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**On the Institutional Details that Mediate the Impact of Cash Crops on Food Crop
Intensification: The Case of Cotton**

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Abstract: The surge in basic food commodity prices in 2007/08 and again in 2011, have led to a renewed focus among governments and donors on agricultural growth, especially in staple food production in Sub-Saharan Africa. It is widely agreed that smallholder-led agricultural growth would contribute most to improved food security and reduced poverty. Yet, how to achieve broader and more sustainable access by smallholder farmers to productivity enhancing inputs for food crop production remains a largely unsolved riddle. In light of the great institutional diversity across cotton sectors in Sub-Saharan Africa, this study investigates whether cotton market structures can be used to spur the intensification of smallholder food production. Especially, it examines how the particular institutional structure of a cotton sector might affect its ability to spur such growth in food crop intensification and productivity. With this aim, a conceptual framework linking cotton institutional structures to food crop intensification is first developed. Drawing on the literature, country experience is then reviewed and predictions from the conceptual framework are compared with empirical evidence.

Keywords: Intensification, institutional details, cotton, food crops, conceptual framework

1. Introduction

The worldwide food price crises of 2007-08 and 2011, and continuing high prices for most agricultural commodities to this day, have led to a renewed focus among governments and donor agencies on agricultural growth, especially growth in staple food production and especially in Sub-Saharan Africa (SSA). There is widespread agreement that growth in smallholder agriculture, if it can be achieved, will result in the broadest-based growth that contributes most to improved food security and reduced poverty¹. It is also widely agreed that achieving such growth requires much broader access by smallholders to improved input packages – especially improved seed and fertilizer - and to the technical advice needed to use them properly.

Yet how to achieve broad and sustainable access by smallholder farmers to productivity enhancing inputs for food crop production remains a largely unsolved riddle. From the 1960s through the mid-1980s, and well beyond this time for some countries of SSA (e.g. Malawi), the main approach to spurring such access relied on state-controlled enterprises distributing fertilizer (and, to varying degrees, other inputs such as improved seeds) at subsidized prices. In one dimension, this approach was dramatically successful: FAO data indicates that total fertilizer use in SSA increased by a factor of five between 1961 and 1980. Yet per capita agricultural production remained essentially unchanged during this period (Wik, Pingali, and Broca, 2008), and cereal yields increased slower in SSA than in any other area of the world. Meanwhile, the limits of this model's financial sustainability became apparent even before the start of input market reform in the mid-1980s; after peaking in 1980, total fertilizer use on the continent dropped sharply and then stagnated until at least the late 2000s, even as rural populations and areas cultivated continued to grow (Minot and Benson, 2009).

After a period of sharply reduced subsidies and sporadic attempts at more systematic development of private sector input distribution systems, the past 10 years have seen a dramatic renewal in the use of input subsidies focused on staple grain production. Most of the current programs claim the “smart” subsidy label, implying an attempt to avoid the failures of the earlier state-implemented programs by featuring collaboration with private sector². There is evidence that some of these programs have succeeded in increasing production and yields of selected staple grains among smallholder farmers for some period of time (Druilhe and Barreiro-Hurlé 2012). Yet the dimensions of any success are far from agreed, as for example the apparent dramatic rise in maize production in Malawi in the late 2000s was belied by high prices and shortages in market supply during the very years of claimed large surpluses (Ellis and Manda, 2012; Jayne and Tschirley, 2009; Jayne et al, 2008).

Major questions have also been raised about the financial sustainability of the programs and about their impact on the development of the private sector input distribution systems that are the only robust, long-run solution to the problem. Ricker-Gilbert, Jayne, and Shively (2013) report that seven countries

¹ See Christiansen, Demery and Kuhl (2011) for a broad empirical confirmation of what some have called this “conventional wisdom.” Writers such as Collier and Dercon (2009) and Ellis (2005) primarily question the feasibility of achieving such growth, not the desirability of such growth *per se*. The cost and logistical complexity of achieving it is at the core of their critique.

² See Morris et al (2007) for more detail on the characteristics of “market-smart” input subsidy programs.

of SSA spent approximately US\$2 billion per year in the late 2000s on fertilizer subsidies, with the delivered cost of that fertilizer averaging about US\$950/metric ton – an extraordinarily high cost compared to private sector distribution channels. Minot and Benson (2009) note that today's programs, many based on input vouchers, suffer from some of the same problems of the earlier unsustainable centralized subsidy programs, including late delivery of fertilizer, displacement of private sector input dealers, and very high total costs of the programs. Ricker-Gilbert and Jayne (2008) estimate the effect on purchases from private dealers among farmers receiving the fertilizer subsidy in Malawi. They conclude that, for every 100 kg of subsidized fertilizer distributed in the system, demand for private fertilizer falls by 61 kg; this represents a large displacement of private input dealers, with worrisome implications for farmers' long-term access to affordable inputs.

In this study we ask whether cash cropping structures in SSA can be used to spur the intensification of smallholder food production at lower cost, and with greater positive impact on the development of sustainable private input distribution channels, than has generally been the case even with the new "smart subsidies." We focus on cotton because it is by far the most widely produced cash crop by African smallholder farmers; more than 2 million smallholder farmers, supporting at least 10 million people, depend on it as their main source of cash income (Tschirley, Poulton, and Labaste, 2009³). More specifically, and in light of the great institutional diversity across cotton sectors on the continent, we ask how the particular institutional structure of a cotton sector might affect its ability to spur such growth in food crop intensification and productivity. We suggest that the framework has relevance beyond cotton, as it depends not on characteristics of the crop itself but on the institutional structure in which it is grown and marketed – structures which are known to exist also for some other cash crops.

Our paper makes two contributions to the literature. First, it explicitly examines, in comparative fashion, the institutional details that might allow cash crop production to make a sustainable contribution to food crop intensification. We know of no other study that unpacks the institutional story in comparative fashion as we do⁴. Second, we extend to the food crop question the cotton sector typology first developed by Poulton et al (2004) and further developed by TPL (2009) and Tschirley et al (2010). No study has yet elaborated on the implications of these structures for food crop intensification.

The paper proceeds as follows. First we draw on previous research to highlight the range of institutional structures governing cotton production in SSA and to show how these structures drive cotton sector performance. We then develop a conceptual framework for linking cotton institutional structures to the challenge of promoting food crop intensification; the framework consists of (a) a typology of impact pathways from cotton to food crop intensification and productivity, and (b) predictions as to the impact of varying cotton sector institutional structures on the likelihood that a given pathway will exist and be sustainable. We then draw on literature to review country experience and assess whether available evidence supports the expectations that we have developed in our conceptual framework. The final

³ Since we cite this work frequently, we will henceforth refer to it as TPL.

