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Primary Producer Sales Prices and Cooperatives: A Cross-Country, Multi-Product Analysis

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Abstract

Using data from field surveys of maize farmers in Lao People's Democratic Republic , herders in Mongolia, and fruit farmers in Uzbekistan, this paper presents new evidence concerning the relationship between cooperative membership and producer sales prices. Controlling for covariates previously considered in the literature, and using a range of estimation methods to control for alternative sources of endogeneity bias, the analysis finds three key empirical results that are robust to country, product and estimation methods for farmers in Lao People's Democratic Republic and Uzbekistan.

First, it documents positive relationships between land size under cultivation and farmer sales prices, highlighting the differential marketing challenges faced by smallholder farmers. Second, the results indicate that cooperative membership approximately offsets the relative price disadvantages associated with small farm size. Third, evidence is reported that failing to control for self-selection produces estimates that exhibit a significant downward bias for the effects of cooperatives on farmer sales prices. In contrast to the above results, no statistically significant relationships were found between average sales prices reported by Mongolian herders and either herd size or membership of producer cooperatives.

Key words: farmer sales prices, producer cooperatives, landlocked developing countries

JEL classifications: Q11, Q13, C31

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1 Introduction

An extensive literature has explored the role that producer marketing cooperatives can play in improving the economic sustainability of agricultural producers by increasing their earnings. This literature is particularly relevant in developing countries, where the agricultural sector is often a key source of national income and employment, and where the multitude of challenges faced by smallholder primary producers are of intense policy interest. The general finding of the related empirical literature is that marketing cooperatives are associated with higher producer sales prices. Yet it is difficult to draw more nuanced conclusions from the existing literature because each study typically focuses on an isolated market context, and comparisons between studies are complicated by the diverse limitations of the survey data and estimation methods used.

This study seeks to expand the set of "stylized facts" concerning the relationship between prices received by agricultural producers and cooperatives marketing their products. Using survey data collected from three developing landlocked countries for diverse agricultural products, the study evaluates the link between cooperatives and prices received by producers using a common set of empirical methods designed to address alternative forms of estimation bias. The robust empirical findings highlight the role that producer marketing cooperatives can play in offsetting competitive challenges that smallholder farmers otherwise face in terms of average sales prices.

The agricultural sector is important for many developing countries, accounting for a considerable share of aggregate income and employment, especially in rural areas. For example, with regard to the three countries that are the focus of the current study, data for 2019 indicate that the combined value added of the agriculture, forestry and fishing sectors accounted for 15 per cent of GDP in Lao People's Democratic Republic, 11 per cent in Mongolia and 26 per cent in Uzbekistan.[1] At the same time, these three sectors are estimated to have accounted for 61 per cent of total employment in Lao People's Democratic Republic, 25 per cent in Mongolia and 26 per cent in Uzbekistan. Furthermore, agriculture can play a disproportionately important role in poverty alleviation by enhancing food security (Christiansen et al. 2006), and by improving the market opportunities of vulnerable population subgroups, including women and rural inhabitants.

Consequently, an extensive research effort has considered what factors increase the economic returns from agriculture. The primary strand of this research focuses on agricultural productivity. Dethier and Effenberger (2012) survey this literature and identify a need to conduct agricultural research adapted to local conditions, and to address existing barriers to the adoption of more productive methods in agriculture. Echoing these findings, Alston and Pardey (2014) analyse relationships between agricultural inputs and agricultural sector productivity in alternative countries. The authors highlight the importance of evolving best-practice methods for increasing agricultural productivity, supported by public and private agricultural research investment. In a similar vein, Ruttan (2002) shows how labour and land productivity in

[1] World Bank, World Development Indicators. The importance of agriculture in each of the three countries was appreciably larger in the past: in 1994, agriculture accounted for 44 per cent of GDP in Lao People's Democratic Republic, 28 per cent in Mongolia and 34 per cent in Uzbekistan. In terms of total employment, agriculture accounted for 86 per cent in Lao People's Democratic Republic, 45 per cent in Mongolia and 41 per cent in Uzbekistan. UNCTAD (2019) reports that between 2013 and 2017, 37 countries had exports from agriculture that accounted for at least 60 per cent of total goods exported.

agriculture has evolved in response to technological innovation in fertilizers, crop protection chemicals, and crop varieties.

