Risk and Certification to Agricultural Standards

by

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Abstract

This thesis is comprised of four essays on the economics of certification to agricultural standards in developing countries. It generates new evidence on the relationship between risk and certification.

The first essay builds a theoretical framework to understand the relationship between risk aversion and certification to agricultural standards. In the presence of uncertainty over the proportion of their produce that will be rejected by consumers, results indicate that a relatively risk-averse population of farmers will tend to adopt a high-quality standard in greater numbers. However, analysis suggests that the relationship is sensitive to the relative profitability of adoption, the degree of consumer differentiation between certified and non-certified produce, and the difference in their rejection rates.

The second part of the thesis empirically examines the role of individual risk attitudes in the decision to get certified to an agricultural standard. It investigates the relationship between measured risk aversion and certification

status using primary survey and experiment data gathered through field research with Nepali small-scale tea farmers. Results indicate that farmers who are more risk averse have a higher propensity to get certified. These findings provide concrete evidence against previous assumptions that only risk lovers get certified. Instead, they suggest that certification schemes may provide a benefit not yet considered in the literature: that of providing risk-reduction opportunities to risk averse farmers in developing countries.

In the last chapter, the role of certification in sparking processes of institutional change is taken up in a global value chain (GVC) framework. The theoretical insights of institutional economics are combined with the GVC framework to analyze case study data from Nepali small-scale tea farmers. The typology of institutional change in value chains that emerges from this research suggests that agency, organizations, and informal norms affect whether certification yields benefits in a particular place. The research findings illuminate the institutional conditions under which certification can improve welfare in developing countries.

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Chapter 1

Introduction

This thesis is comprised of four self-contained essays in development economics. The underlying theme throughout this body of work is the economic implications of certification to agricultural standards in developing countries. It examines the relationship between risk, certification and institutions in particular. How does the risk aversion of farmers in developing countries affect their decision to get certified, such that only a subset of the population can benefit from selling into certified markets? Do farmers who get certified experience less price and quantity risk? How does certification to an agricultural standard affect local economic institutions? This thesis aims to answer these questions through four papers in theoretical and empirical economics.

The first essay, presented in Chapter 2, builds a theoretical framework to understand the relationship between risk aversion and certification to agricultural standards. This question is particularly relevant given that the existing literature on standards has not considered the role of risk, despite empirical evidence that farmers in developing countries are risk averse. The framework is built upon assumptions derived directly from the stylized facts of case studies amongst small-scale farmers in the developing world. In the presence of quantity uncertainty over the proportion of their produce that

will be rejected by consumers, and given that certification reduces the extent of this uncertainty, farmers' decision to get certified to a high quality standard will be sensitive to their risk aversion as well as market conditions. The effect of their risk aversion on their certification to agricultural standards is analyzed by considering an industrial organization model of differentiated exchange of high and low quality products between consumers, intermediaries, and farmers. I solve the model in an expected utility framework and show both how the prevalence of certification is sensitive to the farmers' level of risk aversion and how farmer welfare is affected by certification.

Chapters 3 and 4 empirically examine the role of individual risk attitudes in the decision to get certified to an agricultural standard. Chapter 3 provides background on the field research conducted to gather data to evaluate this relationship. It discusses the survey and field experiment methods deployed to elicit the risk preferences of Nepali small-scale tea farmers who faced the option of getting certified to the organic standard. Chapter 4 analyses this data within an expected utility framework which investigates the relationship between risk preferences and certification decisions. The technology adoption literature finds that risk averse farmers tend to avoid adopting risky new technologies, and would therefore predict a negative relationship between risk aversion and certification, but the contract farming approach suggests the opposite. The contract literature suggests that when certification occurs as part of an agricultural contract, adoption can provide access to risk protection that is relatively more appealing to more risk averse farmers, implying a

positive relationship between risk aversion and certification, with more risk averse farmers having a higher propensity to adopt. The chapter tests the technology adoption hypothesis against contract theory's opposing prediction through an empirical investigation into the relationship between measured risk aversion and certification status in a population of Nepali tea farmers.

The role of certification in sparking processes of institutional change is the subject of Chapter 5. The chapter combines the theoretical insights of institutional economics with the analytical apparatus of global value chain analysis to analyze case study data from Nepali small-scale tea farmers. Certification to agricultural standards is taken up by farmers to upgrade their position in value chains. Local conditions in developing countries have long played a part in determining whether their small-scale firms can benefit from such upgrading. Institutional theory allows us to characterize these local conditions not simply as particularistic oddities but rather as elements of an institutional matrix that affects the livelihoods of chain participants. The analysis in this chapter analyzes the case study data with a view to understanding how institutions mediate, in practice, between certification and its livelihood outcomes.

Chapter 6 concludes the thesis. Appendices can be found at the end of each chapter and all references are at the end of the thesis.

Chapter 2

Private Standards and Producer Risk: a Framework for Analysis of Development Implications

2.1 Introduction

While governments and development organizations struggle to reach the rural poor through their policies, in practice, agricultural standards are remaking the countryside. International agri-food firms have in recent decades required that supplying farmers follow private sector standards (Henson and Humphrey 2010). These standards set out stringent rules for production and processing. When they are applied by small-scale farmers in Africa, Asia and Latin America, implications extend into the poorest households on the planet (Maertens and Swinnen 2009). These households tend to be risk averse (Rosenzweig 1988; Hamal and Anderson 1982; Moscardi and de Janvry 1977; Gomez-Limon et al 2003). The purpose of this study is to try to understand how their aversion to risk affects their decision to adopt standards.

Once the exclusive remit of the state, production standards have been taken up by private sector actors particularly since the 1990s, when consumers began demanding quality that went beyond minimum public standards, and agri-food corporations became concerned by quality risks and reputation

(Henson and Humphrey 2010). While public standards are mandatory for importing into a country and retailing a product anywhere within its borders, private standards are voluntary in the sense that they are used by specific firms, and suppliers decide whether or not to supply to those firms and adopt the standard. Private standards tend to be more stringent than public ones, providing a means to match supply to market requirements while helping to reduce the transaction costs of buyer-supplier coordination. They originate from several different sources. Plurilateral negotiating forums such as the International Standardization Organization (ISO) develop industry benchmarks with multistakeholder representation (Buthe and Mattli 2011; Cao and Prakash 2011). Consortia of private firms, such as the European retailers who created GLOBALGAP, or individual firm quality standards, such as Tesco's Nature Choice, set out rules for product homogeneity, safety, and other quality attributes. Civil society actors have created schemes such as the Forest Stewardship Council (FSC) to certify compliance with environmental and social norms (Auld 2014).

An extensive literature shows that these private standards affect the quantity farmers sell, the prices they receive, the level of their income, poverty, and how they allocate their labor (Handschuch et al 2013; Subervie and Vagneron 2013; Ayuya et al 2015; Bolwig et al 2009; Maertens and Swinnen 2009). There is also preliminary evidence that the adoption of standards also affects the risks farmers face, including from volatility in prices and sale quantities (Bolwig et al 2009; Handschuch et al 2013; see also fourth chapter

of this thesis). Given the riskiness of marketing cash crops, and farmers' risk aversion, it stands to reason that when a farmer decides whether to adopt a high-quality standard, the impact of adoption on risk could influence their decision.

Farmers' risk aversion has not yet been studied in the theoretical literature on standards and development. When such research has focused on producers and standards (Swinnen et al 2015; Bazoche et al 2005; Xiang et al 2012; Yu and Bouamra-Mechemache 2016), it has examined how farmers choose the stringency of standards they adopt, taking into account how the standard affects mean farmer income through prices and market access, and in light of market power in the value chain. Yet this focus on the strategic choice of standards by developed-world farmers is less relevant to developing world conditions, where farmers tend to be standard takers rather than makers. Furthermore, it is generally assumed in this literature that farmers are risk neutral, but this is violated in reality (Rosenzweig 1988; Barham et al 2014).

The broader literature on standards has focused on how standards are used by consumers and their intermediaries. This research has, for example, shown how standards can be used to leverage intermediary power in input markets (von Schlippenbach and Teichmann 2012; Baake and von Schlippenbach 2011), signal quality to consumers (Dasgupta and Mondria 2012; Auriol and Schilizzi 2015), attain social objectives (Podhorsky 2015), and incentivize quality revelation (Albano and Lizzeri 2001; Weaver and Kim 2002).

To our knowledge, the literature on private standards and development has not yet analyzed the link between risk and farmer welfare. However, several papers on standards have suggested that future research could relax the risk neutrality assumption (BGS; Baake and von Schlippenbach 2011; Albano and Lizzeri 2001). We intend to address this gap by investigating how developing world small-scale farmers' aversion to risk affects their decision to adopt standards.

We consider farmer standard choice in an industrial organization model characterized by quantity uncertainty. The market is set up as a differentiated exchange of high and low quality product between consumers, intermediaries, and producers. There is a quality information asymmetry between producers and consumers which is resolved by an intermediary who signals the quality of the good. Although the standard model assumes that all that is produced is sold, this paper follows evidence from agricultural trade and assumes that some of what is produced goes to waste. Producers are risk averse and respond to quantity uncertainty by changing their production choices accordingly. The analysis proceeds by examining how producers optimally partition themselves between high and low quality standards given quantity uncertainty and prices quoted by competing intermediaries. This market structure emerges through interactions between prices, risk aversion, quantity uncertainty, and standard choice.

Our main results include the following. We show that risk averse producers

tend to adopt high quality standards more than risk neutral ones. We also show that the relationship can be reversed if market conditions change. And finally, the model suggests that the welfare impact of certification is sensitive to risk aversion, the degree of risk, and other market conditions.

This research contributes to the literature on private sector standards by investigating the implications of farmer risk aversion for standard-governed value chains. The use of assumptions derived directly from the stylized facts of fieldwork and case studies amongst small-scale farmers in the developing world provides real-world decision sequences and modelling which adds institutional richness to the literature. Finally, the paper also adds to the theoretical literature on the production implications of risk aversion. Classic scholarship shows that producer risk aversion can lead to suboptimal output levels (Sandmo 1971) and quality (Leland 1972). More recent work has analyzed how suppliers' risk aversion impacts whether moral hazard in their quality effort can be addressed (Yoo 2014). We show that farmers' risk aversion also affects their relationship with quality standards.

The chapter is organized as follows. The next section discusses the stylized facts of farmers' production choices that motivate the assumptions in the paper. Section 2.3 presents the model. It is solved in Section 2.4, where a game of exchange takes place given either risk neutrality or risk aversion. The welfare implications for producers are studied in Section 2.5. The last section summarizes and concludes.

2.2 The Nature of Trade with Private Standards

In order to model the role of standards in farmer optimization in developing countries, it is necessary to first understand how standards operate in agri-food systems there. A full survey would go well beyond the scope of this paper. Instead, this section presents a collection of selected cases in turn. Notwithstanding the great diversity of agricultural institutions present in rural areas of the developing world, the cases presented here suggest common features that undergird the proposed model, suggesting it will be of reasonably general relevance.

The case of Nepali tea provides a good starting point to understand rural marketing arrangements (Mohan 2014; Mohan 2016). Small-scale orthodox tea farmers in Nepal can produce conventional quality tea, and sell it to the local factory, which processes it and sells it mostly to Indian and Nepali buyers. Alternatively, farmers can adopt the Organic certification scheme, in which case the factory would pay them a higher price for their high quality standard produce, process the tea, and sell the certified produce to top-price overseas markets. Farmers who adopted the high quality standard tended to receive higher prices but also had higher costs than those who continued to produce using the low quality standard (Mohan 2016). Additional costs came from the certification process itself, the purchase of additional livestock for making organic fertilizer, and higher levels of labour needed for organic methods. Local processing factories quote a price at the beginning of each

growing season, and farmers produce as much as their land will yield, given weather and pest conditions. With an average tea farm of three-quarters of a hectare, and a standard deviation of just 0.55, each farmer produced roughly the same quantity. That is, in the short run, with a limited amount of land, the quantity each farmer supplied was fixed. Although the factory accepted all the tea supplied by each farmer, the factory decided after delivery what proportion was deemed to be A-grade, which earned top price, and what proportion was B-grade, which garnered a lower return or none at all. The factory assessment was based in particular on the proportion of the supply which consisted of two leaf and a bud of the tea bush since this small plucking morsel yields the best quality made tea. Several months later, the factory informed the farmer what proportion was deemed top quality and paid him or her accordingly.

Similar stylized facts emerge from research with Malian cotton farmers (Bingen 2006). Farmers drop off as much seed cotton as they like at village-level collection points, where a member of the village association grades it as first or second quality based on colour and cleanliness, and gives them a receipt: they are guaranteed to receive at least the fixed price for second quality cotton. Once confirmation of the grade of sold cotton is received from the buyer in France, the intermediary, CMDT (Compagnie Malienne pour le Developpement des Textiles /the Malian Company for the Development of Textiles), pays the village associations according to the proportion of first and second grade product that was delivered by the associations. There is

uncertainty concerning the quantity of product that will be paid full price. While they grow all their cotton following high quality standards, only some of it is graded as first quality and paid accordingly.

The fact that a significant and uncertain proportion of product can be rejected because of quality issues has been echoed in other papers. De Janvry et al (2001) find that only one half to one seventh of Fair Trade certified output actually sells on the Fair Trade market. In his study of potato farmers in India's Punjab region, Singh (2008) reports that Frito-Lay rejected 46 per cent of produce supplied by farmers, with some farmers experiencing a rejection rate as high as 62 per cent (Singh 2008: 301). In rural areas of developing countries, it appears that buyers often quote a given price for a whole season and price uncertainty is minimized (Bingen 2006). As such, the rest of this paper thus focuses on quantity uncertainty, abstracting from price uncertainty which has been studied elsewhere (c.f. Bourguignon et al 2004). Quantity uncertainty can be particularly problematic and arises, inter alia, from production and marketing risks.

Research suggests that farmers' choices are sensitive to production risks, including from pests, rainfall, flooding, and droughts. Rosenweig and Binswanger (1993), for example, find that farmers reduce the responsiveness of their asset portfolio (including livestock, machines and land) to rainfall variation when there is greater expected rainfall variability, while Ogada et al (2010) shows that farmers minimize investment in technologies (such as fertil-

izer) when there is a higher possibility of crop failure (downside risk). Unfortunately, there is very little data on how certification affects such production risks. The study by Handschuch et al (2013) amongst Chilean raspberry producers provides the best evidence on production risk and certification, finding that certified and uncertified farmers had virtually identical variation in yields (standard deviations of 4061 kg per ha for the former and 4040 kg per ha for the latter). This suggests that it is a reasonable to assume that production risks are independent of certification, and as such this paper follows this approach, and abstracts away from production level risks[1].