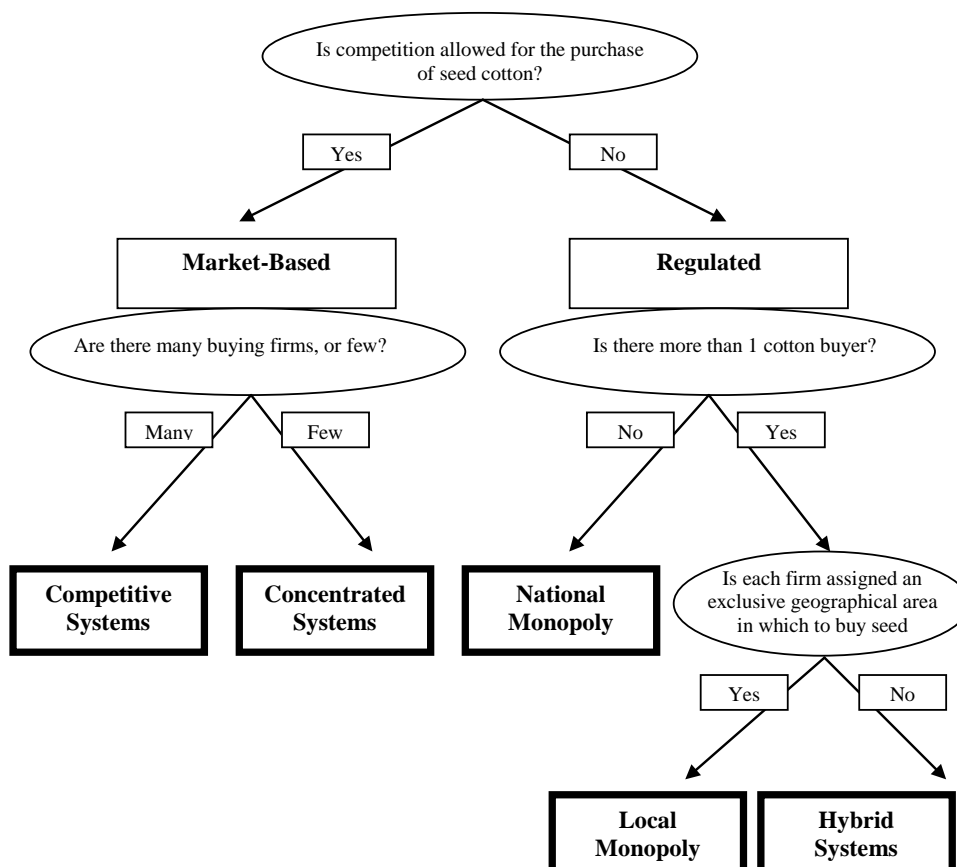
⁴ Jayne, Yamano, and Nyoro called in 2004 for "more research to help identify the institutional details of (sustainable and) workable strategic partnerships between cash crop firms, outgrower farmers, and government." As will be seen below, several authors explore the impacts of particular institutional setups, none in a comparative framework.

section concludes a brief assessment of the framework's performance against evidence, and initial suggestions regarding policy implications and need for additional research.

2. Institutional Structures Governing Cotton Production in SSA

TPL (2009) and Tschirley et al (2010), building on Poulton et al (2004), identified five types of cotton sector on the African continent, based on the structure of the market for the purchase of seed cotton (the cotton as produced by farmers) and the regulatory framework in which firms operate. Figure 1 lays out the typology in a decision-tree framework. The typology is first based on a distinction between “market-based” and “regulated” sectors, with the latter referring to sectors in which free competition for seed cotton purchase is not allowed. The second distinction is based on the number of buyers of seed cotton -- “many” or “few” in the case of market-based systems, and one or more than one in regulated systems. These two distinctions generate four sector types: 1) national monopolies, 2) regional monopolies, 3) concentrated market-based systems, and 4) competitively structured systems. A fifth category, hybrid market structures, captures the sectors that cannot be classified into one of the four main types. Out of nine countries studied by Tschirley et al, two were classified as hybrids.

Figure 1. Cotton sector typology in decision tree framework



Source: TPL (2009)

Broadening our view beyond those nine countries, we note that in Cameroon, Chad, Mali and Togo, cotton sectors remain managed by a national monopoly responsible for purchasing all cotton from farmers at fixed pan-regional prices. Mozambique's cotton sector has been organized as a local monopoly system since about 1990. Its national cotton sector was at that time divided into cotton producing regions and government granted exclusive purchasing rights to one ginning firm per region. , Cote d'Ivoire moved to a local monopoly from a national monopoly in 2001. Burkina Faso also moved to a local monopoly in the early 2000s featuring partial private ownership of three firms, but financial difficulties led to the state re-asserting control over the dominant firm.

Concentrated market structures define cotton sectors, such as in Zambia, or in Zimbabwe until at least the early 2000s, in which a very small number of firms (two in Zambia, one in Zimbabwe) dominate market share but face free competition from other firms and, potentially, from each other. Unlike regional monopolies, concentrated sectors have no geographical zoning delimiting firms' scope of operations. In competitively structured sectors, such as in Tanzania since 1994, Uganda during the first years of liberalization, and Ghana during the 1990s, a large number of buyers compete without restriction to purchase seed cotton from farmers, with no single set of firms dominating. Finally, hybrid structures encompass cotton sectors that are either attempting to liberalize (e.g., Benin) or to solve unintended consequences from the liberalization process (e.g., Uganda since shortly after liberalization).

In all but the competitive market structures, cotton is produced under some type of contract farming scheme. This type of contractual arrangement reduces the liquidity-constraint faced by farmers in using variable inputs, thus increasing such use and raising production and productivity. Yet firms participating in contract farming face challenges of asset specificity, free-riding, moral hazard, adverse selection, and non-excludability. The primary motivation for ginning companies to provide inputs on credit is to increase the flow of product through their gin, which is an asset with little or no value outside of cotton processing (asset specificity). This input provision exposes them to potential free-riding behavior by competitors, who may purchase product without providing input credit, thus promoting contract default by farmers (moral hazard). The moral hazard problem is compounded by adverse selection, because the ginning firms imperfectly observe the probability of an individual farmer defaulting on their promises and side-selling to competitors⁵. As a result, they might ration their input credit to minimize their losses while still ensuring some enhanced flow through their gin. Finally, services such as extension that generate knowledge exhibit a degree of non-excludability, as farmers assisted by one company to improve practices can shift to another company, or share knowledge with others not associated with that company, or these others can observe and learn from the assisted farmers. Recouping the full cost of extension services may thus be difficult in market-based systems – more so in competitively structured systems but also in concentrated - and companies may thus limit their expenditures on such services.

⁵ We define side-selling as farmers selling to a firm other than the firm from which they received input credit. Typically side-selling is done with the purpose of avoiding loan repayment.

3. How Do Institutional Structures Drive Cotton Sector Performance?

Attempts to resolve problems of asset specificity, free-riding, moral hazard, adverse selection, and non-excludability are at the core of ongoing institutional design efforts in cotton sectors. The particular approaches chosen in a given sector, and the outcomes attained, are heavily influenced by the sector's institutional structure. Poulton et al (2004) showed that the diversity in these institutional structures has influenced cotton sector performance in predictable ways across East and Southern Africa (ESA). TPL (2009) and Tschirley et al (2010) deepened the analysis and expanded it to include West and Central Africa (WCA). At the core of their results are two findings. First, there exists a trade-off between competition, which tends to generate higher farm-gate cotton prices and greater cost efficiencies at ginning level, and effective coordination, which is needed to ensure provision of services such as input credit and extension to farmers, and to improve the quality of cotton⁶. Second, different structures strike different balances between these two objectives and therefore perform better or worse in different ways; no single structure performs unambiguously best in all performance dimensions.

These authors found that competitively structured cotton sectors offer higher prices to farmers, but provide no input credit or technical advice and do not invest in cotton quality, due to the very high risk of side-selling in such systems. All three outcomes are predictable results of the competitive structure, which features many buyers competing on price to obtain product. As a result, average cotton yields in these systems tend to be lower than in more concentrated or regulated sectors, and prices realized on world markets for cotton lint (reflecting quality premia or discounts) tend also to be lower.

Concentrated cotton sectors more effectively promote cotton quality and provide inputs on credit and associated extension training. These structures are able to do this due to limited competition in the output market and consequently lower risk of side-selling compared to competitive systems. Yet the input packages provided by these systems are modest compared to those in most national monopoly systems, because firms are not immune to problems of side-selling. Concentrated sectors also tend to charge farmers more for inputs and to pay them lower prices for their seed cotton when measured as a percent of the countries' realized export prices.⁷

Farmers cultivating cotton in national monopoly systems – all of them currently in WCA countries – have historically and to this day enjoyed the best access to inputs on credit and extension services. Average cotton yields are higher, though stagnant over the past two decades. Due to the absence of competition and the heavy regulation of the sector, prices paid to farmers can be highly variable across periods of several years (though fixed within a year), depending on the political dynamics at a given point in time. For example, WCA countries paid among the lowest prices in SSA during the mid-1990s after the devaluation of the CFA but among the very highest 10 years later. The low prices of the mid-1990s became a central justification among those calling for reform of these systems, while the very high

⁶ We follow Poulton et al (2004) in defining coordination as “effort or measures designed to make players within a market system act in a common or complementary way or toward a common goal, (which) may also require effort or measures designed to prevent players from pursuing contrary paths or goals.”