From a development perspective, Restuccia et al. (2008) show that low agricultural productivity, and a high share of labour in agriculture, explain differences in aggregate productivity between rich and poor countries. Gollin et al. (2014) use disaggregated data for rice, maize and wheat to confirm that cross-country differences in labour productivity in agriculture are large. De Janvry and Sadoulet (2010) show that GDP growth that originates in agriculture is especially effective in reducing poverty. Within this literature, a number of studies (Ma et al. 2021; Larson et al. 2012) also explore how farm (herd) size is related to agricultural productivity. This issue is empirically important, as smallholder farmers dominate farming in developing countries.[2]

Although methods of production represent an important differentiator among agricultural producers, how agricultural products are brought to market is also crucially important. Increased prices for produce received by farmers can foster investment, especially in credit-constrained contexts, encourage technological adoption, and improve the quality of produce along the value chain. Higher prices that support increased farmer incomes can also help to ensure that the farming sector remains a viable alternative for employment and entrepreneurship in rural areas, especially in the context of challenges posed by climate change, which are particularly acute for smallholders.

Market power along different segments of agricultural value chains is a key theme running through much of the literature concerning farmer sales prices (Kopp and Sexton 2020; Sexton 2013).[3] Smallholder farmers often have few potential buyers of their produce in the geographic area where they produce, and they face high transport costs to widen their marketing options.[4] Producers of perishable products without adequate storage capacity are vulnerable to opportunistic behaviour by marketing intermediaries (Bergquist and Dinerstein 2020; Sexton and Iskow 1988). Producers in remote locations may lack information about market alternatives (Courtois and Subervie 2014; Mitra et al. 2018), have access to few potential buyers within their geographic region and face high transport costs to widen their marketing options (Bernier and Dorosh 1993; Mérel et al. 2009). These marketing challenges are generally considered to be inversely related to farm size (Ma et al. 2021).

The formation of agricultural marketing cooperatives has long been considered a way to increase farmers' incomes.[5] These cooperatives allow farmers to integrate vertically

[2] Lowder et al. (2016) analysed data for 111 countries and territories between 1990 and 2000 reported by the World Census of Agriculture and found that 84 per cent of farms were not more than two hectares and only 6 per cent were larger than five hectares.

[3] Sexton (2013) points out that market power exercised by agricultural intermediaries has distributional consequences that are much larger than the pure efficiency (deadweight) losses associated with it.

[4] For example, in their study of rice production in Madagascar, Bernier and Dorosh (1993: 23, table 12) show survey data indicating that farmers selling to village collectors have very few choices: in six out of 11 regions surveyed, the average number of collectors available to farmers was one or less, while in only three regions the average number of collectors was more than two.

[5] In addition to their marketing role, cooperatives can perform other functions that boost farmers' profits (Sexton and Iskow 1988). In particular, cooperatives can source and provide agricultural inputs and services to members, including (i) seeds, fertilizers, herbicides, pesticides and other physical inputs; (ii) services related to the use of capital goods such as machinery (both for production or processing of produce); (iii) financial services by benefiting from having collateral or access to official credit that can then be divided among members; and (iv) management services for a collectively used input (i.e. which has characteristics of a public good), such as water access and pasture land (which is subject to

by coordinating horizontally (Sexton 1986). Sexton and Iskow (1988) suggest that marketing cooperatives can increase the prices received by producers in three ways: (i) by reducing marketing margins where private providers of marketing services exercise appreciable market power; (ii) by improving the efficiency of marketing activities in the presence of inefficient private providers of marketing services;[6] and (iii) by exercising a preferential trading position relative to private providers of marketing services to obtain higher prices in the next stage of the value chain.

Marketing cooperatives may increase the prices received by farmers regardless of whether or not they are cooperative members because the influence on prices of non-members of a cooperative is sometimes referred to as a "yardstick of competition" effect. Sexton (1990) uses a formal model of spatial oligopsony to show how open membership cooperatives[7] can reduce the price margins of for-profit marketing firms under different assumptions of spatial competition (i.e. Loschian, Cournot).[8] Fulton and Giannakas (2013) extend Sexton's (1990) analysis to show that the existence of a positive yardstick effect of competition depends on competitive conditions in the marketing sector, on whether the cooperative is open or closed to new members, and on the pricing policy implemented by the cooperative.[9] Hence, the effects of marketing cooperatives on producer prices, both for members and non-members, are a priori ambiguous and conditional on a variety of factors.

A varied empirical literature has explored the relationship between cooperatives and farmer prices (Alwang et al. 2019; Carletti et al. 2019; Ebata et al. 2017; Hanisch et al. 2013; Jardine et al. 2014; Kumse et al. 2021; Milford 2012; Sauer et al. 2012; Ssebunya et al. 2018; Wollni and Zeller 2007).[10] A common finding of this empirical literature is that cooperative membership has positive and significant effects on producer prices, estimated using diverse econometric methods for a range of agricultural produce in both developing and developed countries. Furthermore, the literature has considered a range of alternative proxy measures for cooperative membership in empirical studies, including using dummy variables for cooperative membership (Alwang et al. 2019; Jardine et al. 2014; Ssebunya et al. 2018; Wollni and Zeller 2007), proportion of sales to

congestion or degradation), as well as information services (e.g. prices, best practices in production and sale) and dissemination, and facilitating access to finance. Cooperatives often play more than one of these roles, sometimes in combination with providing marketing services to members.