Marketing risk in quantity arises when produce is rejected by a buyer owing to poor quality. Some of what farmers grow is categorized as A-grade produce, and sells at top price, but the rest is categorized as B-grade and either goes to waste or sells on a separate subsidiary market. Rejection from the target market occurs either on the basis of product-specific quality characteristics such as colour, cleanliness, size of produce, or because of sanitary criteria such as freshness (eg. the produce goes rotten in transit), defects (eg. the produce has bruising and damage), or infestation (eg. high levels of in-

[1]If this assumption is relaxed, then certification could indeed affect production-level risk, but the evidence suggests that certified farms have more and better quality management procedures that improve average yields (Handschuch et al 2013; Bolwig et al 2009; Ruben and Zuniga 2011) which can be expected to also lower variation in yield. This is supported by evidence from the Nepali tea sector, where certified organic farms were if anything more robust because they were more carefully tended with more labour, farmers attended more trainings so knew what to do in case of drought or insect infestation, and where organic instead of agrochemical inputs were used, which tended to increase the resilience and robustness of the plant and its yields. The evidence thus suggests that production level risks are the same or lower on certified farms vis a vis uncertified ones.

sects in the produce). Evidence from Nepal and Chile suggests that certified farmers have a higher and more stable proportion of A-grade produce than their uncertified peers (see fourth chapter of this thesis and Handschuch et al 2013). The literature on certification suggests this may be because the training process entailed in certification can lead to higher-quality and more homogenous produce and because the certification label can increase confidence of overseas consumers in the quality of the product. The low-rejection certification assumption is particularly relevant in a commodity export enclave setting, where developing country farmers produce cash crops entirely for export, such as Kenyan flowers or Peruvian asparagus. Here low quality production is for wholesale export through a loosely governed spot market and is often rejected at the border or by consumers, while high quality production occurs within a tightly governed value chain and is closely supported, monitored and shepherded through each stage in the chain such that less gets rejected at each stage. Yet all farmers are unclear at the start of the season what proportion will sell at full price. The scope of the quantity uncertainty differs across marketing channels, and this chapter follows the stylized facts and assumes that certified produce faces less such uncertainty. Risk-averse producers looking for more secure, stable income streams take these uncertainty profiles into account.

The risk management tools used by their developed country peers are often unavailable to farmers in the developing world, including because of limited assets and credit market failures (Basu 1989; Ghosh et al 2001; Udry 1994).

In an economic environment where farmers have little market power yet live close to subsistence, risk mitigation objectives are met through diversification of income streams (Kurosaki 1997) and strategic crop (Fafchamps 1992) and marketing choices (Zusman 1989). In some settings farmers have no marketing choices for their cash crop, and sell an undifferentiated product to a middleman. As suggested by the Nepali case, however, farmers sometimes have the option of voluntarily adopting a private standard and selling directly to a high quality buyer, who will in turn sell to a downstream wholesaler or retailer who requires compliance with that standard (Jang and Olson 2010). Each contractual option has attendant income implications as well as risks. High-quality standard-governed contracts usually pay a higher price (Jones et al 2006). However, there can be high costs of compliance with quality standards, including for the certification process, associated technologies as well as more labour-intensive production methods (Ransom 2006: 170).

The stylized facts arising from these case studies indicate that farmers decide which crop to grow, taking into account inter alia prices offered and agro-ecological conditions. Taking the crop as a given, they then choose what marketing channel to supply into. Different marketing avenues generate different production, profit, and utility functions for the farm. Farmers exercise choice over crop and contract, but can't influence quantity or price. Their influence over quantity sold is foreclosed by the finite amount of land they have, their helplessness in the face of weather, and assuming that they already use best practices in input use and effort against pests and weeds. They

have little control over price because of market competition. Finally, farmers are embedded in a complex institutional matrix that includes interlinked markets, informal norms, and organizational rigidities (Harriss-White 1996; Bardhan 1989; Bardhan 2003). The next section incorporates these stylized facts as assumptions to build a realistic institutional setting for an industrial organization model of the market structure that emerges from producer choice of standards.

2.3 Model

Producers, intermediaries, and consumers interact in this model of quality differentiated exchange. Consumers want to buy an agri-food commodity from producers. Some of the consumers would prefer to buy a high quality good and others would prefer low quality. Producers are small-scale farmers in a developing country who grow a cash crop and can not successfully signal the quality of their goods to consumers on their own. Intermediaries solve this problem by purchasing the good from producers, signaling its quality, and reselling it to consumers. Intermediaries are wholesalers who buy product from farmers and sell on to consumers. There are two types of intermediaries: those who sell product which meets a high-quality standard, and those who sell low-quality produce. The standards themselves are exogenous and their level taken as a given. Each intermediary invites producers to produce for them and follow the corresponding standard in return for its price.

Every farmer produces according to a standard, choosing whether to adopt the high or low quality standard[2]. I assume that producers do not coordinate with one another nor act strategically: instead, each farmer chooses a standard independently. If the other standard yields higher expected utility, s/he will switch to the other standard, which increases its supply and lowers its relative price. The population will continue to sort itself in this manner until the expected utility of the two types of production are equated and no farmer has the incentive to switch, defining the equilibrium organization of the market. Decisions are made only with respect to short-term outcomes in the single period framework of the model.

If the high standard is adopted, then the farmer faces a contract that corresponds to the high standard. Specifically, farmers that choose the high standard grow high quality product, incur high-standard costs, face high-standard prices, and encounter high standard sale quantities. Farmers that instead decide to adopt the low quality standard face low-standard quality, costs, prices, and quantities. Produce made according to the high quality standard garners higher prices, but also incurs greater costs than low quality goods. Getting certified to a standard is the only source that can create these different qualities, costs, prices and quantities. Farmers must get certified to the high quality standard if they want to access its higher prices, but in so doing they will incur the higher costs of that type of production.

[2]Although in reality there is a whole range of qualities and corresponding range of prices, this model collapses them to two categories, high and low, to clarify the forces at play.

Farmers face uncertainty which affects which standard they adopt. Specifically, there is uncertainty about what quantity of goods they will sell, and the uncertainty profile differs between the two standards. Although I assume that every farmer has the same amount of land, and produces the same quantity of crop, as per the stylized facts presented in the previous section[3], a fraction of what they produce gets rejected by the A-grade target market[4]. The proportion of the produce that is rejected by A-grade markets is, as per the stylized facts presented in the last section, classified as B-grade; I assume that B-grade produce goes to waste and producers are not paid for it. The proportion of their output which is lost in this fashion, which we call the rejection rate, is a random variable which has a different realization for each farmer. Farmers who have adopted the low quality standard have on average more of their produce rejected than those who adopt the high quality standard. Furthermore, there is more variation amongst the rejection rates of low quality farmers. Farmers do not know what proportion of their produce will be rejected at the beginning of the season when they decide which standard

[3]Following the discussion in the previous section, I assume away production-level risks here. If this assumption is relaxed, and following the stylized facts assume certified produce lowers production-level risks, then the modelling of quantity uncertainty can be extended to subsume both production and marketing quantity uncertainty. In this scenario, the rejection rate would encompass both field-level production losses and consumer-quality marketing losses, both of which would be lower in mean and variance for high quality goods. The model would thus be essentially unchanged in its configuration and results, with a lower average and variation in the rejection rate of the high-quality good, although the timing of the rejection would be two-fold.

[4]Although undoubtedly produce loss occurs after consumer purchase, including as household or restaurant waste, we abstract away from this phenomenon and study only the loss that occurs after production but before consumption.

to adopt.

In an extension, which is not included here, I explore the possibility that rejected produce is sold on a secondary, lower-value market. For example, rejected high-quality produce could sell on low-quality markets, and rejected low-quality produce could sell on animal feed markets. The findings of this revised model are similar to those found in this chapter, but highlight that the income generated through subsidiary markets provides insurance to farmers which reduces the sensitivity of standard choice to risk aversion.

The game timing is as follows. Each intermediary offers a contract to producers that consists of a price that corresponds to its standard. Farmers choose which standard to adopt, thereby partitioning themselves into farmers that produce according to high standards and those that produce according to low quality standards. The product is then made, and the agreed-upon quantities are transferred from producers to intermediaries. Intermediaries sell the product to consumers, who reject a proportion of each farmers' output. Consumers have preferences for differentiated quality wherein their demand is partitioned between high and low quality varieties based on the quality-to-price ratio. Prices are realized as markets clear, and intermediaries pay the farmers for the proportion of their produce which has actually been purchased by consumers. The game timing is outlined in Figure 1 below.

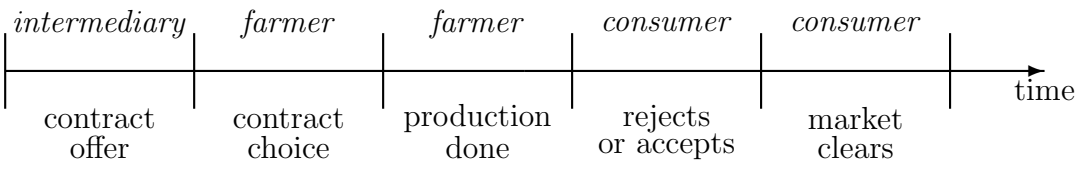


Figure 1: Game timing

An analogy is useful to clarify the nature of quality-related information asymmetries. Suppose we are in a store, buying groceries, and we wish to buy some grapes. Approaching the fruit section, we see there are no-name, bagged grapes, and there are some higher-priced top-grade organic grapes. Given the difference in price between the two goods, a certain proportion of consumers would prefer to buy the higher quality organic grapes. Their preferences are based on product attributes they cannot see at the produce counter: the richness of flavor, say, or the pesticide content. The intermediating wholesaler, however, has imposed a set of organic and production standards and selectively tested the product for compliance, and so knows whether the product meets these requirements; he signals as such through his brand and certification label, consumers trust the signal, and are able to buy the quality level they wish. This corresponds to high/low quality information asymmetry.

Yet there is always a chance that some grapes are simply defective: say they are bruised, or have fungus growing on them (Roy and Thorat 2008). Since neither the producer nor the intermediary can inspect every grape, they do not have full information on this (although the intermediary can predict, based on previous knowledge of his entire shipment, the rough proportion of

overall product that is flawed). Consumers, on the other hand, can see the bruised or rotten character directly, and respond by rejecting the product: they refuse to buy it, instead buying a different one. This leads to a certain rate of rejection of produce. There are thus two dimensions to quality: a high/low dimension that is not observable by consumers, and a defective/acceptable dimension that is observable by neither farmers nor intermediaries. These two dimensions of quality information asymmetry roughly reflect two types of quality regulated by standards, with the high/low quality reflecting product and process method (PPM) issues and the quality failure reflecting sanitary and phytosanitary (SPS) issues[5]. Since producers are homogenous and have the same quality information as intermediaries, and always produce according to the standard they have chosen, there is no adverse selection nor moral hazard in the model[6].

2.3.1 Demand

Consumer demand for the product is differentiated according to quality θ. There are the two qualities available, high $\overline{\theta}$ and low $\underline{\theta}$, which result from production according to high quality and low quality standards respectively.

[5]An extended model would more realistically include a retailer or government who bridges the exchange between consumer and agri-food wholesaler by doing such SPS-type quality failure rejections. In that case, consumers suffer from two dimensions of quality information needs, with two corresponding intermediaries (agri-food wholesalers and retailers) who exist to remedy them. In the interests of simplicity, this model collapses the retailer and consumer into one actor.

[6]Yoo (2014) relaxes these assumptions in a moral hazard model, assuming instead that suppliers' quality is variable and unobservable to intermediaries who incur costs when poor-quality produce is rejected by consumers

These two product types sell for $\overline{p}$ and $\underline{p}$ respectively. Inverse demand is adapted from Shy (1995: 136):

$$\overline{p} = \overline{\alpha} - \beta\overline{q} - \gamma\underline{q} \tag{2.1}$$

$$\underline{p} = \underline{\alpha} - \gamma\overline{q} - \beta\underline{q} \tag{2.2}$$

Where $\beta > 0$, $\gamma > 0$, and $\beta > \gamma$, both expressions are non-negative, $\overline{q}$ is the total demand for high quality product, and $\underline{q}$ is the total demand for low quality product. $\overline{\alpha} > \underline{\alpha}$, reflecting the consumer's higher willingness to pay for high quality product over low quality product, ceteris parebus. β is the effect of a change in own quantity on own price, and γ is the effect of a change in the other varieties' quantity on own price[7]. Varieties that are well differentiated on consumer markets have a low cross-price effect γ such that $\frac{\gamma}{\beta}$ is small.

2.3.2 Production

There is an infinite number of farmers, indexed from 0 to 1. A proportion N of them produce according to low quality standards and $1-N$ produce using high quality standards, where $N \in [0, 1]$. N is determined endogenously. To simplify, we assume that there is no entry of new producers and quantity per

[7]Although in some situations differentiated products may have different own-price effects, and/or differing cross-price effects, for analytical convenience it is assumed here (following Shy 1995) that the own-price effect β is the same for high and low quality product: $\overline{\beta} = \underline{\beta} = \beta$. Similarly, the cross-price effect γ is assumed to be the same in both directions: $\overline{\gamma} = \underline{\gamma} = \gamma$.

farmer is fixed and identical: each farmer is endowed with one unit of land and can produce one unit of output.

Although all actors can perfectly observe whether the product is of high or low quality once the intermediaries have signaled as such, there is a positive probability δ that goods have a quality failure (i.e. rotten fruit) and will be rejected by consumers. We assume that in the event of quality failure, the rejected product goes to waste (Weaver 2002). There is thus a third, implicit quality which is so low that the product goes to disposal. The high-quality intermediary knows the total proportion $\overline{\delta}$ of product certified to high-quality standards that will be rejected. Likewise, the low-quality intermediary knows that $\underline{\delta}$ of the total low-quality product will be rejected.

These industry-level rejection rates are also known by producers, but an individual producer may lose more or less than this proportion. Individual producers do not know the rejection rate δ_i they will experience. The rejection rate faced by an individual producer is a function of weather, chance, labor availability, overseas purchases, and other influences on quality and demand. Indeed, to a given farmer it must seem rather random[8].