⁷ In Zambia, this result is generated by firms paying similar absolute prices to farmers as in Tanzania while earning much higher price premia on their lint.

prices 10 years later led to major, unsustainable deficits in the sector that were large enough in some countries to threaten macroeconomic stability (TPL, 2009; Baffes, 2009).⁸

The outstanding developmental success of national monopoly cotton sectors has been their ability to drive the capitalization of small farm enterprises. Historically these sectors in West Africa provided financial support for household purchases of productive equipment (e.g., traction animals and ploughs). The French ginning parastatal CFDT, which was highly involved in the management of West African cotton sectors following the countries' independence, promoted the adoption of animal traction equipment by subsidizing prices. By facilitating timeliness and reducing labor bottlenecks in farming activities, animal traction enables farmers to increase yields of both food crops and cotton.

This success foundered on growing operational inefficiencies, sometimes linked to political influence on decision-making. These problems are also a predictable feature of monopoly systems. For instance, minimal uses of subcontracting arrangements, call to tender, and auctions for input procurement by parastatals, such as the CMDT⁹ in Mali, created rent-seeking opportunities and inflated operating costs (Banque mondiale, 2002, as cited in Baffes, 2004). Social networks played a greater role than quality of services and expertise in the selection of private operators to import and distribute inputs to Beninese farmers (Yerima and Fabien, 2011), generating loud complaints about the poor quality of inputs. Soft budget constraints – the belief, confirmed frequently by experience, that government would inject funds to cover operating losses of cotton gins in regulated cotton sectors – also created disincentives to good financial performance. As demonstrated in TPL (2009) and Tschirley et al (2010), cotton sectors characterized by higher levels of competition, such as Tanzania, Uganda in the first years of liberalization, and (to a lesser degree) Zimbabwe, exhibit much lower costs compared to sectors managed by monopolistic firms, such as in Mali, Mozambique and Burkina Faso.

4. Linking Cotton Institutional Structures to Food Crop Intensification

This section develops a conceptual framework linking cotton institutional structures to food crop intensification. The framework does three things. First it identifies three classes and 11 distinct types of pathways through which cash cropping may facilitate food crop intensification and productivity. These pathways build on those first discussed by Govereh and Jayne (2003). We then suggest answers to the following question: assuming the pathway exists, what is its expected impact in terms of immediacy (how quickly will the impact on food crop productivity be felt?), magnitude (how large is the impact likely to be?) and durability (how long is the impact likely to last?). This question relates to the nature of an impact itself, independent of the factors, such as sector type, that might support the pathway that generates it. Finally, we extend the framework from Poulton et al (2004) and TPL (2009), summarized above, to develop insights on how sector type affects the probability of the pathway existing and being sustainable. By doing this, we respond to calls in previous literature for more research on the institutional details that determine whether a given avenue for cash crop-food crop synergies actually

⁸ Note also that these higher prices were paid despite the fact that the systems changed very little in response to outside pressure; the high prices were driven by political concerns, not commercial calculations nor donor pressures.

⁹ CMDT replaced the French firm CFDT after independence.

operates (Jayne, Yamano, and Nyoro, 2004). Cash crop sectors that support the sustainable presence of multiple pathways with meaningfully large impact should have strong positive effects on food crop intensification and productivity. Tables 1 and 2 summarize the framework.

Before proceeding, we highlight three aspects of the framework. First, it assumes that the immediacy, magnitude, and durability of a pathway's impact is inherent to the pathway and independent of sector type, while its probability of existing and being sustainable is strongly influenced by sector type. While not strictly true – for example the magnitude of impact of input diversion will be larger in sector types that provide more macro fertilizers – the assumption does capture clear differences in the level of influence of sector type and facilitates systematic thinking about relationships. Second, the framework distinguishes between the durability of an impact and the sustainability of the pathway that generates it. The latter has to do with the sustainability of the conditions that give rise to the impact, while the former relates to the characteristics of the impact itself. For example (see below), the durability of the impact of literacy training on farmer behavior might be high, since people that learn to read tend to remember how to read, and literate parents are more likely to produce literate children. Yet the ability of a given sector type to provide and continue providing literacy training – the sustainability of this pathway - may be low if it depends on outside donor funding or the leadership of a certain processing company CEO committed to approaches that others may not be committed to. Finally, we conceive the sustainability of a pathway as the probability of that pathway existing at any point in time and, by implication, in succeeding time periods.

4.1 Pathways and their Expected Impact

We conceive three classes of pathways (Table 1). *Direct pathways* involve a company providing a service whose purpose is to benefit food crops or whose use is non-excludable – food crops can benefit without detracting from the productivity of the cash crop. *Indirect household level pathways* derive from the cash cropping activity but depend to a greater degree than the direct effects on household choices, and may involve some trade-off between the productivity of food- and cash crops. Finally, *indirect community level pathways* involve investments by private- and public actors that may be induced by the cash cropping activity; these effects are felt by all households in an area and may influence their welfare broadly, across multiple economic activities.

Direct pathways: These include provision of variable inputs (D1) and extension advice (D2) for food crops, access to mechanization (D3) whether animal traction or motorized, and literacy training (D4), all carried out or facilitated by the cash crop company. Input provision and extension for food crops can be in the financial interest of a cash crop processing firm if there exist sufficient complementarities in production between the cash crop and cereals and if the company can recover its costs either directly or indirectly. For example, a firm might achieve higher throughput in its processing plant (thus reducing unit processing costs) if it can attract more households to cotton, or convince households to put more of their land into cotton, by helping them increase their food crop productivity. Input provision should have immediate impacts on food crop productivity as long as the farmers use the inputs on the food crop; and since a company providing inputs for food crops is certainly also providing them for the cash crop, we expect this to be the case. Extension advice may take somewhat longer to reach full impact, as

Table 1. Typology of cash crop-food crop pathways

| Pathway | Dimensions of Impact on Food Crops (if the pathway is operational) | | |
|---|--|--|---|
| | Immediacy | Magnitude | Durability |
| Direct | | | |
| D1: Provision of variable inputs for food crops | High | High | Low (variable inputs) |
| D2: Extension advice on food crops | Medium | High | Medium (learning is retained) |
| D3: Mechanization promotion | High | High | Medium (durable asset) |
| D4: Literacy training | Low | Medium | High (literate parents produce literate children) |
| Indirect, household level | | | |
| IH1: Higher cash income used for food crops | High | Medium to high | Low (variable inputs) |
| IH2: Input diversion to food crops | High | Medium to low | Low (variable inputs) |
| IH3: Stronger agricultural skills | Low | Medium to low | Medium (learning is retained) |
| IH4: Agronomic spillovers | Medium | Medium to low (could be pos or neg) | Low (variable inputs indirectly applied) |
| Indirect, community level | | | |
| IC1: Improved private input supply | Low | Medium to high | High |
| IC2: Improved private marketing infrastructure | Low | Medium to high | High |
| IC3: Public infrastructure | Low | Medium to high | High |

farmers selectively adopt techniques and learn how best to apply them. Mechanization should have quicker impact than extension advice (though perhaps not as quick as provision of variable inputs, as the learning curve for effective use may be steeper), through improved timing of operations and better seedbed preparation.

The magnitude of the impact of all three of these pathways should be high, as each of them, when properly used under adequate agro-ecological conditions, is likely to have a high marginal product in isolation and together may show positive interaction effects (good extension advice will increase the effect of the other two pathways, and their presence will increase the payoff to extension advice).

Durability of impact will vary across pathways. The durability of variable input provision will be low, with only possible fertilizer residues delivering some positive effect the year after application; the effect of extension can be more durable if the training persists long enough for farmers to internalize and put into practice some of the key messages; because mechanization is based on durable assets, its impact should also last longer than that of variable input provision.

