108(10), 2868–2901.
- Bold, T., Kaizzi, K. C., Svensson, J., & Yanagizawa-Drott, D. (2017). Lemon technologies and adoption: Measurement, theory and evidence from agricultural markets in Uganda. *The Quarterly Journal of Economics*, 132(3), 1055–1100.
- Boudreau, L., Cajal-Grossi, J., & Macchiavello, R. (2023). Global Value Chains in Developing Countries: A Relational Perspective from Coffee and Garments. *Journal of Economic Perspectives*, 37(3), 59–86.
- Breitbach, T. (2017). Supply Chain Financing in Developing Countries. Ph.D. thesis.
- Breza, E., Kanz, M., & Klapper, L. F. (2020). Learning to Navigate a New Financial Technology: Evidence from Payroll Accounts. NBER Working Paper.
- Brune, L., Chyn, E., & Kerwin, J. (2021). Pay Me Later: Savings Constraints and the Demand for Deferred Payments. *American Economic Review*, 111(7), 2179–2212.
- Bulte, E., Cecchi, F., Lensink, R., Marr, A., & van Asseldonk, M. (2020). Does bundling crop insurance with certified seeds crowd-in investments? Experimental evidence from Kenya. *Journal of Economic Behavior & Organization*, 180, 744–757.
- Cai, J., Meki, M., Quinn, S., Field, E., Kinnan, C., Morduch, J., & Said, F. (2023). Microfinance. *VoxDevLit*, 3(2), 26.
- Carney, K., Kremer, M., Lin, X., & Rao, G. (2022). The endowment effect and collateralized loans. NBER Working Paper.
- Casaburi, L., & Macchiavello, R. (2019). Demand and supply of infrequent payments as a commitment device: Evidence from Kenya. *American Economic Review*, 109, 523–555.
- Casaburi, L., & Reed, T. (2022). Using individual-level randomized treatment to learn about market structure. *American Economic Journal: Applied Economics*, 14, 58–90.
- Casaburi, L., & Willis, J. (2018). Time versus State in Insurance: Experimental Evidence from Contract Farming in Kenya. *American Economic Review*, 108(12), 3778–3813.
- CENFRI. (2021). Managing the complexities of insurance partnerships: A case study on Turaco and Fenix International in Uganda. Technical report.
- Chen, C., Restuccia, D., & Santaaulàlia-Llopis, R. (2023). Land misallocation and productivity. *American Economic Journal: Macroeconomics*.

- Cole, S., Giné, X., Tobacman, J., Topalova, P., Townsend, R., & Vickery, J. (2013). Barriers to Household Risk Management: Evidence from India. *American Economic Journal: Applied Economics*, 5(1), 104–135.
- Cole, Shawn and Wentao Xiong. 2017. "Agricultural Insurance and Economic Development". *Annual Review of Economics*. 9:1, 235-262
- Cordaro, F., Fafchamps, M., Mayer, C., Meki, M., Quinn, S., & Roll, K. (2022). Microequity and mutuality: Experimental evidence on credit with performance-contingent repayment. Working Paper 30411, National Bureau of Economic Research.
- De Brauw, A., & Bulte, E. (2021). *African farmers, value chains and agricultural development*. Springer International Publishing.
- De Brauw, A., & Swinnen, J. (2023). Building inclusive value chains for smallholders: The role of finance. In *Handbook of Microfinance, Financial Inclusion and Development*.
- De Quidt, J., Fetzer, T., & Ghatak, M. (2018). Market structure and borrower welfare in microfinance. *The Economic Journal*, 128(610), 1019–1046.
- Demirguc-Kunt, A., & Maksimovic, V. (2001). Firms as financial intermediaries: Evidence from trade credit data. *World Bank Policy Research Paper*.
- Deutschmann, J. W., Duru, M., Siegal, K., & Tjernström, E. (2022). Relaxing multiple agricultural productivity constraints at scale. Working Paper.
- Dupas, P., Karlan, D., Robinson, J., & Ubfal, D. (2018). Banking the unbanked? Evidence from three countries. *American Economic Journal: Applied Economics*, 10(2), 257–297.
- Eaton, C., & Shepherd, A. (2001). *Contract farming: Partnerships for growth*. Food & Agriculture Organization.
- Emran, M. S, Mookherjee, D., Shilpi, F., & Uddin, M. H. (2021). Credit Rationing and Pass-Through in Supply Chains: Theory and Evidence from Bangladesh. *American Economic Journal: Applied Economics*, 13(3):202-36.
- Ferris, J. S. (1981). A Transactions Theory of Trade Credit Use. *Quarterly Journal of Economics*, 94, 243–270.
- Fisman, R., & Love, I. (2003). Trade credit, financial intermediary development, and industry growth. *The Journal of Finance*, 58(1), 353–374.
- Gereffi, G. (2018). *Global Value Chains and Development: Redefining the Contours of 21st Century Capitalism*. Cambridge University Press.
- Gertler, P., Green, B., & Wolfram, C. (2021). Digital collateral. NBER Working Paper.
- Ghani, T., & Reed, T. (2022). Relationships on the rocks: Contract evolution in a market for ice. *American Economic Journal: Microeconomics*, 14, 330–365.