Following on these stylized facts – particularly that the rejection rate is a

[8]In reality, rejection is to some degree random, but is also affected by other factors, including production effort and collective action given public good aspects of quality. These influences on the rejection rate are ignored here in favor of a focus on the standard adoption choice. See Tirole (1986) for the classic study of effort and quality in the context of a tripartite contract; Baake and von Schlippenbach (2011) on effort and private quality standards; Cooper and Ross (1985) and Elbasha and Riggs (2003) on effort, quality and producer warranties; and Narrod et al (2009) on certification and collective action.

proportion ranging from 0 to 1 and that it is randomly distributed – we assume that the proportion of an individual producers' output which is rejected, δ_i, is a uniformly distributed random variable[9]. If a producer chooses to produce high-quality goods, $\delta_i \in \overline{\Phi}$, $\overline{\Phi} \sim U(0, 2\overline{\delta})$ and $E\left[\overline{\Phi}\right] = \overline{\delta}$. If s/he chooses to produce low quality goods, $\delta_i \in \underline{\Phi}$, $\underline{\Phi} \sim U(0, 2\underline{\delta})$ and $E\left[\underline{\Phi}\right] = \underline{\delta}$. The industry-level probability of high quality product rejection is lower than that of low quality and average rejection rates are below 50% such that $0 < \overline{\delta} < \underline{\delta} < 0.5$. This ensures that all individual rejection rates are less than 100%; given a random, uniform distribution with equal probabilities below and above the mean, a mean value of the random variable below 50% is required to ensure that each and every draw of the random variable is a proportion between 0 and 1. The survival rate of high quality produce can be defined as $(1 - \overline{\delta})$ while that of low quality produce is $(1 - \underline{\delta})$.

An individual producers' realized profits are a function of rejection rates, prices and costs:

$$\pi_i = (1 - \delta_i)p - c \tag{2.3}$$

Once a producer has decided which standard to adopt, s/he expects to earn profits according to the costs, prices, and uncertainly-distributed quantities that correspond to that contract type. Although goods produced according to the high quality standard have a lower probability of rejection, they also

[9]Without randomness, the beta distribution would be appropriate, but it does not lead to a closed-form solution and as such is not used here. Without the strict bounds of 0 and 1, the normal distribution could be appropriate, as per Yoo (2014).

have a higher cost of production: $\overline{c} > \underline{c}$. All high quality-certified producers have the same costs, and likewise for low quality producers. As noted above, intermediaries quote prices at the beginning of the game: high (low) quality producers earn $\overline{p}$ ($\underline{p}$) for that proportion of production that does not get rejected. As such, the expected profits of high and low producers are respectively:

$$E\left[\pi_i|\overline{\theta}\right] \equiv (1-\overline{\delta})\overline{p} - \overline{c} \tag{2.4}$$

$$E\left[\pi_i|\underline{\theta}\right] \equiv (1-\underline{\delta})\underline{p} - \underline{c} \tag{2.5}$$

2.3.3 Intermediaries

There are two types of intermediaries, high and low. We assume here that there are no costs to intermediation and that there are many of each type of firm[10], which generates perfect competition in the sector and drives profits to zero. As such, the prices $\overline{p}, \underline{p}$ which intermediaries pay to producers who are certified to high and low standards respectively are the same prices that they charge consumers.

We can calculate how much product $\overline{q}$ the high-quality intermediary will sell

[10]A more realistic assumption would incorporate the market power that wholesaling intermediaries, such as Cargill or other global agri-food firms, have in reality. Such a model could, for example, have one of each type of firm, such that there are Bertrand duopoly intermediaries. Such market concentration adds another layer of complexity to the model, rendering it unwieldy, without adding substantively to its insights. Future research could explore the joint implications of risk aversion of farmers and market concentration amongst those who buy from them.

to his customers, and likewise for low-quality product $\underline{q}$. They depend on $\overline{\delta}$ and $\underline{\delta}$ respectively:

$$\overline{q} = (1 - N)(1 - \overline{\delta}) \tag{2.6}$$

$$\underline{q} = N(1 - \underline{\delta}) \tag{2.7}$$

Notwithstanding their passive role in transmitting the product, intermediaries serve a crucial quality signaling function which enables trade in both high and low product (Albano and Lizzeri 2001; Dasgupta and Mondria 2012; Auriol and Schilizzi 2015), as we now show[11].

2.4 Equilibrium Market Structure

We begin with the most simple scenario, that is, where there are no intermediaries and no risk aversion. We then introduce, in turn, intermediaries and risk aversion.

2.4.1 Scenario 1: No intermediaries

Without intermediaries, there is a market failure: producers cannot signal their quality to consumers. We know from Akerlof's classic study of the market for lemons (1970) that this will discourage producers from selling high-quality goods. In the present context, consumers expect they are buying low quality goods and are only willing to pay the low price, $\underline{p} = \underline{\alpha} - \beta q$.

[11] See Dasgupta and Mondria 2012 for a more detailed analysis of the intermediary's signaling role, including partial disclosure and comparative statics with and without entry.

Producers always receive the low price $\underline{p}$ and, given that they can only access the lower rejection rate $\overline{\delta}$ with the advice and help of intermediaries[12], they always suffer $\underline{\delta}$. In this case, given that producing high quality would entail incurring higher costs $\overline{c}$ without any benefits, all producers would choose to produce low quality ($N = 1$). Hence, only the low quality market exists. Total quantity consumed without intermediation, $\widetilde{Q}$ is then:

$$\widetilde{Q} = \underline{q} = N(1 - \underline{\delta}) = 1 - \underline{\delta} \tag{2.8}$$

2.4.2 Scenario 2: Intermediaries and Risk Neutral Producers

By signaling quality to consumers, intermediaries allow producers to sell differentiated goods to consumers. As described above, we assume that there are many perfectly competitive intermediaries of two types: high and low. Recall that the total quantity supplied by producers is always one, regardless of the proportion of them that supply high quality, but this proportion will affect the total that is actually consumed because less high-quality product is rejected than low-quality. Indeed, we show below that so long as we have a separating equilibrium where some producers make high-quality product,

[12]If producers can access the lower rejection rates of high quality production without intermediation, then one could envisage a situation where a small cost advantage of low quality production is outweighed by a large quantity advantage of high quality production. In this scenario, all producers make high quality goods, yet consumers pay the low-quality price. This eventuality is avoided if the cost differential $\overline{c} - \underline{c}$ exceeds a threshold that is proportional to the rejection rate differential $\underline{\delta} - \overline{\delta}$. Empirically, costs appear to be much higher for certified production compared to non-certified production, and low rejection rates seem to follow only from intermediary-led certification guidance, so this scenario is unlikely and is not considered in this paper.

total quantity consumed is higher under intermediated trade.

Total quantity consumed under intermediated trade, Q, includes both high and low product. Substituting values for $\overline{\delta}$ and $\underline{\delta}$ into equations (2.6) and (2.7),

$$Q = \overline{q} + \underline{q} = 1 - \overline{\delta} + N(\overline{\delta} - \underline{\delta}) \tag{2.9}$$

The presence of high quality producers ($N < 1$) implies that quantity consumed under intermediation will be higher than without intermediation ($Q > \widetilde{Q}$).

We solve for the subgame perfect equilibrium of this sequential game by backwards induction. In the last stage of the game, high and low quality production that is not rejected (as specified by equations (2.6) and (2.7) respectively) is consumed. We can find the prices which clear consumer markets by substituting these expressions for $\overline{q}$ and $\underline{q}$ into consumer demand functions (2.1) and (2.2) respectively. The market-clearing prices are then:

$$\overline{p} = \overline{\alpha} - \beta(1 - \overline{\delta}) + N[\beta(1 - \overline{\delta}) - \gamma(1 - \underline{\delta})] \tag{2.10}$$

$$\underline{p} = \underline{\alpha} - \gamma(1 - \overline{\delta}) + N[\gamma(1 - \overline{\delta}) - \beta(1 - \underline{\delta})] \tag{2.11}$$

In the first stage of the game, upstream producers choose whether to produce high or low quality. In equilibrium, producers must be indifferent between them. Since producers are risk neutral, the expected profits of the two types

of producers are equated in equilibrium. That is, $E[\overline{\pi}_i] = E[\underline{\pi}_i]$. This yields

$$(1-\overline{\delta})\overline{p} - \overline{c} = (1-\underline{\delta})\underline{p} - \underline{c} \tag{2.12}$$

Substituting equations (2.10) and (2.11) respectively and solving for the equilibrium partitioning of risk- neutral producers, N_n^*, gives:

$$N_n^* = \frac{\underline{\alpha}(1-\underline{\delta}) - \overline{\alpha}(1-\overline{\delta}) + \beta(1-\overline{\delta})^2 - \gamma(1-\underline{\delta})(1-\overline{\delta}) + \overline{c} - \underline{c}}{\beta[(1-\overline{\delta})^2 + (1-\underline{\delta})^2] - 2\gamma(1-\overline{\delta})(1-\underline{\delta})} \tag{2.13}$$

More farmers will produce high quality in equilibrium when consumer preference for high quality ($\overline{\alpha}$) is higher, consumer preference for low quality ($\underline{\alpha}$) is lower, and the cost differential between high and low ($\overline{c} - \underline{c}$) is smaller.

Let us now introduce producer risk aversion into the model.

2.4.3 Scenario 3: Risk Averse Producers

If we assume that producers are risk averse, the downstream market clearing condition is the same, i.e., equations (2.10) and (2.11) continue to hold. Risk averse producers maximize the expected utility of profit. The use of expected utility in relation to decisions about product quality given risk is based on the literature on standards and warranties (see Cooper and Ross 1985; Yoo 2014, and Swinnen et al 2015: 69). $U(\cdot)$is a von Neumann-Morgenstern utility function which is a non-negative, continuous and twice differentiable function of profit π. It is increasing in profits and concave such that pro-

ducers are risk averse: $U(\cdot) \geq 0 \quad U'(\cdot) > 0 \quad U''(\cdot) < 0$. In equilibrium, the expected utility of high-quality and low-quality producers must be the same, otherwise producers would switch from one type of production to the other. The equilibrium condition for quality partitioning is thus:

$$E\left[U(\overline{\pi})\right] = E\left[U(\underline{\pi})\right] \tag{2.14}$$

We wish to solve this condition for the equilibrium partitioning of risk-averse producers, N_a^*, which is a function of the market-clearing prices specified in equations (2.10) and (2.11) and risk aversion.

A specific assumption on the functional form is necessary to solve this framework. I follow the classic paper by Townsend (1994) and recent scholarship in expected utility analysis (Yoo 2014; von Gaudecker et al 2012; Torkamani and Haji-Rahimi 2001) and use the negative exponential utility function $U = a - be^{-\lambda\pi}$. The theoretical literature notes that it is relatively well-behaved in expected utility analysis (Hassett et al 1982; Torkamani and Haji-Rahimi 2001; Loistl 1976: 909), where its negative second derivative makes it particularly useful in the analysis of risk aversion: indeed, its central parameter, λ, corresponds to the Arrow-Pratt absolute risk aversion (ARA) measure[13].

[13]The iso-elastic utility function $U = \frac{\pi^{1-\sigma}}{1-\sigma}$ has arguably better empirical properties, including decreasing absolute risk aversion (DARA) behavior and decreasing relative risk aversion when adjusted for a subsistence parameter (Ogaki and Zhang 2001). However, scholars note that it generates problems in expected utility analysis and should be avoided (c.f. Hassett et al 1982). When it is used to solve the present model via a Taylor expansion,

The equilibrium condition is then $E\left[e^{-\lambda\overline{\pi}}\right] = E\left[e^{-\lambda\underline{\pi}}\right]$ which simplifies to:

$$\underline{\delta p}e^{\lambda(\underline{p}-\overline{p}-\underline{c}+\overline{c})}(e^{2\lambda\overline{\delta p}}-1) - \overline{\delta p}(e^{2\lambda\underline{\delta p}}-1) = 0 \tag{2.15}$$

This equation as well as the market-clearing price equations (2.10) and (2.11) make up a system of three equations that defines equilibrium partitioning with risk averse producers N_a^*. As the closed-form solution for N_a^* is rather long and involved, we withhold it here and analyze it in more detail analytically.

Recall that N_a^* measures how farmers divide themselves between high-quality standards and low-quality standards. We wish to know how that market structure is affected by changes in risk aversion in the population. If a population becomes more averse to risk, such that λ increases, do more farmers choose to adopt high quality standards such that N_a^* decreases?

Proposition 1: Given reasonable assumptions[14] a relatively more risk-averse population will tend to get certified in greater numbers; that is, N_a^* is decreasing in risk aversion.

Analysis in Appendix 2.7.1 shows that three conditions are relevant to the sign of the relationship between producer standard choice and risk aversion. The first condition requires that the low contract has to have a relatively

the solution yielded thereby exhibits similar trends as that found through deployment of exponential utility.

[14]Specific assumptions include that $\underline{p}-\underline{c} > \overline{p}-\overline{c}$, $\frac{\gamma}{\beta} < \frac{1-\underline{\delta}}{1-\overline{\delta}}$, $A+B > C$ and $E+G+H > D+F$.

large pre-rejection profit margin $\underline{p} - \underline{c} > \overline{p} - \overline{c}$. The stylized facts support this: certified production is not more profitable on average than non-certified production; rather, the high costs of getting certified and high marginal costs from certified production mean that average per unit sold certified profits are often lower than low-quality profits. This general insight is supplemented by analysis in the appendix, which shows that in our model, given that $\underline{p}$ and $\overline{p}$ are a function of N, the condition is equivalent to requiring that N be smaller than a function of the parameters. That is, ceteris paribus, if many farmers produce according to high quality standards, then the positive relationship between the level of risk aversion in the population and the proportion of high quality farmers will hold.

The second condition requires that high and low product varieties are well differentiated on consumer markets (small $\frac{\gamma}{\beta}$): this is supported by the great consumer differentiation between certified high-quality goods (e.g. fair trade organic products) and uncertified low-quality goods (e.g. unbranded bulk goods). Finally, there is a large difference in their survival rates (large $\frac{1-\delta}{1-\overline{\delta}}$), which is consistent with empirical evidence as well (see fourth chapter). The appendix shows that given this, and if the size of the effects are reasonable, then $\frac{dN_a^*}{d\lambda} < 0$: as risk aversion λ increases, N decreases, and more producers choose to adopt high-quality certification as their risk aversion increases.

This model shows a situation in which consumer preferences for high quality provide an incentive for intermediaries to insure producers who undertake

the process of meeting high quality standards. Specifically, by adopting such standards, producers reduce the risk of their produce being rejected in end-markets. Although such standards can thus be demanding in terms of cost and field-level practice, they thus provide an opportunity for improved risk management. The findings here reflect this phenomenon: a relatively more risk averse population will be attracted to the lower average δ offered by certification to high quality produce, as well as the lower uncertainty about the value of the rejection rate in any given draw. A relatively more risk averse population will thus tend to have a higher proportion of farmers who get certified: equilibrium N will be lower.

Appendix 2.7.2 includes a figure simulating this result and a description of the simulation techniques deployed in this paper. The figure shows that the equilibrium partitioning of farmers N_a^* is decreasing and convex in risk aversion λ. That is, as the level of risk aversion in the population increases, the proportion of producers who adopt the high-quality standard increases.

More generally, it can be shown that the sign of the relationships between N_a^* and λ depend upon market conditions, as the following proposition notes.