Literacy training will take the longest of all of these pathways to have impact, and may not have the same magnitude of effect in physical output as the others. Its great advantage is the durability of its impact: literate parents tend to produce literate children, meaning that an investment that increases literacy can be expected to have long-term, multi-generational payoffs¹⁰.

Indirect household level pathways: We identify four indirect pathways at the household level.

Households may use income from the cash crop to purchase food crop inputs or otherwise invest in food crop productivity (IH1; e.g., through purchase of animal traction). They may also divert inputs to food crops that were provided by the cash crop company for use on the cash crop (IH2). Cash cropping households may develop stronger agricultural skills through extension advice and experience with the cash crop (IH3), which may often be more agronomically demanding. Finally, cash cropping households may enjoy agronomic spillovers such as residual fertilizer that benefits food crops through rotation (IH4).

The impact on food crops of income from a cash crop depends on farmer decisions regarding what to do with that income. These decisions depend on the characteristics of the crop and its market (Is the crop responsive to fertilizer?; Is the farmer confident he'll be able to sell the surplus?), and on the farmer's portfolio of economic activities on- and off-farm, her judgment about the rate of return and riskiness of each, and her leisure preferences. Once taken, the magnitude of the impact of this pathway should be similar to that of direct input provision for food crops, with the possible exception that a farmer spending their own cash on the inputs may purchase and apply fewer than if receiving them with no up-front charge.

¹⁰ We realize that these payoffs will not be limited to the cash crop and may eventually be focused entirely on other activities. We also note that the literacy training must be intensive enough and last long enough that beneficiaries become functionally literate – able to use their literacy to improve their understanding and change their behavior.

Like input provision for food crops or use of cash income on a food crop, input diversion can result in immediate increases in food crop productivity, with low durability once the practice starts. The magnitude of impact of this pathway is likely to be lower than these others, however, as farmers are unlikely to divert all their inputs from the cash crop, leading to sub-optimal use on both crops.

Agricultural skill development is a feature of cash crop production under contract farming. Many cotton companies provide extension services such as pest scouting related to cotton cropping that can be beneficial to food crop production. With a reputation for demanding much discipline, cotton cultivation can build habits and skills in farmers that pay-off also on food crops. The immediacy of these impacts on food crops is likely to be low, since learning takes time and transferring learning from one crop to another may take more time. Their magnitude is also likely to be lower than most of our direct pathways. Like literacy training, however, the benefits of such skill development are likely to be long-term, at least over the lifetime of the affected farmer and potentially to their children if they remain in farming.

Agronomic spillovers can be positive or negative. If a cotton or other cash crop company provides macro fertilizers for use on the cash crop, then food crops can benefit from residual fertility the following year through crop rotation. Effects will not be immediate and will not be as high as through direct application to the food crop. Like any variable input effect, its durability will be low. Agronomic spillovers can also be negative, e.g. as cotton attracts pests that negatively affect food crops. We know of no studies that have estimated the productivity effect on food crops either of residual fertilizer or of increased pest pressure from cotton cultivation.

Indirect community level pathways: Our final class of pathways is indirect effects linked to public or private investment induced by the presence of the cash crop and the incomes and market demand it generates. Govereh and Jayne (2003) address private investment, as do Dione (1989) and Strasberg (1998). Governments may also choose to invest in dynamic cash cropping areas, hoping to increase the payoff to their spending by spurring further development in the area, again to the benefit of all economic activities. The immediacy of impact from these pathways is likely to be low, as large-scale responses of this type take time to develop and grow, and households have then to decide how to react to them. Once realized, however, their magnitude may be substantial and also durable, as many of them will involve household behavioral responses that are not quickly reversed.

4.2. Pathways and the Type of Cash Crop Sector

As previous authors have noted, whether a given pathway actually operates depends on “the approaches that marketing firms adopt toward smallholders” and on the “institutional details of ... partnerships between cash crop firms, outgrower farmers, and governments” (Jayne, Yamano, and Nyoro, 2004; Govereh and Jayne, 2003). Sector type, as outlined above, captures key elements of these institutional details. In this section we develop these ideas by extending the framework of Poulton et al (2004), TPL (2009), and Tschirley et al (2010) to cash crop-food crop interactions (Table 2).

Direct Pathways: The existence of direct pathways depends entirely on the ability to recover costs associated with them, which depends on the ability to coordinate across firms (if there is more than

Table 2. Cash crop-food crop pathways: likelihood that they will exist and be sustainable, by type of cash crop sector

| | Cash Crop Sector Type | | | |
|---|---|---|---|---------------------|
| Pathway | National Monopoly | Local Monopoly | Concentrated | Competitive |
| Direct | | | | |
| D1: Input provision for food crops | Medium (but undermined by general inefficiency of the model) | Medium to low (depends largely on outside funding) | Medium to low (depends largely on outside funding) | Unlikely to exist |
| D2: Extension advice on food crops | | | | |
| D3: Mechanization promotion | | | | |
| D4: Literacy training | | | | |
| Indirect, household level | | | | |
| IH1: higher cash income used for food crops | No clear prediction | No clear prediction | No clear prediction | No clear prediction |
| IH2: Input diversion to food crops | Medium (undermines cash crop scheme) | Low (undermines cash crop scheme) | Low (undermines cash crop scheme) | Unlikely to exist |
| IH3: Stronger agricultural skills | High | Medium | Medium | Unlikely to exist |
| IH4: Agronomic spillovers | High | Medium | Medium | Unlikely to exist |
| Indirect, community level | | | | |
| IC1: Private input supply | High | Medium | Medium | No clear prediction |
| IC2: Private marketing infrastructure | High | Medium | Medium | No clear prediction |
| IC3: Public infrastructure | High | Low | Low | Low |

one) and between firms and farmers. Systems that are good (poor) at coordination will have some (little or no) ability to support these pathways. Thus our predictions for each pathway within this class are the same within any given sector type. Also, our two extremes in this dimension - national monopolies and competitive structures - generate the clearest predictions. All these pathways are extremely unlikely to exist in competitive structures, while we suggest that all of them have at least a medium probability of existing under national monopolies. The inability of a competitive sector to support these pathways lies in their inability to ensure cost recovery through the purchase of all cotton from a benefitting farmer. In fact, competitive cotton sectors in SSA have struggled mightily with institutional design to facilitate input and service provision just for cotton, with little if any success.¹¹ Poulton and Maro (2009) document this fact for Tanzania, and TPL (2009) and Tschirley et al (2010) document it for Uganda immediately after liberalization and cite it as a key reason that such systems are likely to be ineffective in agro-ecologically challenged areas such as the Sahel, which require higher use of external inputs (especially fertilizer) for profitable production.

We give all these pathways a medium probability of existing and being sustainable under national monopolies, for the inverse of the reason they do not exist in competitive systems: a national monopoly, even if not particularly well-managed, has a reasonable chance of recovering the cost of these programs through its cotton activities; and if it doesn't, the soft budget constraint often associated with such systems may allow the services to continue anyway, at least for a time. We have two reasons for not rating sustainability as high for any of these pathways. First, positive impacts on cotton (as discussed above) will not be as large as for these same services focused on cotton, making it more difficult for the firm to recover costs. If the firm attempts to do so through lower cotton prices, this may undermine the entire operation, while if they do so through soft budget constraints, sustainability may also eventually be undermined. Second, national monopolies are expected to show generalized cost-inefficiency which, independent of what we just discussed, undermines their ability over time to continue providing these services.

We rate the sustainability of all direct pathways under concentrated sectors as medium to low. This prediction stems directly from the characteristics of a concentrated sector. Firms in a concentrated sector are more subject to side-selling and therefore less able to recover costs than a national monopoly, but less subject to it and therefore more able to recover costs than firms in a competitive system. We expect that such pathways are unlikely to exist in concentrated sectors in the absence of outside funding to support them, but note that the larger firms typical in such systems, less pressed on all sides by competitive pressures, able to focus on medium-term objectives, and already providing some services to their farmers, will be more attractive to donors as vehicles for broader service delivery than will the smaller and necessarily less service-oriented firms most often found in competitive systems.