[6] This point is related to the "quiet life" hypothesis of Berger and Hannan (1998), which links cost inefficiency with market power. For efficiency gains to appear in this context, the required assumption is that cooperatives carrying out marketing services would be less inefficient than existing profit-oriented firms.

[7] An "open membership cooperative" is one that allows a member to join at any time, typically by purchasing a share of membership stock at a nominal fee. A "closed membership cooperative," in contrast, obtains most of its working capital during an initial membership drive. Usage rights to the facilities and services of a closed cooperative are granted by shares of the membership stock. In contrast to the shares of an open cooperative, shares of a closed cooperative are generally limited to the initial issue, and can represent a substantial investment.

[8] Other important factors to consider when analysing the yardstick effect of open cooperatives are whether they apply net average revenue product (NARP) pricing or net marginal revenue product pricing, and whether they operate in the upward- or downward-sloping parts of their NARP curves.

[9] For open membership cooperatives, a positive yardstick effect requires that (i) the prices of marketing first be strategic complements; and (ii) cooperatives seek to increase the prices paid to farmers. For closed membership cooperatives, the fixed costs of the cooperative are also important.

[10] Throughout this paper, the terms "farmer prices," "producer prices," and "prices received by farmers" are used interchangeably.

cooperatives (Carletti et al. 2019; Ebata et al. 2017; Hanisch et al. 2013; Sauer et al. 2012), and geographic indicators linked to cooperatives.[11]

One feature that all of the studies cited above share is that they focus on relationships between prices and a proxy for cooperative membership, omitting any interaction effects of the latter with other explanatory variables, including farm (herd) size. This type of specification is useful, as associated parameter estimates then represent average correlations between cooperative membership and producer prices as described by the survey data. Yet this feature of the literature also may obscure systematic differences in the way that marketing cooperatives influence prices received by agricultural producers.

This paper tests for a joint hypothesis derived from two key observations reported by the literature discussed above. If small farmers suffer from marketing disadvantages, and marketing cooperatives are effective in offsetting these disadvantages, then one should find the strongest positive effects of cooperatives on farmer sales prices among the smallest producers. This hypothesis is important because it would suggest that the average effects of cooperatives on farmer sales prices reported by the existing literature understate the effects relevant for the smallest producers, and overstate those for larger producers. These observations, in turn, have implications for the incentives of farmers of different sizes to be members of a cooperative.

Whereas the existing literature typically focuses on a single product in a single country, the above hypothesis is tested here on survey data collected from a diverse set of producers: maize farmers in Lao People's Democratic Republic, apricot, grape and plum farmers in Uzbekistan, and herders in Mongolia.[12] The surveys to collect the data were designed to facilitate comparisons between the different countries and products surveyed. These data are used to estimate a common empirical specification for producer sales prices, using four alternative econometric methods that are designed to control for alternative forms of endogeneity bias (Wooldridge 2010), in addition to ordinary least squares estimated for reference purposes.

There are two key findings from the empirical analysis. First, the results highlight the extent to which smallholder farmers received lower prices for produce than larger farmers: in both Uzbekistan and Lao People's Democratic Republic, farmer sales prices increase with the area of land under cultivation. Second, in both of these countries, the results indicate that participation in cooperatives is associated with a fixed increase in average sales prices, offset by a muted relationship between farm size and sales prices. Taken together, these results suggest that cooperatives are effective actors for "levelling the playing field" in support of smaller agricultural producers.

Furthermore, the analysis finds that controlling for self-selection is statistically important, and the results indicate the extent to which the influence of cooperative membership on farmer sales prices suffers a downward bias if self-selection is not controlled for.

[11] Milford (2012) employs the number of organic cooperatives divided by number of coffee producers in each municipality.

[12] Hanisch et al. (2013) and Sauer et al. (2012) consider cross-country data, with the former analysing data for milk producers from the EU-27 countries and the latter also considering milk producers, but for Armenia, the Republic of Moldova and Ukraine.

In the case of Mongolian herders, no significant and robust correlations are found between cooperative membership and producer sales prices.[13] This finding is consistent with the view that cooperatives operating in the Mongolian livestock sector play more of a resource management role (i.e., related to management of grazing land) than a marketing role. The finding highlights the diversity of potential roles played by cooperatives in assisting agricultural producers.