Proposition 2: The sign of the relationship between standard choice and risk aversion depends upon market conditions. This relationship becomes negative, with fewer producers choosing high quality certification as risk aversion increases, if one of the following sufficient conditions is met:

- the pre-rejection profit margins of the high quality contract become superior to the low quality contract such that $\overline{p} - \overline{c} > \underline{p} - \underline{c}$;
- the differentiation between varieties on consumer markets and survival rates decreases such that $\frac{\gamma}{\beta} > \frac{1-\underline{\delta}}{1-\overline{\delta}}$.

There are several scenarios under which the first condition can be met. The appendix shows that if, for example, consumer preference for high quality goods $\overline{\alpha}$ increases or $\underline{\alpha}$ decreases, then the producer premium for high quality production increases and the $\overline{p}-\overline{c} > \underline{p}-\underline{c}$ condition, or its equivalent condition in terms of N, will be more likely to hold. In this case, ceteris parebis, as risk aversion increases, the proportion of high quality producers will decrease: $\frac{dN_a^*}{d\lambda} > 0$.

Since we are assuming symmetric risk preferences, and since $p > c$ for each contract in general, farmers are experiencing risk in terms of the chances of gaining or losing a positive profit margin whose size is defined by $p - c$. The chance of gaining or losing this margin are a function of the random variable delta. However, if this margin is bigger – for example, if p gets higher or c gets lower – then the size of what they are losing or winning with each rejection gets bigger. These heightened stakes worsen the severity of losses or gains, which is not desirable for more risk averse farmers. As such, the increased profit margins of the high quality contract are "amplifying" the risk in the high quality contract here, making it the risky option, inducing

relatively more risk averse farmers to avoid taking it. This amplification effect is based on the fact that the variance in profits is magnified or muted by the size of the margins of a contract. It can be shown that the variance of profits depends on the random variable and prices:

$$Var(\overline{\pi}) = \overline{p}^2 Var(\overline{\delta}) \tag{2.16}$$

$$Var(\underline{\pi}) = \underline{p}^2 Var(\underline{\delta}) \tag{2.17}$$

While the variance of profits is a function of the variance of the random variable δ, the latter is "amplified" by the square of the price corresponding to that standard. So, for example, farmers who are certified to the high-quality standard in the model have a RV with a relatively low variance: $Var(\overline{\delta}) < Var(\underline{\delta})$[15]. Yet they face prices which are relatively high: $\overline{p} > \underline{p}$. If the price differential is not great, then it can be assumed that the random variable effect will dominate and $Var(\overline{\pi}) < Var(\underline{\pi})$. If, however, consumer preferences for high-quality are so strong, or the availability of high-quality goods so limited, that high-quality goods fetch very high prices[16], this price effect so amplifies the random variable variance as to make the high-quality contract the relatively high variance option. The low-quality contract may

[15]For example, with the assumption that $\overline{\delta} \in U(0, 0.7)$ and $\underline{\delta} \in U(0, 1)$ and since $Var(X) = \frac{1}{12}(b-a)^2$ where $X \in U(a, b)$, $Var(\overline{\pi}) = 0.0408\overline{3}\overline{p}^2$ and $Var(\underline{\pi}) = 0.08\underline{3}\underline{p}^2$.

[16]This will arise if the ratio in consumer preferences between high and low quality goods is high since $\frac{dE[\overline{\pi}-\underline{\pi}]}{d\overline{\alpha}/\underline{\alpha}} > 0$ and is consistent with a scenario where N is quite high since $\frac{dE[\overline{\pi}-\underline{\pi}]}{dN} = \beta(1-\overline{\delta})^2 - 2\gamma(1-\overline{\delta})(1-\underline{\delta}) + \beta(1-\underline{\delta})^2 > 0$. In this scenario, few producers do the high-quality contract, high quality goods' prices are high but their variance is also high and it is the risky option.

have a relatively higher rate of quantity uncertainty, but the margins at stake are relatively low, so the impact of uncertainty on total income risk is muted. As such, the low-quality contract becomes the lower risk option. This amplification effect makes certification the "high stakes" game and risk averse producers will turn in greater numbers to the low-quality option. The stylized facts from empirical studies of certification do at times reflect this phenomenon: that while certification can lead to high prices and lowered volatility, it can be a high-stakes game which could scare away producers.

One can also imagine a situation where the two varieties become more similar on consumer or producer markets. If, say, the degree of consumer differentiation between the two decreases, then the high-quality product may become a small market with a high price. This would once again trigger the amplification effect and higher risk aversion would induce a move away from the high quality standard. If survival rates of the two varieties become more similar, then the ratio of them decreases and $\frac{dN_a^*}{d\lambda}$ will once again be negative. The effect of a combination of these changes – for example, a decrease in consumer preference for high quality $\overline{\alpha}$ alongside a increase in the survival rate of high quality goods – depends upon the sizes of the changes and the parameters. Changes in the size of the parameters can shift the relative sizes of terms in the derivative and also lead to changes in the equilibrium relationship between risk aversion and certification[17].

[17]If neither of the sufficient conditions of Proposition 2 is met, then a necessary condition for a positive relationship between risk aversion and certification is that the terms outlined in the appendix relate as follows: $A + B > C$ and $E + G + H > D + F$.

The figure in Appendix 2.7.3 illustrates Proposition 2 through simulation. It represents the equilibrium partitioning of producers as a function of risk aversion given that $\overline{p} - \overline{c} > \underline{p} - \underline{c}$[18]. The figure shows that the equilibrium relationship between risk and standard choice has effectively flipped: the equilibrium partitioning of farmers N_a^* is increasing and concave in risk aversion λ. That is, as the level of risk aversion in the population increases in this market context, the proportion of producers who adopt the high-quality standard decreases.

More generally, proposition 2 suggests that the popularity of certification amongst risk averse producers depends upon market parameters such as the ex ante consumer demand for certified goods, $\overline{\alpha}$, the cost of producing certified goods $\overline{c}$, the differentiation of goods on end-markets and relative rejection rates. It implies that the underlying demand affects whether a relatively more risk averse population will tend to be more, or less, interested in certification.

2.5 Producer Welfare

Do farmers benefit from certification? This section answers this question by studying the welfare impact of certification. We examine how certification affects small-scale farmers, starting with a comparison to the pre-certification state. This is followed by a discussion of how the welfare impact of certification interacts with risk aversion and market conditions.

[18]It is assumed that $\underline{\alpha}$ has decreased from 0.75 to 0.65 such that this condition holds.

The impact of certification on producer welfare can be found by comparing the expected utility of producers before certification to the expected utility of producers after certification. Prior to certification all production and consumption is of low-quality goods, so the utility of agents is a function of low-quality profits, $N = 1$, and the pre-certification price is $\underline{p} = \underline{\alpha} - \beta(1 - \underline{\delta})$. Expected utility of producers pre-certification is thus $E[U(\underline{\pi}|\underline{p}, N = 1)]$. Once the intermediaries are in place, some farmers can get certified to the high quality standard and $N < 1$ with $\overline{q} > 0$. In this case, the price attained by low quality producers is the market-clearing one noted above, namely $\underline{p'} = \underline{\alpha} - \gamma(1 - \overline{\delta}) + N[\gamma(1 - \overline{\delta}) - \beta(1 - \underline{\delta})]$. Since in equilibrium the expected utility of high and low producers will be identical, we can focus on the expected utility of low producers to understand the welfare impact of certification; that of high-quality producers follows by implication. The utility obtained by low quality producers given certification is then $E[U(\underline{\pi}|\underline{p'}, N < 1)]$. The welfare gain from certification ΔW is then the difference between the post and pre-certification expected utility.

Proposition 3: Certification has a positive welfare impact on producers provided there is a high average rejection rate of low-quality produce, certified and uncertified varieties are well-differentiated in consumer demand, and the survival rates of the two varieties differ substantially.

Analysis in Appendix 2.7.4 highlights three conditions under which producer welfare improves with the introduction of high-quality certified production.

The first condition notes that the existence of welfare benefits for producers from certification are contingent on a high rejection rate for low quality produce. Since one of the main benefits from certification for producers is access to a lower average rejection rate, this makes intuitive sense. The second and third conditions echo those described in the previous section: the two varieties can't be close substitutes in consumer markets and there must be a large difference in rejection rates. This suggests that for producers to benefit from the introduction of the high quality standard, the latter must be quite different in its demand conditions. If these conditions are true, then it is shown in the appendix that producers benefit from the introduction of certification.

This analysis illuminates the boundary condition under which certification is welfare-improving for producers ($\Delta W > 0$). If, for example, there is little consumer substitution between the two varieties, then certification will increase prices for producers substantially and certification will be welfare-improving. Yet the space provided for the condition to hold is generated by the balance between the two ratios. For example, if the high quality rejection rate increases, such that $\overline{\delta}$ increases, then the cross-price effect γ can increase and the welfare condition will continue to hold. If on the other hand there is a high cross-price effect, or the difference in rejection rates is low, then $\frac{\gamma}{\beta} > \frac{1-\underline{\delta}}{1-\overline{\delta}}$ and there will be a negative impact of certification on the welfare of producers. If the low-quality rejection rate is low, there may also be a negative welfare impact from certification. As such, the welfare impact of

certification can be negative in our model.

How does the welfare impact of certification change with risk aversion? Shifts in producers' attitudes to risk affect the risk aversion parameter in their utility function, which in turn affects both the decisions they make and how they evaluate how things have changed with certification. This relationship, which is captured in the present model by how ΔW changes with λ, is not simple since risk aversion (λ) affects welfare directly through expected utility as well as indirectly through the partitioning rate N. The direction of the relationship between the level of risk aversion in the population of farmers and the welfare impact of certification is ambiguous[19]. It is not just certification itself, but how certification affects prices, costs, and quantities sold, that influences how the welfare impact of standards changes in producers' risk profile. As noted in the discussion of Proposition 2, certification's lower rejection rates interact with price changes to alter the variance in profits, and this affects the welfare of risk-averse agents.

The finding of a positive welfare impact in Proposition 3 and the analysis of the welfare-risk relationship are illustrated through simulation in Appendix 2.3. This figure is generated using the simulation parameters noted pre-

[19]Formally,

$$\frac{d\Delta W}{d\lambda} = \frac{b}{\lambda^2 \underline{p}\underline{p}'\underline{\delta}} \Big\{ \underline{p}'[\lambda(2\underline{p}\underline{\delta} + \underline{c} - \underline{p})e^{\lambda(2\underline{p}\underline{\delta}+\underline{c}-\underline{p})} - \lambda(\underline{c}-\underline{p})e^{\lambda(\underline{c}-\underline{p})} - e^{\lambda(2\underline{p}\underline{\delta}+\underline{c}-\underline{p})} + e^{\lambda(\underline{c}-\underline{p})}] \\ - \underline{p}[\lambda(2\underline{p}'\underline{\delta} + \underline{c} - \underline{p}')e^{\lambda(2\underline{p}'\underline{\delta}+\underline{c}-\underline{p}')} - \lambda(\underline{c}-\underline{p}')e^{\lambda(\underline{c}-\underline{p}')} - e^{\lambda(2\underline{p}'\underline{\delta}+\underline{c}-\underline{p}')} + e^{\lambda(\underline{c}-\underline{p}')}] \Big\} \tag{2.18}$$

viously, which are consistent with the three conditions on Proposition 3. It shows that the difference between post- and pre-certification welfare is positive ($\Delta W > 0$), that is, that producers gain from certification, as per Proposition 3. It also indicates that with this parameterization, an increase in the level of risk aversion λ leads to a larger welfare gain from certification ΔW.

The welfare impact of certification varies in the other parameters of the model. It is increasing in the degree of quantity uncertainty, the degree of consumer differentiation amongst standards, and the differential in rejection rates. The welfare impact is also affected by costs. If the cost of production of low quality increases, ceteris paribus, then the welfare gain from certification increases. If the cost of high quality production increases, then the welfare gain from certification decreases[20]. There are lower welfare benefits from certification if ex ante consumer preferences for the low quality good $\underline{\alpha}$ are higher. If consumers become more willing to pay more for the high quality good, such that $\overline{\alpha}$ increases, the welfare impact of certification increases.

2.6 Conclusion

How does the adoption of high-quality standards affect the market structure and welfare of risk averse farmers in the developing world? This chapter has taken up this question through an industrial organization model of trade

[20]This result, and the other comparative statics findings described here, are proven in Appendix 2.7.5.

between consumers, intermediaries, and producers. In particular, it has examined how the introduction of risk aversion affects the market structure of agricultural economies in the developing world. When farmers exercise choice over how their crop is produced and marketed – but not over quantity or price – they choose marketing options that maximize their welfare, which includes risk mitigation objectives. In a setting where producers choose whether to get certified to a high-quality standard or not, this model has shown that this choice is acutely sensitive to the degree of producers' risk aversion.

In particular, the model predicts that given uncertainty, risk averse farmers will tend to get certified to high quality standards more than risk neutral farmers, given reasonable empirical assumptions on the degree of risk aversion and relative profits. This highlights a relatively neglected aspect of the development implication of certification schemes such as Organic, Fair Trade, or Rainforest Alliance: they may also help risk-averse, vulnerable small-scale farmers in the developing world get secure, stable market access to lucrative markets. Yet the relationship between the standard's market structure and risk aversion is sensitive to market conditions. Analysis shows that relatively more risk averse farmers will have a higher tendency to get certified to a high quality standard provided that the low quality contract is relatively more profitable per unit produced; high and low product varieties are well differentiated on consumer markets; and there is a large difference in the rejection rates of of high quality and low quality produce.

The findings of the model are necessarily contingent on the assumptions – including that price uncertainty is insignificant and that there is perfect information and rationality. Furthermore, on several fronts the model highlights how welfare implications are contingent on the specific market conditions that obtain in a given case. Nonetheless, several general implications remain. One is that risk aversion has a monotonic impact on farmers' choice of standards in a closed economy. Another is that producer welfare is increasing in the degree of differentiation of certified and uncertified goods. Lastly, the relative profitability of certified and uncertified markets is shown to be a crucial ingredient affecting risk averse farmers' choice calculus. Indeed, high certified profits can actually amplify the riskiness of getting certified and deter the risk-averse from adopting.

The empirical facts provide preliminary evidence in support of the findings of this paper. Although there is relatively little quantitative evidence on relative rates of rejection amongst value chain threads, analysis of data gathered for the third and fourth chapter of this thesis indicates that farmers who adopted the organic standard faced lower rates of product rejection and a lower standard deviation in that rate than their conventional counterparts. Furthermore, a regression of standard adoption status on an experimental measure of respondent's risk aversion revealed a positive relationship between risk aversion and certification status, consistent with the prediction of the theoretical framework in this paper (see fourth chapter). Unfortunately, the absence of data on consumer substitution between high quality and low

quality in the same tea market prevents us from using the data from this study to fully calibrate the model in this paper. More generally, the very sparse data on rejection rates experienced by developing country farmers, and mixed evidence on risk aversion amongst certified farmers, makes it difficult to test the model here. Further empirical study of quantity uncertainty and risk aversion is thus in order. However, the facts do suggest that it is a simplification to assume that farmers choose a standard solely to access a lower final rejection rate. In reality, one is more likely to find a tiered system of acceptance and rejection, with produce rejected by A-grade markets bought on B-grade markets. In this context, adopting the standard may be a way for farmers to sell a higher and more stable proportion of their produce on lucrative A-grade markets.