¹¹ See Baffes (2008; 2009) for Uganda's struggles; Poulton and Maro (2009) for Tanzania, and Tschirley et al (2009; 2010) for further treatment of same. See George (2012) for the most recent effort in Tanzania, which failed to be implemented as planned in 2012. Goreux and Macrae (2002) documents the collapse of input provision in Ghana, which developed a competitive structure following reform in the late 1980s.

We assess the sustainability of direct pathways in local monopolies as we do in concentrated systems for three reasons. First, limited regulatory capacity in low income economies means that such monopolies may be subject to periodic side-selling pressures just like firms in concentrated systems. Second, the firms in these systems tend to be more similar to those in concentrated sectors, in terms of size and service orientation, than to most of those found in competitive sectors. Finally, as pointed out by Poulton, Tschirley, and Plerhoples (2010; p. 44), firm history and culture matter in both of these systems, with larger firms (many of them multi-nationals) often having longer time horizons and being more committed to service delivery and quality than smaller (often local) firms.

Indirect Household Level Pathways: As a group, the existence and sustainability of these pathways rests on the sustainability of the sectors' service delivery for cotton and income generation from the same. Pathway IH1 depends only on the reliability with which households can generate income from cotton. Here, TPL (2009) were clear that no *a priori* prediction can be made because "more than one process can contribute to an outcome and a particular sector type may be expected to perform strongly in one of the processes but poorly in another." Yields are expected to be higher in more coordinated sectors (monopolies and concentrated) but so are input costs, and prices are expected to be lower than in competitive systems, making no clear prediction possible for household incomes.

Sustainability of the input diversion and strengthened skills pathways depends on the sustainability of input credit and extension delivery for cotton. Here we can form more reliable expectations: national monopoly systems are expected to perform best in this regard, with competitive systems providing no input credit and no extension. Neither of these pathways is thus operational in competitive systems. In the other three sector types, input diversion undermines the cash crop scheme and so must be considered less sustainable than the provision of input credit for cotton. We thus rate sustainability of this pathway as medium in national monopolies, and low in local monopolies and concentrated systems. In these latter two sector types, we also expect sustainability to be variable across companies due to differing cultures and capabilities, and variable over time due to periodic side-selling crises. We rate sustainability of the agricultural skills pathway higher in each case: high in national monopolies and medium in local monopolies and concentrated systems.

The primary agronomic spillover is residual nitrogen benefitting food crops through rotation. The sustainability of this pathway thus depends on sustainability in the provision of macronutrient fertilizers for cotton. We rate this pathway the same as we do the agricultural skills pathway.

Indirect Community Level Pathways: These pathways are based on induced investment in cash cropping areas, primarily by private sector but potentially by public sector as well. Induced private investment requires a sufficiently large increase in income among sufficient numbers of farmers in a defined geographical area to make such investment profitable. Thus, sectors that succeed in enlisting large shares of the rural population in agro-ecologically appropriate areas in cotton production and that generate solid profits for these households should perform well in this pathway. In this regard, national monopolies hold a clear advantage: TPL (2009; Table 6.1) found that upwards of 90% of all farmers in key production zones of the WCA national monopolies produced cotton, and as noted earlier, these sectors also generated the highest farmer returns. As long as broader government policy and practices

of the cotton parastatal do not hinder it, the resulting aggregate cash income should induce substantially more private investment in related input supply and marketing infrastructure than would otherwise exist.

Local monopolies may also perform well in this regard, since for example in Mozambique the government requires, in exchange for the monopoly right that companies receive to purchase cotton, that they provide assistance to all interested farmers in their area. Presumably as a result, farmer participation in Mozambique's so-called "concession" areas typically exceeds 80%, and participation in Burkina Faso is higher than that. Peltzer and Rottger (2013) report that *Ivoire Coton* (CID) works with about 90% of farmers in its concession area. The performance of these sectors on returns to farmers is more variable, however, making this case less clear-cut than that of the national monopolies.

Among concentrated sectors, Zimbabwe sees 70% to 80% of farmers in key production zones cultivating cotton, while this percentage rises only to 30% to 35% in Zambia. In Tanzania's competitive sector, according to Poulton and Maro (2009), "in the major cotton producing zones, the vast majority of households grow cotton, especially in years when sentiment towards cotton is positive." We attribute this broad participation primarily to positive agro-ecology and suggest that it would not be replicated under this sector type in less productive areas such as the Sahel.

Public sector investment linked to cotton is most evident in the WCA national monopolies, many of which built broader rural development strategies around cotton cultivation. Indeed we know of no other countries in which governments explicitly used cotton in this way as a vehicle for rural development.

5. Country Experience

This section draws on literature to review country experience and assess whether available evidence supports the expectations that we have developed in our conceptual framework. We focus primarily on Table 2, which relates cash crop sector type to the expected existence and continued sustainability of each pathway.

5.1 National Monopolies

Our conceptual framework suggests that this structure has at least a medium probability (higher than for any other structure) of supporting direct pathways for food crops (D1 through D4), and high probabilities of supporting most indirect pathways at household and community levels (IH and IC).

After reviewing the evidence, the most balanced conclusion regarding direct pathways appears to be that this structure makes it possible to support such pathways but that such assistance has not always been pursued. A clear distinction exists in this regard between WCA and pre-reform Zambia and Zimbabwe in ESA (both of which had national cotton monopolies), with several of the former pursuing these pathways and the latter largely not. Most indirect pathways have been robust in these sectors regardless of region. We explain these assertions in the next several paragraphs.

WCA: Research provides strong evidence of direct pathways in the national monopolies of WCA but also shows that these pathways are not always pursued even in this region. Mali and Cameroon actively used cotton as a vehicle for broader rural development that included promotion of food crops, while the evidence suggests that Burkina Faso, Ivory Coast, and other countries in the region were less ambitious than Mali and Cameroon but still more so than countries in ESA¹². In Mali, the CMDT upon nationalization of the cotton sector received a broad mandate for an integrated rural development program explicitly focusing on cotton and cereals through the provision of applied research, extension services, and credit. The CMDT in Mali financially supported agronomic research programs on food crops conducted by local research institutes (Coulibaly, 2005). The promotion of early maturing, disease-resistant maize varieties by CMDT extension agents and their adoption by farmers in the CMDT southern region led to important increase in maize production (Tefft, 2010). In addition to promoting cereal production, CMDT worked to develop market outlets, notably via the maize development project (Dione, 1989).

SODECOTON in Cameroon received a similar mandate to CMDT's. It has not historically supported research on food crops, but has supported extension for them, shares joint responsibility with another agency for animal advisory services, and has implemented soil fertility management programs whose benefits were not limited to cotton; animal manure, produced in larger volume due to assistance for animal husbandry, is said to be applied in roughly equal proportions to cotton, maize, and sorghum. Peltzer and Rottger (2013) report that SODECOTON currently provides input credit (though only partial) for food crop inputs along with cotton, and that it provides its cotton farmers with "investment credits" as well.¹³ As stated by Gergely (2009; p. 27), "it can ... be argued that ... SODECOTON had a strong spillover effect on other crops: it developed maize, which reaches very impressive yields, taking into account the soil fertility problems in the cotton area; it gave access, either directly or indirectly (through sales between farmers) to inputs; it disseminated new cropping techniques, like direct sowing with the use of herbicides; it contributed to reduce illiteracy; it also contributed to improve animal production, and developed the use of organic manure, which is critical to the zone."

Due to weaknesses in credit and input markets, Mali's CMDT became the major input supplier in the cotton growing regions. Village-based organizations, called *Associations villageoises* (AVs), were made responsible for distribution of cotton inputs on credit, as well as for cotton grading and weighing during marketing. Cotton villages benefited from improved access to inputs on credit compared to villages where no cotton was grown. In addition to enabling the provision of inputs on credit, the AVs were able to access formal credit for activities related to relieve hunger, improve cereal marketing and build cereal banks at the village-level (Dione, 1989).

