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Agricultural commercialization: Risk perceptions, risk management and the role of pesticides in Thailand

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ABSTRACT

The transformation of agriculture in lower income countries from subsistence-to market-oriented production systems has important implications for farmers' risk exposure and risk management yet only few studies have paid attention to this. This paper fills this gap and particularly focuses on the role of pesticides in managing the risk from crop pests and diseases, which is major source of risk to farmers. Data were collected for 240 Thai upland farmers stratified by ten levels of agricultural commercialization. The results show that risk perceptions and management strategies are strongly associated with levels of agricultural commercialization. Key strategies for commercial farmers included monitoring market prices, diversifying sales channels and applying large quantities of pesticides, while crop diversification and debt avoidance were more important for subsistence-oriented farmers. High levels of pesticide use at commercial farms were not accompanied by a safer handling practices, as farmers largely neglected pesticide health risks. The results point at the importance of tailored agricultural policies to strengthen farmers' resilience against risk at varying levels of commercialization, rather than following a one size fits all approach.

Introduction

Risk and uncertainty are inherent to agricultural production. In the context of lower income countries, risk and uncertainty are closely linked to vulnerability of farm households to remaining in or falling into poverty. Yet sources of risk and uncertainty are not uniformly spread over all farmers, neither are they constant over time. As farming systems in lower income countries transform from subsistence-to market-oriented production, the sources of risk to which farm households are exposed change (Kahan, 2008). Understanding the change brought about by commercialization is important for policy-makers to better manage the sustainable intensification of agriculture.

Whereas commercialization and land use change in Asia have been widely studied (e.g Pingali & Rosegrant, 1995; Tipraqsa & Schreinemachers, 2009; Vanwambeke, Somboon, & Lambin, 2007; von Braun, 1995), the relationship of commercialization to risk and risk management has received little attention. Most likely this is because commercialization and changes in risk are difficult to study as they require longitudinal data. Some studies have examined commercialization as a driver of farm productivity and rising farm household incomes, partly also

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considering market risk (Jayne, Haggblade, Minot, & Rashid, 2011; Pandey, 2006; Zeller et al., 2013). Other studies have put a focus on analyzing farmer decision-making under risk (Aimin, 2010; Akcaoz, Kizilay, & Ozcatalbas, 2009; Harwood, Heifner, Coble, Perry, & Somwaru, 1999; Liu & Huang, 2013; Waibel, 1990).

However, the role of risk that farmers face in the process of commercialization and market integration is underappreciated. It is therefore the first objective of this study is to improve the understanding of how risk and risk management of farmers change in the course of agricultural commercialization.

One of the sources of risk of greatest concern to farmers is crop pests and diseases. The unpredictability of pest and disease incidence and resulting crop damage creates much anxiety among farmers. Lack of functioning extension services, absence of pest and disease monitoring systems, and poor levels of education, magnify such anxieties. There is also heightened pest pressure from the introduction of cash crops that are often poorly adapted to farmers' agro-ecological conditions and the simplification of cultivation patterns with widespread mono-cropping. Therefore, in the process of commercialization, farmers turn to using synthetic pesticides, which also become more accessible, to lower their risk exposure and to increase the odds of a good harvest. The second objective of this study thus is to analyze the relationship between commercialization and the role of synthetic pesticides in managing the risk of crop pests and diseases.

The paper starts by describing our methods and data. It then identifies the various sources of risk as perceived by the farmers, shows their main risk management strategies, and shows how these vary with the level of agricultural commercialization. The second part of the results section then concentrates on the role of pesticides in risk management and estimates a regression model to identify drivers of pesticide use. We then discuss our findings and conclude.

Material and Methods

Data

The uplands of northern Thailand are ideal for this type of study because the mountainous terrain creates unequal opportunities for agricultural development within a relatively small geographical area. A few decades ago, rice was the main crop grown virtually everywhere. Yet current land use patterns are much more diverse and include rice alongside many high-value crops such as maize, soybean, vegetables, fruits and flowers (Rerkasem, 1998; Vanwambeke et al., 2007).

We selected three northern provinces for our research: Nan, Chiang Rai and Chiang Mai because they form a north−south axis from the main urban center of Chiang Mai. It appeared logical to assume that opportunities for commercial agriculture increase with the proximity to a major urban center. These provinces have 1,079 rural upland villages. We used secondary data from the Highland Research and Development Institute in Chiang Mai to find a proxy for agricultural commercialization. The best available proxy variable was the average income per adult employed in agriculture. We ranked the villages by this variable and divided them into ten equal segments. We selected the median village from each segment. To represent the extremes, we additionally selected the village at the 25th percentile of the first segment and at the 75th percentile in the last segment. This resulted in a sample of 12 villages of roughly equal size on a spectrum of agricultural commercialization.

We developed a structured questionnaire to collect data on risk perceptions and risk management strategies as well as about farm production and farm household characteristics. The questionnaire was tested in three out-of-sample villages (one subsistence, one semi-subsistence and one commercial village) and refined after each test. Survey data were collected over a five-month period between November 2011 and March 2012, using a 12-month recall period. In each sample village we first conducted a focus group discussion with a small group of farmers and then compiled a list of all households with the village headmen. From this list we randomly selected 20 farm households for an interview.

Respondents were asked to indicate the level of importance of various sources of risk using a 5-point Likert scale ranging from one (not important) to five (very important). Sources of risk were grouped into four categories, including production, market, financial as well as human and personal risk. For each source, respondents were asked to explain how they tried to control it and how effective each of the mentioned control methods were; again, using a 5-point Likert scale ranging from one (useless) to five (very useful). These risk management strategies were initially taken from the literature and refined through the pre-tests and focus group discussions. We also quantified the value of input use and output for each crop. For pesticide use, we recorded the product name and the quantity applied. Secondary data were collected for each pesticide product to convert quantities of formulated product into quantities of active ingredients.

Quantifying Commercialization

Agricultural commercialization was quantified using farm performance indicators as originally suggested by Dillon, Hardaker, and Food & Nations A. O. o. t. U (1993) and later applied by Tipraqsa and Schreinemachers (2009) for a study in northern Thailand. More specifically, we used two indicators: (1) integration into farm input markets, defined as the value of variable inputs bought relative to the total value of variable inputs used on the farm (including seeds, fertilizers, hormones, labor and any other inputs, but excluding pesticides); and (2) integration into farm output markets or marketable surplus, defined as the gross farm output sold as a quotient of the total gross farm output at average farm gate selling prices.

$$\text{Integration into variable input markets} = \frac{\text{Value of variable inputs bought}}{\text{Total value of variable inputs used}} \quad (1)$$

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