These findings, while illustrative, yield an addition series of questions. Given that the real world features both price and quantity uncertainty, how is producer welfare affected by risk aversion given price and quantity uncertainty in a partial equilibrium setting that abstracts from consumer markets? Do certified markets really offer less risky marketing options? Are there selection effects, such that risk lovers choose to get certified first and tend to benefit more from certification? How do farmers choose standards given that in practice they sell into multiple end-markets? These questions illustrate how much remains to be learned about the impact of private sector standards on risk-averse farmers' welfare.

2.7 Appendices

2.7.1 Technical Appendix 1: Producer Choice of Standards and Risk Aversion

Using Cramer's rule and the implicit function theorem, $\frac{dN_a^*}{d\lambda}$ can be solved as:

$$\frac{dN_a^*}{d\lambda} = -\frac{\frac{dF}{d\lambda}}{\frac{d\underline{p}}{dN}\frac{dF}{d\underline{p}} + \frac{d\overline{p}}{dN}\frac{dF}{d\overline{p}}} = \frac{A+B+C}{D+E+F+G+H} \tag{2.19}$$

where

$$A = \underline{\delta}\underline{p}(\underline{p} - \overline{p} - \underline{c} + \overline{c})e^{\lambda(\underline{p}-\overline{p}-\underline{c}+\overline{c})}(1 - e^{2\lambda\overline{\delta p}}) \tag{2.20}$$

$$B = -2\underline{\delta}\overline{\delta}\underline{p}\overline{p}e^{\lambda(\underline{p}-\overline{p}-\underline{c}+\overline{c}+2\overline{\delta p})} \tag{2.21}$$

$$C = 2\underline{\delta}\overline{\delta}\underline{p}\overline{p}e^{2\lambda\underline{\delta p}} \tag{2.22}$$

$$D = \underline{\delta}e^{\lambda(\underline{p}-\overline{p}-\underline{c}+\overline{c})}[\gamma(1-\overline{\delta}) - \beta(1-\underline{\delta})][e^{2\lambda\overline{\delta p}} - 1] \tag{2.23}$$

$$E = -2\underline{\delta}\overline{\delta}\lambda\overline{p}e^{2\lambda\underline{\delta p}}[\gamma(1-\overline{\delta}) - \beta(1-\underline{\delta})] \tag{2.24}$$

$$F = -\lambda\underline{\delta}\underline{p}e^{\lambda(\underline{p}-\overline{p}-\underline{c}+\overline{c})}[e^{2\lambda\overline{\delta p}} - 1][\beta - \gamma][2 - \overline{\delta} - \underline{\delta}] \tag{2.25}$$

$$G = 2\underline{\delta}\overline{\delta}\lambda\underline{p}e^{\lambda(\underline{p}-\overline{p}-\underline{c}+\overline{c}+2\overline{\delta p})}[\beta(1-\overline{\delta}) - \gamma(1-\underline{\delta})] \tag{2.26}$$

$$H = -\overline{\delta}[e^{2\lambda\underline{\delta p}} - 1][\beta(1-\overline{\delta}) - \gamma(1-\underline{\delta})] \tag{2.27}$$

The signs of the components of the derivative can be analyzed to assess the overall sign of the relationship. Assuming that producers are somewhat risk averse ($\lambda > 0$), that some produce is always rejected for each contract type

($\overline{\delta} > 0$ and $\underline{\delta} > 0$) and positive prices ($\overline{p} > 0$) and ($\underline{p} > 0$), and given previous assumptions that the own-price effect is stronger than the cross-price effect ($\beta > \gamma$) and that more low-quality produce is rejected on average than high-quality produce ($\underline{\delta} > \overline{\delta}$), C, G and H will be positive, while F and B will be negative. The signs on the other terms depends on the market conditions, represented here by the parameters.

Specifically, if $\underline{p} - \underline{c} > \overline{p} - \overline{c}$ (called condition X) is true, term A will be negative. Intuitively, condition X highlights how the relative margins offered in each production contract affect producers' decision-making. Recall, however, that $\underline{p}$ and $\overline{p}$ are functions of N as specified in equations (10) and (11). Using those equations, it can be shown that condition X reduces to the following condition:

$$N < \frac{(\overline{\alpha} - \overline{c}) - (\underline{\alpha} - \underline{c}) + (\gamma - \beta)(1 - \overline{\delta})}{(\gamma - \beta)(2 - \overline{\delta} - \underline{\delta})} \tag{2.28}$$

The denominator here is negative, as is the last term in the numerator. If $(\overline{\alpha} - \overline{c}) - (\underline{\alpha} - \underline{c})$ is negative, or if it is smaller than $(\gamma - \beta)(1 - \overline{\delta})$, then the numerator will be negative and the quotient will be positive, with its size determined by the parameters. If for example $(\overline{\alpha} - \overline{c}) - (\underline{\alpha} - \underline{c}) < (\gamma - \beta)(1 - \overline{\delta})$, then if the producer premium for high quality production $(\overline{\alpha} - \overline{c}) - (\underline{\alpha} - \underline{c})$ becomes smaller, then Condition X is more likely to hold.

Furthermore, Term D will be negative if condition Y holds:

$$\frac{\gamma}{\beta} < \frac{1 - \underline{\delta}}{1 - \overline{\delta}} \tag{2.29}$$

If this condition is true, term E will be positive. The signs of terms D and E thus alternate in sign depending on this condition.

Since Condition Y is crucial to the findings of this section and the next, further analysis is warranted. The left hand side of the inequality is the square root of the measure of consumer differentiation (Shy 1995: 136), which is decreasing in the degree of differentiation between the two varieties. Recall that β is the effect of a change in quantity on the price of the same type of production (the own-price effect), and γ is the effect of a change in the other varieties' quantity on own price (the cross-price effect). The brand's measure of differentiation $\frac{\gamma^2}{\beta^2}$ goes to zero when the products are highly differentiated such that a change in the price of the high-quality good has a negligible impact on the demand for the low-quality good. The condition requires that this be the case, that is, that the products be well-differentiated on consumer markets such that γ is small and the square root of the measure of differentiation – which will have the same sign and direction as the measure itself, since both parameters are positive – be relatively small as well. The right hand side of the inequality, on the other hand, is the ratio of the low and high-quality product survival rates. Condition Y thus states that high and low product varieties have to be well differentiated on consumer markets and there has to be a large difference in the survival rates of each variety.

If conditions X and Y hold, then we have that terms A and B are negative, while C is positive: so long as $A + B > C$, as is reasonable by the size of

the terms, then the numerator is negative. In the denominator, E, G and H are positive, while D and F are negative. C, G and H will be positive, while F and B will be negative. If $E + G + H > D + F$, as will tend to be the case with the assumptions on the model, then the denominator is positive. In these circumstances, $\frac{dN_a^*}{d\lambda} < 0$: as risk aversion λ increases, N decreases, and more producers choose to adopt high-quality certification as their risk aversion increases.

By implication, if condition X and condition Y are violated, terms A and D will be positive, both the numerator and denominator will be positive, and $\frac{dN_a^*}{d\lambda} > 0$: as risk aversion λ increases, N increases, and fewer producers choose to adopt high-quality certification as their risk aversion increases.

2.7.2 Simulation Results for Proposition 1

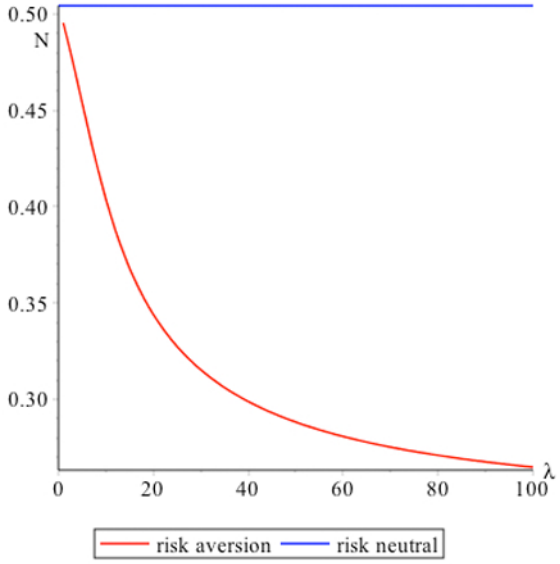
The model was simulated using Maple 2015.1 software calibrated to parameter values that fulfill the assumptions of the model and the specific assumptions of each proposition. The assistance of Patrick Boily in this process is gratefully acknowledged.

Each appendix specifies the parameter values (which fulfil the proposition assumptions) and shows a graph of the result that emanates from those assumptions. The Y-axis measures N, the partitioning of farmers into high and low quality producers, in all graphs except graph 3, where it corresponds to the welfare measure. Only the relevant part of each graph's Y-axis is

shown: for example, in the graph below, the curve never goes above $N = 0.5$ and as such the empty part of the graph is not shown. The X axis measures λ, the absolute risk aversion of the population, and similarly it extends to a level at which the result becomes asymptotic. For example while the result becomes obvious at $\lambda = 100$ in graph 1, in graph 3 it is evident by $\lambda = 25$, and thus that is all that is shown.

The following parameter values are used for this simulation: $\overline{\alpha} = 0.95 \quad \underline{\alpha} = 0.75 \quad \beta = 0.5 \quad \gamma = 0.3 \quad \overline{c} = 0.4 \quad \underline{c} = 0.2$ and it is assumed that $\overline{\Phi}$ is defined from 0 to 0.7 such that $E[\overline{\Phi}] = \overline{\delta} = 0.35$ and $\underline{\Phi}$ is defined from 0 to 1 such that $E[\underline{\Phi}] = \underline{\delta} = 0.5$.

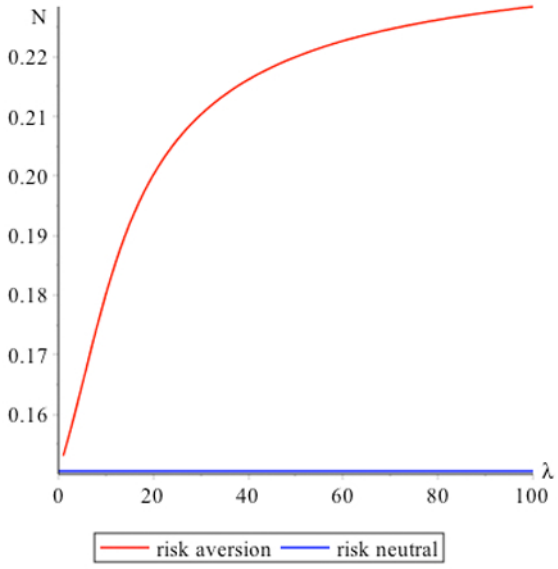
Figure 2.1: Simulation Results for Proposition 1



2.7.3 Simulation Results for Proposition 2

It is assumed that $\underline{\alpha}$ has decreased from 0.75 to 0.65 so that $\underline{p} - \underline{c} < \overline{p} - \overline{c}$.

Figure 2.2: Simulation Results for Proposition 2



2.7.4 Technical Appendix 2: Producer Welfare

The welfare gain from certification is then the difference between the post and pre-certification expected utility.

Given exponential utility, that is:

$$\Delta W = E[U(\underline{\pi}|\underline{p}', N < 1)] - E[U(\underline{\pi}|\underline{p}, N = 1)] \tag{2.30}$$

$$= a - b\left[\frac{e^{\lambda(2\underline{p}'\underline{\delta}+\underline{c}-\underline{p}')} - e^{\lambda(\underline{c}-\underline{p}')}}{\lambda\underline{p}'\underline{\delta}}\right] - a + b\left[\frac{e^{\lambda(2\underline{p}\underline{\delta}+\underline{c}-\underline{p})} - e^{\lambda(\underline{c}-\underline{p})}}{\lambda\underline{p}\underline{\delta}}\right] \tag{2.31}$$

$$= b\left[\frac{e^{\lambda(2\underline{p}\underline{\delta}+\underline{c}-\underline{p})} - e^{\lambda(\underline{c}-\underline{p})}}{\lambda\underline{p}\underline{\delta}} - \frac{e^{\lambda(2\underline{p}'\underline{\delta}+\underline{c}-\underline{p}')} - e^{\lambda(\underline{c}-\underline{p}')}}{\lambda\underline{p}'\underline{\delta}}\right] \tag{2.32}$$

Given that $b > 0$ by assumption, there will be a positive welfare impact of certification iff the expression inside brackets is positive. After simplification, this condition gives:

$$\frac{e^{-\lambda\underline{p}}(e^{\lambda\underline{p}2\underline{\delta}} - 1)}{\underline{p}} > \frac{e^{-\lambda\underline{p}'}(e^{\lambda\underline{p}'2\underline{\delta}} - 1)}{\underline{p}'} \tag{2.33}$$

This will be true, and certification will have a positive impact on welfare, if both of two conditions are true: one, given $F(p) = \frac{e^{-\lambda\underline{p}}(e^{\lambda\underline{p}2\underline{\delta}}-1)}{\underline{p}}$, that $F'(p) < 0$; and two, that $\underline{p}' > \underline{p}$.

The first condition requires that $F'(\underline{p}) < 0$. We have:

$$\frac{dF}{d\underline{p}} = \frac{e^{-\lambda\underline{p}}\{\underline{p}\lambda[1 + e^{\lambda\underline{p}2\underline{\delta}}(2\underline{\delta} - 1)] - e^{2\underline{\delta}\lambda\underline{p}} + 1\}}{\underline{p}^2} \tag{2.34}$$

Since $\underline{p}^2$ is always positive, $\frac{dF}{d\underline{p}} < 0$, as required, iff the numerator is less than

zero:

$$e^{-\lambda \underline{p}}\{\underline{p}\lambda[1+e^{\lambda \underline{p} 2\underline{\delta}}(2\underline{\delta}-1)]-e^{2\underline{\delta}\lambda \underline{p}}+1\}<0 \tag{2.35}$$

$$\underline{p}\lambda[1+e^{\lambda \underline{p} 2\underline{\delta}}(2\underline{\delta}-1)]-e^{2\underline{\delta}\lambda \underline{p}}+1<0 \tag{2.36}$$

$$\underline{p}\lambda+1<\underline{p}\lambda e^{\lambda \underline{p} 2\underline{\delta}}(2\underline{\delta}-1)+e^{2\underline{\delta}\lambda \underline{p}} \tag{2.37}$$

This condition will be more likely to hold the higher is the low quality rejection rate. To see this, say that $\underline{\delta}=0.5$. Then notice then the right hand side reduces to $e^{2\underline{\delta}\lambda \underline{p}}$. Recall that $0<\lambda<1$ and $0<p<1$. In that case, $\lambda \underline{p}>0$ and $e^{\lambda \underline{p}}>1$. Then while the left hand side expression must, speaking graphically, have a y-intercept of 1 and a slope of λ, the right hand side expression must have a y-intercept of at least 1 and a slope of $\lambda e^{\lambda \underline{p}}$. The right hand side expression has an intercept that is at least as high, and a steeper slope, implying that it must lie everywhere above the left hand side expression given $0<\underline{p}<1$. As such, the inequality is fulfilled and the first condition holds. Intuitively, the existence of welfare benefits for producers from certification are contingent on a high rejection rate for low quality produce since one of the main benefits from certification for producers is access to a lower average rejection rate.