¹² It must be said that this conclusion is slightly speculative and might be driven in part by the fact that Mali is the most studied of the WCA countries while information on other countries is less complete. Yet a broad indicator that is consistent with this assertion is that only 15% of Malian farmers cultivate cotton manually compared with 60% of farmers in Benin and Burkina Faso and 85% in Togo (Fok and Tazi, 2004). Note also that all these percentages are lower – the share of farmers using mechanization is higher – than in any country of ESA including Zambia and Zimbabwe

¹³ They do not define nor give specific examples of what these investment credits are, but by their nature can be considered of a kind with D3, promotion of mechanization.

Historically, CFDT and CMDT were also extensively involved in agricultural mechanization (D3). Both companies supported the adoption of animal traction as a means to increase productivity. In the early 1970s, programs were created to train blacksmiths to make and repair farming equipment (Campbell et al., 2007). To overcome farmers' liquidity constraints, credit advance and subsidy programs were also offered, along with training and information on how to improve farming techniques, to make organic fertilizers and build stockyards. As a result, the share of cotton farmers using animal traction rose from low levels to 85% by the end of the 1980s. Compared to the national average, regions producing cash crops, in particular cotton and rice, have higher rates of mechanized farms and higher farm incomes (Republique du Mali, 2005). In non-cotton regions, difficulties in accessing equipment and credit have limited farm mechanization. CMDT also provided literacy lessons (D4) as part of its rural development campaign after 1974 (CMDT, 2001). The investment credits that SODECOTON in Cameroon provides to its growers are also likely used at least in part for agricultural mechanization.

With the promotion of market reforms, the CMDT has refocused its activities toward cotton and has gradually withdrawn from broader input supply activities, promotion of mechanization, and literacy training. AVs have been transformed into cotton cooperatives, where membership is exclusive to cotton growers. Under this new structure, non-cotton farmers have lost access to the interlinked credit-input-cotton scheme and have to rely on the private market to obtain inputs and credit, and cotton growers have also to rely on the private market to purchase inputs for cereal crops (unless they divert cotton inputs to these crops). Weak private input and credit markets, however (Theriault et al, 2013), mean that it is now primarily IH2-IH4 (as opposed to the direct pathways) that drive any contribution that cotton makes to food crops, specifically input diversion from cotton to cereal fields, fertilizer residue from crop rotations, and application of organic manure.

IH1 depends on strong income generation from cotton. For pre-reform Burkina Faso, Goreux and Macrae (2002) cite research showing that growing cotton and maize in rotation provided higher cash incomes than growing only food crops, and that the cotton/maize system also led to better health outcomes. TPL (2009) show that farmers in the WCA national monopolies earned (along with Zimbabwe; see below for more on this) the highest returns from cotton of all studied countries. Peltzer and Rottger (2013) show with 2008 data that cotton growing households in three WCA countries (Benin, Ivory Coast, and Burkina Faso) had median asset values about 10 times higher than those in three ESA countries (Malawi, Mozambique, and Zambia). Since all three WCA countries had come out of national monopoly systems while none of the ESA countries had done so, and since asset values are in part an indicator of past incomes, we take this as evidence that strengthens the findings of TPL (2009).

Whether cotton in Mali generates such income has been the subject of recent debate, especially in the Sikasso region of Mali. Despite being both the bread basket and the white gold region of Mali, an unpublished report by Wodon et al. (2006) described what it called "the Sikasso Paradox", suggesting that poverty and hunger were widespread in Sikasso. A large number of cotton producers were found to be poorer than non-cotton farmers, contradicting the perception that Malian households growing cotton were better-off in terms of income and food security. However, Delarue et al. (2009) found major issues with the underlying dataset and methodology used. After correcting for these issues, new findings suggested that cotton farmers were better off than non-cotton farmers. Though also not yet

published, this last result is consistent with Fok and Tazi (2004) who previously concluded that cotton farms are more food secure than non-cotton farms and have the advantage of not being forced to sell their cereal surplus at the harvest, when prices are low, in order to meet their liquidity constraint. Likewise, Dione (1989) found that coarse grain production of farmers in CMDT regions was more likely than in other regions to exceed their annual consumption requirements, providing them with market surpluses.

The evidence on indirect community level pathways in Mali is not entirely consistent. On the one hand, Dione (1989) showed that cotton cultivation in southern Mali led private input dealers to expand their operations in the area due to increased demand for fertilizer, leading to greater availability and lower prices for a range of inputs. This is strong evidence of IC1 and IC2. Yet Theriault (2011) speaks of continued weakness in private input markets in cotton growing areas, which tends to undercut our expectation that such monopolies, by driving strong income growth for large shares of the population in cotton growing areas, will promote strong indirect community level pathways. The question to be asked is whether poor performance of private input markets in these areas is due to the national monopoly *per se* or, as we suspect, to the fact that the national monopoly chose to supply food crop inputs directly (one of our direct pathways) rather than working with private sector to accomplish this. Note that, until the late 2000s, CMDT was the body responsible for the call to tender to purchase inputs and to distribute them, potentially crowding out the private sector. In the late 2000s, this responsibility was transferred to the cotton producer cooperative union, UN-SCPC. It remains to be seen whether this arrangement will spur more sustained private sector investment to build on what Dione noted in the late 1980s. Perhaps the best conclusion at this point is that these systems have the potential to support strong IC pathways but that to realize this potential they must discipline their efforts to promote broader input access by doing so in close collaboration with, and as facilitators of, private sector investment. Under what conditions the political economy of such firms allows them to make such decisions is a topic for another paper.

Other indirect community level pathways have been very active in Mali. Village cooperatives (formerly the AVs), are financially compensated by the CMDT for the cotton marketing services that they provide (e.g., cotton weighting and grading). These funds are then used on collective development projects aimed to improve living conditions in rural villages. The construction of water wells, medical dispensaries, and schools are all examples of investments made possible through these funds (Theriault and Sterns, 2012). In contrast, non-cotton villages have to support collective projects through village-level tax revenues only. Moreover, the CMDT has invested in road construction and maintenance in order to adequately connect cotton villages to gins. Improved market access has been beneficial to smallholder farmers, notably for those with marketable cereal surpluses. All of these can be considered examples of IC3, public sector investment linked to cotton that generates broader benefits.

ESA: In pre-reform Zambia and Zimbabwe we find no evidence of direct support for food crops by the cotton parastatals. Neither Chiwele, Muyatwa, and Kalinda (1998; p. 23) nor Jha and Hojjati (1993), two of the few available studies of pre-reform cotton in Zambia, report any support to food crops. Neither Poulton and Maro (2009) nor Akiyama et al (2001) report any such support in Zimbabwe. We attribute the difference in behavior between national monopolies in WCA and ESA to the maize-centric nature of

the agricultural economies in ESA and the resulting existence of large programs (with specialized institutions) to directly support maize production. These institutions – the Grain Marketing Board in Zimbabwe and various programs in Zambia, provided subsidized seed and fertilizer directly for maize without using cotton as the vehicle. This strong maize orientation may be at least partially explained by agro-ecological and agronomic factors; much of Zambia and important portions of Zimbabwe are well adapted to maize production, unlike much of the Sahel, so cotton was not seen as a necessary vehicle for promoting intensification of maize and other food crops. In the Sahel, more drought-resistant cotton may have provided a more secure basis for promotion of food crops. This admittedly speculative suggestion requires further research. Yet further support for the idea comes from the fact that maize is far more dominant in diets in ESA than it is in WCA, and is more responsive to fertilizer than the millet and sorghum that are more common in the latter. Both these facts make large-scale fertilizer and seed programs for maize more politically attractive and more likely to generate positive payoffs in ESA.¹⁴

Evidence is strong that Zimbabwe's pre-reform sector supported strong indirect effects at household and community levels (IH and IC; though there is less evidence on the latter). Evidence is much less strong in Zambia, where the number of cotton farmers prior to reform was never high. Chiwele, Muyatwa, and Kalinda (1998; p. 23) report in Zambia that farmers were largely moving out of cotton during the last several years of the pre-liberalization period due to low prices. Jha and Hojjati (1993), report that the cotton parastatal LINTCO did not include fertilizer in their input package for cotton, despite the fact that "... research showed that the major nutrient deficiency in plateau soils was nitrogen" (p. 23) and "evidence from on-farm trials that fertilizer can result in significant responses and profits" (p. 37). Given Zambia's history of farm level default on fertilizer credit, and LINTCO's lesser state support compared to the various maize promotion agencies, this decision is not difficult to understand.