- Gollin, D., & Udry, C. (2021). Heterogeneity, measurement error, and misallocation: Evidence from African agriculture. *Journal of Political Economy*.
- Hussam, R., Rigol, N., & Roth, B. N. (2022). Targeting High Ability Entrepreneurs Using Community Information: Mechanism Design in the Field. *American Economic Review*, 112(3), 861–898.
- IFAD. (2012). Agricultural value chain finance strategy and design. Technical note.
- Jack, W., Kremer, M., de Laet, J., & Suri, T. (2023). Credit access, selection, and incentives in a market for asset collateralized loans: Evidence from Kenya. *The Review of Economic Studies*.
- Karlan, D., Mullainathan, S., & Roth, B. N. (2019). Debt Traps? Market Vendors and Moneylender Debt in India and the Philippines. *American Economic Review: Insights*, 1(1), 27–42.
- Klapper, L. (2006). The role of factoring for financing small and medium enterprises. *Journal of Banking Finance*, 30(11), 3111–3130.
- Klapper, L., Laeven, L., & Rajan, R. (2012). Trade Credit Contracts. *The Review of Financial Studies*, 25(3), 838–867.
- KIT and IIRR. (2010). Value chain finance: Beyond microfinance for rural entrepreneurs. Technical report.
- Mach, T.L. and Wolken, J.D., 2006. Financial services used by small businesses: Evidence from the 2003 Survey of Small Business Finances. *Federal Reserve Bulletin*, 92(Oct), pp.167-195.
- Macchiavello, R., & Morjaria, A. (2021). Competition and Relational Contracts in the Rwanda Coffee Chain. *The Quarterly Journal of Economics*, 136, 1089–1143.
- Meltzer, A. H. (1960). Mercantile Credit, Monetary Policy, and Size of Firms. *Review of Economics and Statistics*, 42, 429–437.
- Mian, S. L., & Smith Jr, C. W. (1992). Accounts receivable management policy: Theory and evidence. *The Journal of Finance*, 47(1), 169–200.
- Morduch, J. (1999). The Microfinance Promise. *Journal of Economic Literature*, 37(4), 1569–1614.
- Muralidharan, K., & Niehaus, P. (2017). Experimentation at scale. *Journal of Economic Perspectives*.
- Petersen, M. A., & Rajan, R. G. (1997). Trade credit: Theories and evidence. *The Review of Financial Studies*, 10(3), 661–691.
- Ray, D. (1998). *Development economics*. Princeton University Press.
- Riley, E. (2022). Resisting Social Pressure in the Household Using Mobile Money: Experimental Evidence on Microenterprise Investment in Uganda. Working paper.
- Schwartz, R. A. (1974). An Economic Model of Trade Credit. *Journal of Financial and Quantitative Analysis*, 9, 643–657.

Smith, J. (1987). Trade Credit and Information Asymmetry. *Journal of Finance*, 4, 863–869.

Sylvester, Gerard. *E-agriculture in action: blockchain for agriculture, opportunities and challenges*. FAO, 2019.

Tinsley, E., & Agapitova, N. (2018). Private Sector Solutions to Helping Smallholders Succeed. World Bank.

Udell, G. F., Bakker, M.-R., & Klapper, L. (2004). Financing Small and Medium-Size Enterprises with Factoring: Global Growth and Its Potential in Eastern Europe. The World Bank.

UNDP. 2021. Blockchain for Agri-Food Traceability, UNDP report

USAID. (2009). FS series #5: Value Chain Finance. Technical report.

World Bank. (2019). World development report 2020: Trading for development in the age of global value chains. The World Bank.