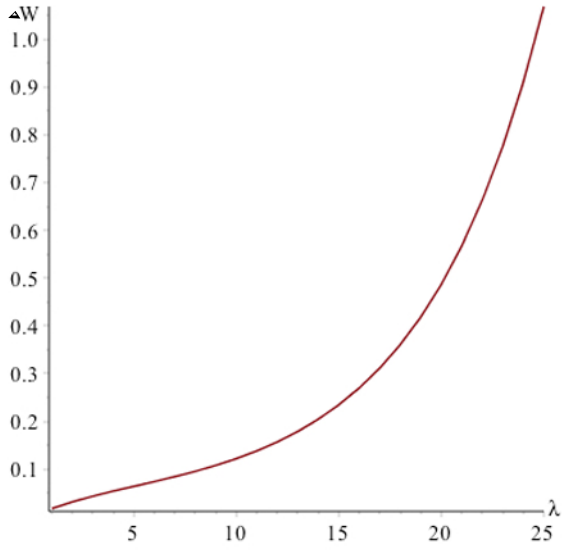
Condition 2 requires that prices improve as a result of certification, $\underline{p'}>\underline{p}$. This will be true, given $\underline{p}=\underline{\alpha}-\beta(1-\underline{\delta})$ and $\underline{p'}=\underline{\alpha}-\gamma(1-\overline{\delta})+N[\gamma(1-$

$\overline{\delta}) - \beta(1 - \underline{\delta})]$, if:

$$\frac{\gamma}{\beta} < \frac{1 - \underline{\delta}}{1 - \overline{\delta}} \tag{2.38}$$

This is condition Y noted in Technical Appendix 1: recall that it requires that the two varieties be well differentiated in consumer demand and have a large difference in survival rates. For producers to benefit from the introduction of the high quality standard, the latter must be quite different in its demand conditions. If both of these conditions are true, then producers benefit from the introduction of certification.

Figure 2.3: Simulation Results for Proposition 3



2.7.5 Technical Appendix 3: Welfare Comparative Statics

Given that $\overline{\Phi}$ is defined from 0 to 0.7 such that $E[\overline{\Phi}] = \overline{\delta} = 0.35$ and $\underline{\Phi}$ is defined from 0 to 1 such that $E[\underline{\Phi}] = \underline{\delta} = 0.5$, equation (2.30) can be re-stated as:

$$\Delta W = \underbrace{\frac{b}{\lambda \underline{p}\underline{p'}}}_{A} \left[\underbrace{e^{\lambda \underline{c}}(\underline{p'} - \underline{p})}_{B} + \underbrace{\underline{p} e^{\lambda(\underline{c} - \underline{p'})}}_{C} - \underbrace{\underline{p'} e^{\lambda(\underline{c} - \underline{p})}}_{D} \right] \tag{2.39}$$

The welfare impact of certification is affected by a change in low quality costs:

$$\frac{d\Delta W}{d\underline{c}} = \frac{b}{\lambda \underline{p}\underline{p'}} \left[\lambda e^{\lambda \underline{c}}(\underline{p'} - \underline{p}) + \lambda \underline{p} e^{\lambda(\underline{c} - \underline{p'})} - \lambda \underline{p'} e^{\lambda(\underline{c} - \underline{p})} \right] = \lambda \Delta W > 0 \tag{2.40}$$

Where the last inequality follows from the proof in section 5.1.1. Welfare gains from certification are increasing in the cost of producing low quality since pre-certification welfare is lower. Following this line of reasoning, one may similarly deduce that the welfare impact of certification is decreasing in the cost of producing high quality goods; that is, $\frac{d\Delta W}{d\overline{c}} < 0$. The benefits of certification stem from access to the new high quality contract, so if that contract becomes less profitable, these benefits will be mitigated.

If $\overline{\alpha}$ increases, the welfare benefit from certification will increase, by similar reasoning. The high quality contract will be more profitable, making it all the more beneficial to have access to that contract. The fact that $\frac{d\Delta W}{d\overline{\alpha}} > 0$

can also be seen from the fact that $\frac{d\overline{p}}{d\overline{\alpha}} > 0$, $\frac{dN}{d\overline{p}} < 0$, $\frac{dp'}{dN} < 0$ and $\frac{d\Delta W}{d\underline{p'}}$. In words, as consumer preference for high-quality goods increases, so does the price for high quality goods. This induces more producers to make high quality, which decreases equilibrium N. As there are fewer post-certification low quality producers catering to the same market, the price they receive increases. As the post-certification price has increased relative to the pre-certification price, the welfare benefit from certification increases.

ΔW is also affected by a change in $\underline{\alpha}$. As the explicit solution to $\frac{d\Delta W}{d\underline{\alpha}}$ is rather long and involved, we sketch out a proof here. If consumer demand for the low quality good $\underline{\alpha}$ increases, then both $\underline{p}$ and $\underline{p'}$ increase by the same amount. In equation (2.39), term A decreases in value, term B does not change, and both terms C and D increase, with the latter two changes balancing each other out with their positive and negative signs. The impact of a change in $\underline{\alpha}$ is thus dominated by the reduction in the first term: the welfare impact of certification is lower if consumer demand for the low-quality variety is lower, ceteris paribus.

Chapter 3

Field Research Amongst the Nepali Tea Hills

3.1 Introduction

How does farmers' risk aversion affect their decision whether to get certified to an agricultural standard? Field research conducted in 2016 aimed to answer this question through a large-scale survey of small-scale Nepali tea farmers. The project interviewed 270 Nepali small-scale tea farmers and in so doing successfully gathered the largest database that I am aware of on the connections between risk, certification to food standards, and labour. This chapter provides background on the field research process as a backdrop to analysis provided in subsequent chapters of this thesis.

There are several reasons why a case study of orthodox[1] tea in Nepal is a good fit to address the research question noted above. The characteristics of the sector match our research agenda: standards are in use for the production and marketing of part, but not all, of the crop, and farming is dominated by poor smallholder farmers. Farmers are risk-averse and were offered a chance

[1]There are two ways to process tea. The cut, tear and curl (CTC) method produces low-quality, easily soluble tea for tea bags, is rarely certified to a standard, and is generally paid a low price per kg. The orthodox method involves withering, rolling and drying the tea leaf, producing a high-quality loose leaf tea sold in tea boutiques around the world. This paper focuses on tea leaf produced and processed in the orthodox tea sector. This focus was adopted since orthodox tea is subject to extensive standard certification and has been the focus of development efforts in Nepal.

to adopt the organic standard: some chose to adopt it, and some did not.

A six-year research agenda provided essential background to this fieldwork and research. In 2009, I decided to do a PhD studying the relationship between agricultural standards and small-scale farming in the developing world. I identified the Nepali tea case study on the grounds described in the previous paragraph and designed a pilot project to prepare for my PhD. In 2010, with the help of a junior research grant from the International Development Research Centre (IDRC), I implemented that pilot through a research project including three months of fieldwork and a year of work at the IDRC office. The 2010 project enabled me to identify the research gap to study in my PhD, gain knowledge of the socio-economic context of the case study, and develop local contacts and resources.

The first chapter of this thesis also provided essential background to fieldwork. Its theoretical investigation of the relationship between risk and certification framed the methodology presented in this chapter, and its conclusions are investigated empirically through the analysis in the third chapter.

The field research was designed in 2015 with the aim of investigating whether risk aversion increases or decreases the propensity to get certified amongst Nepali tea farmers. I also aimed to gather information on labour in the sector for future research. The research design and implementation benefitted from the advice of experts, supervisors, and from the hard work of a dedicated and skilled research team. Yet it was not without its challenges. The rest of this

chapter describes the field research process in detail. Section 3.2 discusses research design while 3.3 discusses the early stages of fieldwork. Section 3.4 presents the details of the actual data gathering, including survey and game protocols. The next section highlights supporting actors, section 3.6 briefly outlines post-fieldwork data clean-up, and the last section concludes.

3.2 Research Design

3.2.1 Administrative Preparations

Several administrative tasks were carried out prior to fieldwork. I applied for and obtained ethical clearance from the Carleton University research ethics board (see section 3.5.2). I applied for and received a doctoral research grant from IDRC (see section 3.5.1). I began circulating job ads for the interviewer and research assistant positions. Finally, I set up meetings with Kathmandu contacts, and planned hotels and homestays.

3.2.2 Survey Design

The research instrument included a household survey and games (see Appendix). The household survey was based on questions from three sources: a previous survey in the region, the household survey questionnaires of the Living Standards Measurement Surveys (LSMS) (Grosh and Glewwe 2000), and the literature. Approximately 50% of the questions in the survey are from the survey developed and implemented by the researcher in 2010 amongst

the same population. Those survey questions were the result of a lengthy inductive and qualitative process by which the relevant issues, terms and problematiques were identified (Mohan 2016). Additional questions, particularly in the demographic, household economics, and labour sections were based on questions in the LSMS surveys and discussion of the same (Grosh and Glewwe 2000). Certain specific questions were modeled on similar questions in the literature: for example, the questions in the risk section come from the 2010 survey and from Mosley and Verschoor (2005).

3.2.3 Game Design

The Eckel-Grossman-Binswanger (hereafter EGB) risk game used in the survey instrument was based on the game used in Binswanger (1981) and as revised by Eckel Grossman (2008) (see Appendix). The EGB game is popular in research on the risk aversion of small-scale farmers in the developing world (eg. Engle-Warnick et al 2006; Ruben and Fort 2009; Yesuf and Bluffstone 2009; Dhungana et al 2004; Vargas Hill 2009; Bezabih 2009; Kisaka-Lwayo and Obi 2014), because relatively simple games are easier for respondents to understand (Dave et al 2010; Ihli et al 2016). The Holt-Laury (HL) type multiple price list risk and ambiguity games in the survey instrument were based on Barham et al (2014) and Ward and Singh (2015). Although the HL experiment has emerged as the most popular method to elicit risk attitudes in developed countries, and provides more fine-grained classification of subjects, evidence suggests that in populations with low numeracy, the

structure of the Holt-Laury game can be difficult to understand. Indeed, it has been accompanied by confusion with noisy and inconsistent choices (Dave et al 2010; Ihli et al 2016; Engle-Warnick et al 2006). When working with low-literacy populations, including in rural areas of the developing world, simpler games (Binswanger 1980; Binswanger 1981; Eckel and Grossman 2008; Brick et al 2012; Gneezy and Potters 1997) generate behaviour that is significantly more consistent and less noisy than behaviour in more complex risk elucidation tasks (Dave et al 2010; Ihli et al 2016; Charness and Viceisza 2016). This is particularly relevant for the present study given evidence of the limited numeracy and literacy of rural Nepali farmers (UNDP 2009; Mohan 2013; Mohan 2014; Mohan 2015). As such, when preparing the research instrument prior to entry in the field, I opted to also include the EGB experiment, in case there were difficulties with the HL game and data. Indeed, during fieldwork, despite our best efforts, respondents often exhibited significantly confusion with the HL game, which was not the case with the EGB game. Ongoing work by the author shows that the HL data has more noise compared to the EGB game. For this reason, the rest of this thesis uses the EGB data for its risk aversion measure.

The price uncertainty game was based on the game used in Vargas Hill (2009). The cognitive ability game was based on the exercise in Barham et al (2014). The basic time game was derived by the author, as was the basic loss aversion question. The details of these games are discussed in the forth chapter of this thesis.

The final design of the research instrument involved interspersing the survey questions and games. That is, interviewers asked a module of household survey questions, then did a game, then more survey questions etc. This follows precedent in household field research, and the pilot of the instrument, where it helped maintain interest of respondents and prevent question fatigue.

3.3 Entry into Field

3.3.1 Geo-political Context

Although the fieldwork was scheduled to begin on 15 December 2015, it was delayed until 2 February 2016 because of the blockade of Nepal. In September 2015, after several years of negotiations, the Constituent Assembly of Nepal agreed on a new Constitution. However, several minority groups objected to its provisions. In response to their perceived marginalization in the new federation, the Madhesis, a group based in the Southern Terai plains, began a mobilization at the southern border of the country with India, through which virtually all goods enter Nepal. They blockaded the border with the tacit support of the Indian government. The blockade led to severe shortages and a humanitarian crisis. The shortages were lessened by February; although later that month the Madhesis called off their agitation, shortages continued to be felt throughout the country for several more months. Transportation was more costly and problematic than normal during fieldwork, with higher gas prices and difficulty getting gas. Notwithstanding these issues, fieldwork

was able to proceed peacefully.

3.3.2 Arrival and Hiring the Research Team

After arrival in Kathmandu, I met with a few key contacts in the tea sector in the city and purchased supplies before flying and then catching a taxi to the research area. The first task was to hire a research team. I was looking for five interviewers and one research assistant/interpreter. The interviewers were to go to households on the sample list and conduct the survey and games. The RA was to provide day-to-day interpretation for me, logistical support, and data entry during the implementation phase. I was committed to hiring locally from the study area, specifically from the young people of the region who have a background in tea. This approach to human resources was based on previous experience that locals are more accustomed to the terrain, know about the tea sector, are often well-educated but looking for work, and are viewed well by respondents. My job ads were circulated by NGOs, factory owners and coops throughout the Ilam and Panchthar districts and I received twenty applications for the posts. I interviewed each of those twenty people over the course of a few days. The interviews revealed candidates' problem-solving skills, cultural sensitivity, numeracy, interviewing technique, and character.

I hired a female research assistant, Alisha Magar Barton, who had strong English and Nepali skills and previous interpretation experience. Her job entailed day-to-day translation and interpretation for the lead researcher,

revising the survey instrument, logistical coordination of the research project, and data entry. She was Nepali-Canadian and spoke very good English, which was crucial; although she was young, she had good interpersonal skills which enabled her to act as a go-between with the interviewers and I.