In pre-reform Zimbabwe, Abbot (1987, p. 155) states that "the expansion of the cotton industry and the development of the neglected smallholder areas of Zimbabwe are integrally linked", suggesting some broader role for cotton during the national monopoly days. Poulton and Hanyani-Mlambo (2009; p. 8) echo this by stating "at Independence, the broad thrust of agricultural policy was to extend service support from commercial farming areas into communal areas, where most smallholders live." The number of Cotton Marketing Board depots in communal areas tripled from 1980 to 1985, helping drive (along with attractive prices) large increases in cotton production. Lending to better-off smallholders by the Agricultural Finance Corporation was also a contributing factor

Together, this evidence suggests the likelihood that cotton production helped spur maize production growth through indirect household level pathways (certainly higher cash income and perhaps the others) and at least indirect community level pathways driven by public sector, all as part of a rural development package. But the cotton parastatal itself focused on cotton and left maize and other food crop promotion to other institutions.

¹⁴ Though we note that voluminous literature, some cited earlier in this paper, suggesting that the programs as designed and run often have not generated positive overall returns.

5.2 Local monopolies

The evidence base on local monopolies is thin because the model is not common and the complexity of the model itself makes prediction difficult and may make varying performance the norm. Mozambique has the longest-standing structure of this type and has been studied with some intensity. Ivory Coast is next in line, with a local monopoly system replacing the national monopoly in 2001 and lasting until very recently, but we find only two studies that provide some limited evidence on this case. Burkina Faso's experience is the shortest and is potentially misleading, in that the former parastatal SOFITEX never had less than an 85% market share following re-structuring into three local monopolies. Here we present what evidence is available while being cautious in our conclusions.

Direct Pathways: Available evidence does show that these sectors in all three countries have supported direct pathways at different times. For instance, SOFITEX in Burkina Faso provides farmers with inputs on credit for cotton and maize at the start of the planting season, recouping their costs by deducting both input loans from cotton payment after the harvest. Given that a large majority of Burkinabe producers are grow coarse grains along with cotton, in part for their own consumption, provision of inputs for both crops is aimed at limiting input diversion from cotton and ensuring higher cotton productivity (Theriault, 2011). Gergely (2009) reports in post-reform Burkina that SOFITEX provided farm management advisory services “with a holistic approach on cropping patterns”, clearly suggesting that the company supported direct extension on food crops (D2). It is not clear if other companies did the same. Peltzer and Rottger (2013) rate *Faso Coton*, one of the two minor companies in Burkina's local monopoly system, as “good” in providing what they call investment credit to farmers; they rate *Ivoire Coton* as “very good” in this regard (Table 5, p. 11), while noting that the same company provides inputs “beyond that needed for cotton” based on their estimate (from an excellent data base) of individual farmers' ability to repay.¹⁵ Strasberg (1998) showed in Mozambique that one firm among the four that were studied provided seed and fertilizer for maize and purchased the maize. But this practice was based on strong demand from donors for maize for food aid; as the need for food aid declined after the end of the civil war, the company (Lonrho) abandoned the practice, and we have no evidence of any such practices among any companies in Mozambique for at least 15 years. Still, it strikes us as reasonable to suggest that this company would not have provided this service in a competitively structured system. Overall, the evidence is perhaps stronger than we expected in our conceptual section that local monopolies can support direct pathways, but that actual practice depends on history (WCA vs. Mozambique) and particular circumstances that make such an approach attractive (Lonrho in Mozambique).

Indirect Household Level Pathways: As has been said before, the existence and sustainability of indirect household level pathways (IH) depends either on income generated from cotton (IH1) or on the

¹⁵ Peltzer and Rottger classify Ivory Coast as a concentrated sector, not a local monopoly. Here we put it in the latter category because at the time of their study it had only very recently moved to a concentrated set-up and *Ivoire Coton* was still the dominant firm, suggesting that performance at that time may have been driven more by the recent past (under which the local monopoly system lasted about 10 years) than by the current set-up. Note also that at the time of the Peltzer and Rottger study the country was already considering returning to a local monopoly setup.

sustainability of service provision for cotton (IH2-IH4). For IH1, TPL (2009) show that Burkina Faso and Mozambique delivered very different results, with past performance (as a national monopoly) in input provision and mechanization leading to strong farmer returns in Burkina and absence of same, combined with very low prices, leading to the lowest returns of any country in Mozambique. Peltzer and Rottger (2013) show similar variability: *Faso Coton* in Burkina showed the lowest net return on cotton among all six of their studied countries in 2007/08 and 2008/09, but the highest in 2011/12; *Ivoire Coton* consistently ranked among the top among their countries; and Plexus in Mozambique consistently ranked among the lowest.¹⁶

Cotton service provision (the driver of IH2-IH4) is also variable within the local monopoly system. TPL (2009) showed that Mozambique's provision was far inferior to that of Burkina Faso. Peltzer and Rottger (2013) likewise rate cotton input provision by *Faso Coton* and *Ivoire Coton* as "very good", while Plexus in Mozambique is rated only as "good." We note that Plexus is the successor to Lonrho, which Strasberg (1998) and Tschirley, Osorio, and Boughton (2009) both showed to perform the best among all Mozambican companies in cotton input provision; personal observation in 2013 suggests that this pattern continues today, with most other companies in the country providing inferior cotton input supply compared to that of Plexus.

Indirect Community Level Pathways: The empirical record on these pathways is not robust, in part because attribution is difficult. One general observation is that local monopoly systems have, in all cases that we are aware of, reflected a step away from a national monopoly¹⁷. Such a move is typically accompanied by efforts to reduce expenses in the cotton sector, with one way of doing this being to delink broader rural development objectives from cotton promotion. It is thus reasonable to expect that IC3 - public infrastructural investment in cotton areas – would be less strong than in national monopolies. There is no evidence that we have found in Mozambique of private sector investing more heavily in cotton areas than in other productive areas of the country, and private sector investment in general has remained exceptionally low until very recently. In Burkina it will be difficult to attribute any private sector investment to the local monopoly model, given that the country was for so long under a national monopoly. Ivory Coast provides a longer time frame for analysis but we find no studies that address this issue.

5.3 Concentrated

Direct Pathways: As noted earlier, Peltzer and Rottger (2013) provide evidence that *Ivoire Coton*, until very recently operating in a local monopoly system, has after the elimination of monopoly zones continued to provide some of its cotton growers with input credit for food crops. They also note the complementarities, for cotton ginning companies that also process oil, between cotton and soybean

¹⁶ A limitation in Peltzer and Rottger's study – made necessary by the nature of the broader Cotton made in Africa program of which the study was a part - is that they focused on particular companies in each country, rather than sampling across all companies. In the case of Burkina, *Faso Coton* had a much smaller market share and operated in less favorable agro-ecological conditions than did SOFITEX.

¹⁷ Though different in many ways from those seen in WCA, pre-reform Mozambique maintained key national monopoly powers over its cotton sector.

cultivation. With soybean production skyrocketing in southern Africa due to rapid growth in demand for poultry, both Cargill and Dunavant in Zambia are said to be in the experimental phase of jointly promoting the two crops. This may be a bit of a special case for two related reasons. First, soybeans are not a traditional food crop for African smallholders and require more complex processing than do most cereals to be consumable; all in all, the crop is best considered a cash crop in this region. Second, and following from the first, the market for soybeans is unlikely ever to support the very high number of buyers seen for most cereal crops, reducing somewhat the risk that a ginner faces in providing some support for it. Neither Poulton and Hanyani-Mlambo (2009) nor any other authors that we could find show evidence that Cotco (or any other firm) in post-reform Zimbabwe has supported any of our direct pathways.