The next section of this report describes the data considered for analysis and the econometric methods employed. Empirical results are reported in Section 3, and policy implications are discussed in Section 4.

2 Survey data and empirical methods

2.1 Survey data

The analysis in this study is based on data collected via field surveys administered to primary producers in three landlocked developing countries: Lao People's Democratic Republic, Uzbekistan and Mongolia. Each survey focuses on agricultural products that are, or have the potential to be, important export products in the respective countries. The surveys were conducted with the collaboration of official representatives from each country The Lao survey focuses on maize producers, the survey for Uzbekistan focuses on grape, plum and apricot producers, and the survey for Mongolia focuses on livestock herders.[14]

2.1.1 Questionnaire design

The survey questionnaires were designed to elicit details concerning producer characteristics, production quantities, sales prices and marketing activities, including variables that are generally found to be important determinants of producer prices in the existing literature. Each of the three survey questionnaires used in the study was designed by an UNCTAD research team working in collaboration with consultants located in the three respective countries who were also engaged to conduct the surveys in the field.

All three questionnaires start from a common base structure that organizes questions by topic area, including (i) "identification", reporting the date and regional information for each survey respondent; (ii) "producer characteristics", describing features of the respondent's productive activity, including size, range of products, production volumes, income sources and participation in producer groups; (iii) "processing and transport", detailing pre-sale product processing and transport of goods for sale; (iv) "trade", describing the timing of sales, the characteristics of customers and customer relationships, and average sales prices for alternative products during the year preceding each survey; and (v) "pre-sales agreements", recording the incidence and terms of use of such agreements. While each survey incorporated a number of questions tailored to specific geographic and product circumstances, the main strength

[13] In common with much of the related literature, limitations of the survey data used (including potential measurement error) do not permit a detailed empirical analysis of causality. Where discussion of results depends upon causality, this causality is assumed in the current text. For an example of an empirical study of the causal effects of cooperatives on producer prices, see Jardine et al. (2014).

[14] See Cárcamo-Díaz (2020) and Cárcamo-Díaz et al. (2021) for further details concerning the respective value chains for export.

of the surveys in the three countries is that they were designed to facilitate comparisons between them.

2.1.2 Sample design and administration

Survey respondents were selected using a stratified sampling approach based on the geographic distribution of productive activities of interest. Only commercially active farmers were selected for inclusion in the survey, ex post verified by measures of self-consumption. The same consultants who participated in the design of the survey questionnaires were commissioned to identify the sample pool and conduct the survey in their respective countries.

Respondents to the Lao survey of maize producers were selected from the three largest maize-producing provinces in that country: Xayaboury, Oudomxay and Xiengkhuang. These provinces together accounted for 64 per cent of the total harvested area of maize in Lao People's Democratic Republic in 2017 (Lao Statistics Bureau 2018). The three sampled regions represent diversity in the export value chains for maize from Lao People's Democratic Republic: Xayaboury, in the west of the country, has extensive trading links with Thailand; Oudomxay, in the north, trades mostly with China; and Xiengkhang, in the east, has strong trade links especially with Viet Nam. The Lao survey team worked in collaboration with the provincial and district agriculture and forestry offices, as well as with the offices of industry and commerce, to select representative districts and villages for the survey sample. The Lao survey includes data for 181 farmers distributed across 15 villages in six districts (60 farmers each in Oudomxay and Xiengkhang, and 61 in Xayaboury). Data were collected via in-person field surveys conducted between May and June 2019.

Respondents to the Uzbekistan survey of fruit producers were selected from five of the principal fruit-growing regions: Andijon, Fergana, Namangan, Samarkand and Tashkent. These regions together accounted for 62 per cent, 61 per cent and 72 per cent of the national planted area of grapes, apricots and plums, respectively, in 2018 (Cárcamo-Díaz et al. 2021). The survey reports data for 103 farms collected between March and April 2020. Data were collected via in-person field surveys of farmers in all regions other than Samarkand, where interviews were conducted remotely due to COVID-19 restrictions imposed in that region during the sampling period.

In Mongolia, the survey sampled 168 herders from eight Mongolian aimags: Arkhangai, Bulgan, Dornod, Dornogobi, Khentii, Selenge, Tuv, and Uvurkhangai.[15] These aimags are situated predominantly in the centre and east of Mongolia near important border crossings with approvals to transport meat, including Zamiin Uud (Dornogobi aimag, exports to China) and Altanbulag (Selenge aimag, exports to the Russian Federation)

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