I hired a team of five interviewers who fit the profile of having at least an undergraduate degree, growing up in Ilam or Panchthar, a background in tea, and being young and fit. Unfortunately, I was not able to find as many female members of the team as I had desired. Of the six local staff, I could find only two qualified women: Alisha as well as one of the interviewers, Sunita Phago. I was not able to find people from all three villages: one candidate from Kolbung balked when she learned she would have to communicate in English, and one young woman from Phidim was just 16 years old and had never left home. We felt the work conditions too challenging for her, and we could not guarantee her safety working alone in the forested mountains to her parents, so she did not join the team.

In addition to Sunita, I hired four other (male) interviewers: Somnath Acharya, Bhushit Dahal, Lashang Lama, and Ganesh Raisili. Two of them had grown up on tea farms in Ilam; one of them was part of a family that ran a small-scale tea processing factory; and one worked part-time as an organic compliance inspector at a tea factory. After the team was hired, we found office space in Fikkal town and began training the team and finalizing the survey.

3.3.3 Translation and Training

Each member of the research team participated in a thorough training program. This included training in interview procedures, ethical conduct, the research instrument, game procedures, and the tea value chain. An interview guide was provided to each interviewer. Equipment for conducting the survey and risk games was provided to each interviewer.

The survey and games were drafted, as described above, in English and translated into Nepali prior to fieldwork. The translation was then verified by the research assistant prior to the training session. On the last day of the training, the team went through the research instrument word-by-word, adjusting language and clarifying the game procedures. Following a practice interview with the full interview team, the language in the survey was revised once more.

3.3.4 Pilot Phase and Revisions to the Research Instrument

The draft research instrument was then tried out via a week-long pilot phase. A pilot sample was drawn from nearby tea farmers who were not part of the main population and the research project proceeded as normal, with interviewers conducting interviews, the lead researcher generating sample lists (see next subsection), and the research assistant inputting data. Each evening the team would meet, the interviewers would hand in completed surveys, and we would discuss which questions were not working well and how they should be

changed. The next day the RA would input the data and prepare a revised version of the survey that included the alterations suggested in the previous day's meeting. These revisions fixed translation issues, simplified and clarified the language, made transcribing answers easier, and so on. A few substantive changes were made: for example, a question which tried to ascertain wealth by asking about the construction materials of their outhouse-toilet was discarded, since it could just show consumption behaviour. Most notably, after some difficulties with the execution of HL games during the pilot, I wrote to the scholar at IFPRI India who had pioneered the use of these games in Bihar for advice. Patrick Ward made several suggestions – including to frame the games in terms of tea farming options – which I incorporated into the final version of the survey. The instrument with and without interspersion was tested during the pilot phase, and interviews went better with interspersion, and as such interspersion of questions and games was retained. As the principal researcher, I evaluated the data coming in to ensure it was generating enough diversity in responses. While the risk games appeared to be generating enough diversity in response, it became clear that we needed more detail in our certification data.

I became concerned that a simple binary dependent variable (equal to 1 if organic and 0 if conventional or conversion) could possibly not yield enough diversity in the data. As such, I introduced several additional measures of certification into the survey. In addition to the factory data on certification status, I obtained year of certification, which enabled me to separate several

waves of certification in each location. I obtained a reported certification status from each survey respondent, as well as a measure of the duration of time between when they heard about the certification option and their decision to get certified. Although I hoped this would enable me to construct a duration variable similar to Liu (2013), the poor quality of the reported data precluded its use. Finally, I introduced a series of questions that describe a hypothetical standard and ask the respondent whether they would decide to get certified to such a scheme were it to be presented to them. We took a day's break from the pilot and met in the office, where I introduced the hypothetical certification questions noted above. The team refined and tested them, and then resumed the survey with the new questions. These measures helped unpack the meaning of certification, get a pure measure of certification propensity, and ensured diversity in the data.

3.3.5 Sampling

I wished to identify the population of Nepali orthodox farmers who had been offered the option of converting to certified organic methods. To identify which factories were offering that option to their suppliers, and to obtain their lists, the RA and I visited 6 factories (whose supplier locations are in brackets): Gorkha (Sundarepani and Kolbung), Green Tea (Sundarepani), NESTPROL (Fikkal), Himalayan Shangri-La (Sankhejung), Kanchenjenga (Phidim region), and Guranse (Dhankuta). We also met with the General Secretary of the Central Tea Cooperative Federation, an umbrella organiza-

tion for the tea cooperatives, who shared his lists as well. Although Guranse and Jun Chiya Bari estates in Dhankuta district and their associated factories were certified organic, they did not have any certified small-scale farmers. Several factories were in the process of converting to organic at the time of the survey, but had not progressed to selling certified organic tea from Nepali smallholders. I did not include farmers who supplied to conventional factories, because their farmers never faced the certification option. On the basis of those meetings I was able to identify four factories that had offered the organic option to their suppliers and successfully marketed it (Gorkha, Green Tea, Himalayan Shangri-La, and Kanchenjenga) and identify the four villages where their supplying farmers lived (Kolbung, Sundarepani, Sankhejung, and Phidim). Using the farmer lists these factories gave me, and cross-checking where possible from farmer lists supplied by cooperatives, I compiled a sample frame of the entire population of Nepali farmers who had faced the option of going organic. This generated a final sample frame of 841 farming households. These factories accept conventional, organic-conversion, and organic tea, so my sample was made up of farmers who supplied these three types.

Simple stratified random sampling in Stata, stratified by the four villages (Kolbung, Sundarepani, Sankhejung, and Phidim), was used to select the sample for this study. The sample size, $n*$, was determined using the follow-

ing formula[2]:

$$n* = \left(\frac{N z^2_{\frac{\alpha}{2}} P(1-P)}{z^2_{\frac{\alpha}{2}} P(1-P) + N(0.10P)^2} \right) * \left(\frac{deff}{r} \right) \tag{3.1}$$

where N is the total size of the population (841 in our case). P is the risk aversion coefficient I was trying to measure: since I did not know this value ex ante, a conservative value of P=0.5 was used. The Z-score $z^2_{\frac{\alpha}{2}}$ is the normal distribution critical value (1.96). The target N then has to be multiplied by the design effect, or $deff$. Given that I have simple one-stage sampling without clustering, $deff$=1. I must also divide by the expected response rate, which I took as 85%. This generated a sample size of 310 and a target final sample (given nonresponse) of 269. At the end of fieldwork we had 270 responses with an 87% response rate. Of these responses, one had data missing from the Binswanger game, and so was omitted, for a final sample of 269.

3.4 Data Gathering Procedures

3.4.1 Survey Procedures

The sample was divided into four village lists. The first phase of the survey had the team based in Fikkal town with daily visits to the two sample villages (Sundarepani and Kolbung) nearby. I split the interviewers into two teams:

[2]Assistance from Emmanuel Benhin (Carleton University/Statistics Canada) with the sampling strategy, and in the construction of this sample size formula, is gratefully acknowledged.

two interviewers conducted the survey in Sundarepani and three did surveys in Kolbung. In this stage of the project, part of the research team did homestays with farmers, some lived with family, and one stayed in a hotel. The second phase of the survey took the survey team to Sankhejung, where we were based in Nepaltar town. Interviewers went in a pair and trio in succession to different sub-villages in the region, but each carried out his or her interviews on their own. Part of the research team stayed in a hotel, one with family, and one in factory accomodations. In the last phase of data-gathering, which just lasted a few days, the team was based in a hotel in Rakhe and interviewed farmers in the Phidim region.

At daily team meetings either at the beginning or end of day, the interviewers dropped off completed surveys with the lead researcher and research assistant, verified which households had been interviewed, and verified the money they held for payoffs for the games. The lead researcher checked that the interviewer had the amount of money they would be expected to have given payoffs to respondents from the previous day, and gave additional cash to cover the forthcoming day's interviews. We went around the room and each interviewer briefly discussed what they had done the previous day. If previous sample lists had been completed, they would receive a new sample list at this time. Additional training and/or troubleshooting was also frequent at these daily meetings.

After a morning meeting, the interviewer then travelled to the research area

for that day and sought out the household identified on the sample list. Although it was often difficult for the interviewer to find the person whose name was on their sample list, they persevered and found over 85% of the names on their lists. This involved a bus or motorcycle ride of roughly an hour to the closest point on the main road, then two hours' hiking in paths in the forested mountains, until they found the household. The sample list had information on the sub-village (sub-VDC) location and name of household head, but this information was generally insufficient to find the household in the heavily forested and mountainous terrain. Interviewers relied on directions from neighbours to find the household.

Sometimes there was no one home; or they finally found the household and person, only to discover that person was drunk and incoherent. Inebriated individuals were not interviewed: the interviewer went back another day in the hopes of finding them sober and able to respond. Each of the interviewers proved to have their strengths and weaknesses, and were given samples that met those capabilities. For example, the female interviewer was reluctant to be on her own in far-flung areas in rough terrain, particularly later in the day: she was thus given a sample that was close to where she was living, and had another (male) interviewer nearby and reachable by phone. One male interviewer was particularly adventurous and had his own motorbike: he was given samples in the most remote areas.

On arriving at the farm household, the interviewer asked if this was the home

of the person listed on the sample list. If the answer was in the affirmative, s/he asked who was the head of the household who could answer questions. In most cases it was a middle-aged male who self-identified as the household head, but when the man was away and the household was run by a woman, or the woman was most knowledgeable about tea, a female would answer. Once the individual was identified, the interviewer proceeded to share information on the research project and interview, including telling them that there would be a "game where you are asked to choose lotteries and you will win some money, but the exact amount depends on how the random lottery turns out". The interviewer then asked for consent, as outlined in the research instrument in the Appendix. If the respondent consented to audio and photo recordings, the interviewer would start the audio recording at this time.

The interviewer then proceeded to ask the survey questions and conduct the games. Respondent answers were recorded next to the questions on a hard copy paper survey. At the conclusion of the interview, after the payoff was made, the interviewer thanked the respondent for their time and left.

3.4.2 Game Procedures

Respondents played several games in the course of the interview (see Appendix). Before each game they were told that "one of the games will be randomly chosen for a real payoff at the end, but which game will be chosen will only be seen at the end, so you should make each choice as if it were for a real payoff", and asked them if they understood they would be getting real

cash as a result of their choices. At the end of the interview, the respondent was asked to draw two chips from a bag containing numbered chips corresponding to each of the games in the research instrument (eg. Binswanger game, price list game, time preference game). The two games thereby chosen were actually played. The interviewer consulted the record for what the respondent chose for that game, and reminded the respondent what the game was and what they had chosen. If it was a 50/50 game, a coin was tossed; for the ambiguity game, another bag was taken out. This other bag had 100 chips in it, some of a winning colour, some of a losing colour. The respondent was told that the lead researcher had put the chips in, and neither the interviewer nor respondent knew the proportion of chips. In all cases, the respondent was asked which colour (or coin side) would be considered a "win". Then the coin was tossed, or the chip drawn, the interviewer announced if it was a win or a lose, confirmed the payoff to that outcome, and recorded the payoff on the hard copy survey. The interviewer then paid the respondent.

If the chosen game was a time preference game, and the respondent had chosen a "later" amount, the interviewer informed the respondent that he would be back in two weeks with the payoff. The interviewer then returned between one and two weeks later with the appropriate amount of money.

The decision to offer real payoffs to the risk games follows research showing that real payoffs reduce the bias of risk preference estimation. The literature suggests the average payoff should amount to one to three days of labour in

the community concerned (Liu 2013; Yesuf and Bluffstone 2009). Respondents received on average 438 Nepali Rupees (CA$5.23), which amounts to approximately two days' wage as a tea labourer. If participants withdrew from the project during the household survey, before any games were played, they received no compensation. If they withdrew after just one game, they received compensation as payoff for that game. Otherwise, they received full compensation as normal.

3.4.3 Data Entry

The research assistant inputted data from the hard copy surveys into an excel database containing all responses for all respondents. I regularly evaluated the database and was able to spot problems on a day-to-day basis and do quality checks.

3.4.4 Quality Checks

The quality of the data was crucial to the success of the project. Training, motivation and monitoring was done throughout the data gathering process to ensure the quality of the data was as high as possible. During training before and during the project, interviewers were taught to be as accurate as possible, not to suggest answers, and other best practices. Data quality was continually prioritized during the project. To ensure that good quality surveying was being done, the lead researcher and research assistant did quality checks. For audio quality checks, there was an audio recording of each

interview (where the respondent consented to the recording). The research assistant and lead researcher randomly chose some of these audio files, listened to the interview, and gave feedback, constructive criticism and a grade to the respective interviewer. Any inaccuracies or serious problems were monitored more closely until resolved. The review of the audio recording also enabled us to verify that the information reported on the hard copy of the survey, including the game choices and amount of money disbursed, corresponded to an actual interview with a farmer and were not simply invented by the interviewer. This was also confirmed through informal discussion with other interviewers active in the region, the farmers' signature on the survey form as receiving the cash, and selected in-person verification visits during interviews. In such interviewing checks, the lead researcher and research assistant accompanied the interviewer for selected interviews and gave feedback afterwards on interview technique and procedures. For data inputting checks, the lead researcher enlisted the help of an interviewer to verify that the research assistant's inputting of data from hard copy surveys into the computer database was done correctly.

3.4.5 Human Resource Management

We had our share of intercultural human resource challenges, and chief among them was the question of work time. According to Nepali customs, breakfast is eaten around 10am. For much of the Nepali population, including the research team for this project, this implies that work starts in earnest around

11am, and should end around 3pm, when one heads back home for a rest before dinner at around 7pm. This made for a work day of about 4 hours, which was sufficient to conduct about 1 or maximum 2 surveys per person per day, which amounted to quite low productivity indeed. We thus had several discussions about the work day schedule, including a try at a Canadian eating and work schedule, and settled on a compromise that enabled about 6 hours of work a day and 2 to 3 surveys per person per day.

During the research project, one interviewer had a hard time understanding several aspects of the survey procedures, which had to be re-explained to him. Throughout the project I paid special attention to managing him, checking the quality of his surveys, and encouraging him to improve.

3.4.6 Challenges

A few challenges arose from the "hardware" supporting the research project. My computer crashed completely some five days into the survey. Luckily, the sample frame, sample, and survey had all been finalized a few days before and backed up. To fix the computer would have required some four days of expensive and dangerous travel into India for repair or replacement, which was deemed unnecessarily costly, risky and time-consuming. Instead, one of the interviewers rented his computer to the PR until early April, when the survey was completed and there was time to get the computer fixed. The Indian blockade of Nepal and its aftermath increased the cost of gas, so I decided not to hire a full-time driver, and instead paid for taxis as needed,

the gas costs of the 2 interviewers with motorbikes, and bus fares. One of the interviewers had a motorbike accident on the job during a hailstorm. No one was hurt, but the team lost a day of work in retrieving the stranded team members. The project turned out to need quite a lot of supplies, which added to the budget and kept the RA & PR busy repairing printers, getting change for incentive payments, etc.