Indirect Pathways (household and community level): Govereh and Jayne (2003) provide indirect evidence of indirect effects at household and community levels in Gokwe area of Zimbabwe, though they do not identify exactly what these pathways are; their analysis simply shows higher maize yields associated with cotton growing and with the number of cotton input traders in the village, which they interpret as an indicator of community level indirect pathways supported by cotton.

Hanyani-Mlambo and Poulton (2009; p. 35) support this idea by finding that, in 2006/07, economic hardship had made it difficult for farmers to purchase inputs “... and many input stockists have closed”, but that “cotton companies are providing more support to producers than ever before.” Because this support included fertilizer among other inputs, and because maize is produced with cotton in Zimbabwe, it stands to reason that at least pathways IH1 – IH4 were functioning.

These same authors also note (p. 51) on the basis of focus group interviews that some fertilizer meant for cotton was being diverted to maize (IH2) in agro-ecologically marginal areas where most households are deficit in the grain and wish to reduce their need for maize purchases. But, in keeping with the maize-centric policy noted earlier, these authors also note (p. 51) that subsidized fertilizer meant for maize, distributed by the Grain Marketing Board, gets diverted to cotton in more agro-ecologically favorable zones, while cotton fertilizer does not get diverted to maize in these zones. This tells a similar story to the Sahel, which is broadly agro-ecologically marginal: fertilizer in that zone is provided for cotton, not maize, but some gets diverted to maize.

In a testimony to indirect community level pathways, Poulton and Hanyani-Mlambo (2009) note (p. 52) “the growth of the Gokwe ‘growth point’ over the past decade is an impressive testimony to the multiplier effects of an expanding cotton industry.” Surprisingly they say nothing about animal traction except to note that it is concentrated among the better-off cotton farmers. It is not clear how farmers obtained these equipment and animals and particularly not clear if the cotton company played any direct role. If not, then it stands to reason that pathway IH1 played at least some role.

The pattern of agricultural development in Zambia has been massively influenced since independence by the country’s focus on subsidized maize purchase and distribution of subsidized maize seed and fertilizer for use on maize. For as much as a decade after economic reform began in 1994, these subsidies were reduced. Yet they were never eliminated and have again grown to very high levels over

the past eight years. The ability of cotton to support private sector indirect pathways at community level under these circumstances is very limited. Mason and Ricker-Gilbert (2012) and Mason and Jayne (2012) provide broad evidence of the negative effect of these programs on private sector input provision. The former estimate that 1 kg of subsidized maize seed distributed by government in the late 2000s reduced private maize seed sales by 0.49 kg, while the latter find that each kg of subsidized fertilizer reduces private fertilizer demand by 0.13 kg, and reduces private sector *procurement* of fertilizer for onward sale by 0.47 kg (the difference is accounted for by leakage of fertilizer out of the subsidy program into the private sector).

5.4 Competitively Structured Systems

The empirical record shows clearly that direct pathways are not supported by competitively structured cotton sectors and that service provision for cotton, which IH2 and IH4 depend on, has also not been sustainable. Goreux and Macrae (2002) and Poulton et al (2004) review Ghana's experience after reform ending-up with a competitive structure in 1985. Production initially rose, and quite against the predictions of our framework the leading company actually began providing input credit in 1995, with some smaller companies following suit shortly thereafter. Rampant side-selling, however, quickly brought such input credit to a halt, led to a "disastrous" drop in production, and prompted a move to a local monopoly system in 2001. This latter set of patterns is fully consistent with our framework. TPL (2009; pp. 76-77) document the repeated and unsuccessful struggles that Uganda (in the few years after reform in which it had an unregulated competitive system) and Tanzania had in trying to provide input credit and extension in unregulated, competitively structured systems.

Evidence is uneven regarding the level of profits earned from cotton, which drives IH1. TPL (2009) show Tanzania to generate among the lower returns among the nine countries it studied; Peltzer and Rottger (2013) show cotton farmers in Malawi to earn among the higher returns to cotton among their six study countries, but to have the lowest total per capita household income (in purchasing power parity terms) of all the countries; the collapse of Ghana's cotton sector under the competitive structure suggests that it was not able to sustainably maintain strong returns to farmers. IH3 – stronger agricultural skills – is also likely to be less operational in these systems because it would depend on farmers' independent learning, given that these systems provide no extension assistance for cotton. We find no studies of indirect community level pathways in competitive systems.

6. Concluding Comments

Table 3 summarizes expected performance of cotton sector types on our 11 pathways, compares this to empirical evidence, and assesses the adequacy of the evidence base. Where clear predictions were possible, we generally find that the evidence supports our expectations. For national monopolies and competitive sectors (where theoretical predictions were clearest), the evidence base tends to be strong. Interpreting the absence of any evidence regarding indirect community level pathways in competitive sectors is difficult; does the absence indicate that these pathways do not exist, or that the question has simply not been investigated? In local monopolies and concentrated sectors, predictions are less clear and the evidence is equally mixed.

Table 3. Summary of Expected and Realized Performance, and Assessment of Adequacy of the Evidence Base across Pathways

| Pathway | Expected Performance | Realized Performance | Does evidence concur with expectations? | Adequacy of Evidence Base & Other Comments |
|---|--|---|--|--|
| Direct | | | | |
| D1: Input provision for food crops | Strongest for national monopolies, absent for competitive, medium-to-low for local monopolies and concentrated | Inconsistent for national and local monopolies: pathways frequently but not always supported. Positive (but limited evidence) for concentrated sectors. Entirely absent in competitive. | Largely yes, though stronger evidence than expected for existence in local monopolies. | Strong for national monopolies and competitive; medium for local monopolies (and often complicated by recent move out of national monopolies). Limited for concentrated. |
| D2: Extension advice on food crops | | | | |
| D3: Mechanization promotion | | | | |
| D4: Literacy training | | | | |
| Indirect, household level | | | | |
| IH1: higher cash income used for food crops | No clear prediction for IH1 in any type. For IH2-IH4, best in national monopolies, lower in local monopolies and concentrated, absent in competitive | All four (including IH1) strong in national monopolies. Variable in local monopolies. Inconclusive in concentrated. Absent in competitive. | NA for IH1. Yes for IH2-IH4 | For IH1: strong for national monopolies, relatively weak in other sector types. For IH2-IH4: Strong for national monopolies and competitive. Less so in concentrated (confounding effect of maize policies in Zambia) and local monopolies. |
| IH2: Input diversion to food crops | | | | |
| IH3: Stronger agricultural skills | | | | |
| IH4: Agronomic spillovers | | | | |
| Indirect, community level | | | | |
| IC1: Private input supply | Strong in national monopolies, medium-to-low in local monopolies and concentrated, absent in competitive. | Strong in national monopolies. Inconsistent in local monopolies and concentrated. No evidence in competitive. | Yes for national and local monopolies and concentrated. Not clear for competitive. | Strong evidence base for local monopolies. No evidence in competitive (does this indicate absence?). Weak for local monopolies. |
| IC2: Private marketing infrastructure | | | | |
| IC3: Public infrastructure | | | | |

Some results stand out. First, the evidence suggests that competitively structured cotton sectors sharply limit the ability of the crop to contribute to food crop intensification. This finding provides another argument for avoiding reflexive recommendations to liberalize such sectors. Instead, and as argued by Poulton, Tschirley and Plerhoples (2010), feasible reform paths need to take account of a country's previous experience to avoid wide divergence between what a different structure *could* deliver if "properly" implemented, and what it actually does deliver. Second, the frequently inconsistent performance of local monopolies and concentrated sectors suggests strongly that the institutional details in these systems matter greatly to performance. Closer assessment of the reasons behind their varying performance is thus called for.

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