3.5 Project Support

3.5.1 Financial Support

A doctoral research grant (#108066-027) from the International Development Research Centre (IDRC) supported the majority of field research costs. Supplementary funding for additional field research costs was obtained from the Office of the Dean (Faculty of Public Affairs) and the Graduate Students' Association Travel Grant, Carleton University. The author also gratefully acknowledges financial assistance received during the course of this research from the Social Sciences and Humanities Research Council (SSHRC) Doctoral Award (752-2013-2559) and the Ontario Graduate Scholarship (OGS). The researcher has no conflicts of interest concerning this research.

3.5.2 Ethics

Ethical approval for this study was sought and obtained from the Carleton University Research Ethics Board-A as project #103831. Ethical procedures

were followed across all aspects of the data-gathering process, including, but not limited to, prior and informed consent for respondent participation; consent for photos; withdrawal; and remuneration. Oral consent was used since illiteracy is common in the region. The language of the consent form was simplified for comprehension. Although one might think it appropriate to make all responses anonymous, during the 2010 survey, several respondents objected vehemently to remaining anonymous, and wanted their names noted by their responses. The Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research Ethics (CORE) says that respondents have the right to have their name associated with their data if they so desire. Indeed, the Ethics Board told us to give respondents the choice of whether to be anonymous, and so we did.

3.5.3 Benefits to Nepalis

Participating farmers benefitted from the compensation through the game payoffs. They also benefitted by learning about the sector in which they work through the questions and possible discussion at the end. They also commented on how much fun they had with the games. Their responses helped make policy-makers in government, business, and NGOs in Nepal become more aware of the challenges faced by farmers, including through follow-up discussions I had with business actors and stakeholders, dissemination of research results in the academic paper, and circulation of policy papers for the United Nations Food and Agricultural Organization (FAO)

and the World Trade Organization (WTO) based in part on this research. This could lead to changes in policies and practices in a way that positively impacts participants. Their involvement in the research helped lead to the successful completion of the study and results will be disseminated via media overseas, including international media and in Canada, which could help their market prospects. Furthermore, discussions were undertaken concerning use of results for export promotion of Nepali Tea in Canada and overseas. This could lead to improvements in the sales of Nepali tea, which in turn would improve the economic welfare of participants.

The research assistant and interviewers benefitted from financial remuneration for their work and from valuable work experience. Homestay families and other rural actors also benefitted directly. More generally, Nepali tea development stakeholders such as NGOs, government and factory owners may benefit from learning about the suppliers into the tea value chain.

3.6 Data Clean Up

After the primary data gathering and inputted was completed, the data was cleaned up. Data clean-up included rectifying typos in the database, checking manually the answers to all certification and risk questions, and random checks that the hard copy data matched the database. I cross checked that the individuals in the master survey database were the same as in the sample records. I found that several individuals' index numbers had been

misreported and fixed the problem. Surveys were put in numerical order in binders. The survey database was merged with the factory data on year of certification and other variables into one master database. All the data for the risk games was crosschecked between the database and the hard copy surveys and corrected as needed. The data was then brought into econometric software and processed into usable variables: for example, the responses from two questions about time preferences was combined into a single variable that has three possible values, each expressing a different time discount factor. Selected quality checks were performed on whole surveys and incorrect data points identified and corrected.

3.7 Conclusion

The fieldwork carried out for this PhD thesis was challenging and rewarding. The research process was characterized by expert advice, careful design, revisions, and quality-attuned implementation. Quality checks and all other monitoring methods affirm that interviews were carried out according to the highest ethical, accuracy, and quality standards. Although it was not without its difficulties, the dedication and attention to detail of the research team and supporting actors made it possible to construct a high-quality database on risk and certification attitudes amongst 270 Nepali tea farmers.

3.8 Appendix: Research Instrument

Carleton UNIVERSITY

Certification and Risk in the Nepali Tea Trade
Sarah Mohan PhD field research
Quantitative Survey

Household #:_____

A. Introduction & Informed Consent

My name is (interviewer name) and I am here as part of a research project on tea in Nepal. This project is called "Certification and Risk in the Nepali Tea Trade" and was started by a foreigner named Sarah Mohan for her studies at Carleton University in Canada. Sarah buys Nepali tea in Canada and enjoys it very much. She came here to find out about certified and noncertified tea, how you feel about risk and if you have good, stable sales. She hired me to ask you and other farmers some questions to find this out. There will be a game where you are asked to choose lotteries and you will win some money, but the exact amount depends on how the random lottery turns out. You and several other farmers in the village were randomly selected to be invited to participate from lists of names provided by cooperatives and factories. We are not from the government: we're just studying. We will protect the information you give us and not tell anyone unless you want us to.

We're gathering this info from farmers across Ilam and Panchthar. If you participate, we will tell people in the tea trade some of the things we have learned from you, so they understand the real situation of farmers here. We'll do our best to make sure the study makes them run things better. By participating, you will also have the opportunity to reflect on these issues, to have your voice heard by powerful people, and to ask me questions at the end about where the tea you grow eventually goes.

By giving verbal consent, you testify that you have agreed to participate in this study. Do you accept to participate in this research? [Yes No]

We could put your name with your responses, and possibly use it in reports or publicity, or keep it secret. Would you like to have your name shared (Circle One)? [Yes No]

(ask only if said yes to previous question) Would you like to have your photo and audio taken during the survey? [Yes No]

B. Basic Demographic Information

1. Name: _____
2. Location: _____

3. Gender? [Male Female]

4. Ethnicity? _____

5. Age? _____

6. Can you read and write [Yes No]

7. What is the highest level of education you have completed?_____

8. How many people are currently living in this household?_____

9. Are any of them not related to you? [Yes No] If Yes, please explain:
_____

10. Of the people who are living in this household, how many are exclusively engaged on the farm? _____

11. Of the people who are living in this household, how many are working part-time on the farm?_____

12. How many adult family members used to live here but are now living elsewhere and sending money home? _____

13. (If there are outmigrants) How many of these people are living outside Nepal?
_____

14. Please name your three nearest neighbours (on basis of distance):
_____
_____
_____

C: Ambiguity Aversion Game

Now we will play a game. One of the games will be randomly chosen for a real payoff at the end, but which game will be chosen will only be seen at the end, so you should make each choice as if it were for a real payoff.

Let's first do a practice game. Pretend you are facing two ways of tea farming. The first way of tea farming is very stable and safe and you're sure to earn NRs50 from each bush a year. But someone has come along and suggested a new, second way of tea farming that is quite uncertain. From what you've heard, you could earn only NRs10 per bush per year, or maybe NRs100 per bush per year, but you're not sure the likelihood of each outcome. Would you choose the first way of farming or the second way? (Discuss until respondent is clear. If they ask, say the likelihood of the good outcome is unknown.)

OK? Great, let's play the game now (Ask every question with the same script as above. Write down the answer to each question; record when they first switched from B to A, and if they switched a second time, below the table).

#	A: Safe farming	B: New Farming		Respondent choice (A or B)
		Good	Bad	
15.	140	280	140	
16.	140	280	110	
17.	140	280	90	
18.	140	280	70	
19.	140	280	50	
20.	140	280	30	
21.	140	280	10	

22. What did you think the chance of getting the good outcome with the new kind of tea farming was for these questions? _____%

D. Basic Household Economics

23. What proportion (out of 100) of your household's food consumption needs are met by food made on your farm? _____

24. Can you name all the activities done in your household to make a living? (Circle one or more)[Tea Other Agriculture Business Teacher Shop Other (specify:____)]

25. Which activity is the main activity in the household - the one that takes up a majority of the household time? [Tea Other Agriculture Business Teacher Shop Other (specify:____)]

26. Do you grow Crops besides Tea? [Yes No] If Yes, please list the most important other crops, in order of importance: _____

27. How many livestock do you have? a. cows: _____ b. ox:_____ c. calf:_____ d. goats: _____ e. chickens: _____ f. pigs:_____ g. buffalo:_____

28. Please list the main ways you get loans (microcredit, bank, etc) and their associated interest rates: _____

29. How much do you owe in outstanding loans?_____

30. How many ropani land do you own?_____

31. How many ropani land do you rent? _____

32. How many ropani land do you have for tea?_____

E. Certification

33. When did you first hear that you could get certified as organic? Month: _____ Year:_____

34. Were you using chemicals for your tea farming at that time? [Yes No] Explain: _____

35. Did you decide to get certified organic? [Yes No] If yes, how many months after you heard about certification did you decide to get certified? (eg. 20 months later): _____ Months later, Notes:_____

36. (if yes in 34) How much land did you own in total then? _____ ropani

37. (If yes in 34) Have you started conversion to organic? [Yes No] If yes, when did you start the formal conversion process? Month: _____ Year: _____

38. (If yes in 34) Have you been certified as fully organic? [Yes No] If yes, when were you certified? Month: _____ Year: _____

39. You know about the organic scheme. Now say the factory tells you that there is a new certification standard called "Fair Trade". They tell you the scheme involves paying labourers more. In return there will be social projects in your community. Do you agree to adopt now, or wait and see? [Adopt Now Wait]

40. (if answered wait in question 41) One year has passed. A third of the people in your village have adopted the Fair Trade Scheme. You see a community health centre that has been constructed, but people who have adopted complain about the labour costs. Do you agree to adopt now, or wait and see? [Adopt Now Wait]

41. (if answered wait in questions 41 and 42) Two years have passed. Two thirds of the people in your village have adopted the Fair Trade Scheme. Do you agree to adopt now, or wait and see? [Adopt Now Wait]

42. Now pretend that the factory tells you about yet another certification scheme called "Rainforest Alliance". They tell you the scheme involves many extra hours of record keeping and training on farm practices and your output will probably decrease somewhat. In return they say that the prices you receive will be more stable from year to year. Do you agree to adopt now, or wait and see? [Adopt Now Wait]

43. (if answered wait in question 42) One year has passed. Half the people in your village have adopted the Rainforest Alliance scheme. It seems that people who have adopted have tea bushes which are more full and healthy than your bushes, but they complain about the time spent in trainings. Do you agree to adopt now, or wait and see? [Adopt Now Wait]

44. (if answered wait in questions 42 and 43) Two years have passed. three-quarters of the people in your village have adopted the Rainforest Alliance scheme. Do you agree to adopt now, or wait and see? [Adopt Now Wait]

F. Tea Economics

45. What factory do you sell your tea to? _____

46. What proportion of your tea is sold to a small-scale processing factory? _____

47. Are you part of a farmers group or cooperative? [Yes No] If yes, Cooperative Name: _____

48. Roughly what percentage of household income comes from tea? _____ %
Notes:_____

49. What price did you get for A grade first flush tea per kg last year? Rs_____

50. What price did you get for A grade second flush tea per kg last year? Rs_____

51. What price did you get for A grade third flush tea per kg last year? Rs_____

52. What price did you get for A grade fourth flush tea per kg last year? Rs_____

53. What price did you get on average last year for B grade tea per kg? Rs_____

54. What proportion of your tea sold as A grade on average last year? _____%

55. How much tea did you sell last year in total? _____kg

56. How many kilograms of your own tea did you consume within the household? _____Kg

57. What was your cost per kg last year on average, roughly? NRs_____

58. How long does it take to get paid for A grade tea?(weeks)_____

59. How long does it take to get paid for B grade tea? (weeks) _____

E: Binswanger Risk Exercise

Each coloured paper on this board shows a lottery where there is a 50/50 chance of each outcome. Please choose one of the six lotteries.

lottery #	Option A (50%)	Option B (50%)
GREEN	200	200
PINK	175	250
BLUE	150	300
YELLOW	125	350
WHITE	100	400
PURPLE	75	450

60. Respondent chooses lottery colour:
[Green Pink Blue Yellow White Purple]

61. Imagine you own the lottery and are about to play it for real money. What is the minimum amount I would have to give you so that you forego playing?
NRs_____

F. Labour

62. How do you pay plucking labourers? [Per kg Daily basis]

63. How much did you pay plucking labourers in second flush of 2015 (per day or per kg)? _____

64. Did you provide other benefits (eg snacks) to labourers? [Yes No] If Yes, explain_____

65. How much time went by between plucking work and payment of labourers (in weeks)? _____

66. Did you supervise your own labour? [Yes No] If Yes, explain_____

67. Did you hire someone to supervise your labour? [Yes No] If Yes, explain_____

68. On average in second flush, how much could one labourer pick in one day? _____kg

69. How many plucking labour-days did you hire in second flush? _____ days

70. Imagine a situation where your tea bushes need to be plucked, so you go looking for labourers, but you can't find enough of them. How many times did this happen to you last year? _____ times

71. What did you do about this labour shortage? (Circle all that apply then rank them from most to least important by putting "1" in front of the most important):

check	describe	rank
	spend more time looking for labour	
	did the labour yourself	
	had labourers you hired work more days, reduced quality	
	overtime: told labourers to start early in morning, go late at night	
	hired parma	
	other, describe:	

note:_____

72. How did you pay pruning, weeding, fertilizer and pesticide labourers [Contract Daily basis Other]

73. How much did you pay these labourers last year? Type of Labourer:_____ NRs:_____unit:_____, Notes:_____

74. How many hours of family labour were done in tea on an average week during second flush? _____hours

75. Do children under 16 do work on the tea farm? [Yes No]

76. (If answer to last question was yes) How many hours of labour is done per week on the tea farm by children under 16? _____hours

77. How many hours did you work on your own tea farm on an average week last year? _____ hours

78. How many hours of parma (labour exchange) did you do on other people's tea farms on an average week last year? _____ hours

G: Risk Aversion Game

Now we will play another game. Once again you should pick one of two options.

Let's first do a practice game. Pretend you are facing two ways of tea farming. The first way of tea farming is very stable and safe and you're sure to earn NRs50 from each bush a year. But someone has come along and suggested a new, second way of tea farming that is quite risky, but now you know the chance of each outcome. There is a 50% chance of getting NRs10 per bush per year, and a 50% chance of getting NRs100 per bush per year. Would you choose the first way of farming or the second way? (Discuss until respondent is clear.)

OK? Great, let's play the game now (Ask every question with the same script as above. Write down the answer to each question; record when they first switched from B to A, and if they switched a second time, below the table).

#	A: safe farming	B: new farming		Respondent choice (A or B)
		Good (50%)	Bad (50%)	
79.	140	280	140	
80.	140	280	110	
81.	140	280	90	
82.	140	280	70	
83.	140	280	50	
84.	140	280	30	
85.	140	280	10	

H. Risk & Uncertainty

86. Say there was a fire that burned down your home. How many different people could you go to for help? _____

87. If there was a drought for four months April to June and there was no tea to sell, do you think that you would be able to put 2 meals a day on the table? [Yes Maybe No]

88. Do you remember a time when there was such a crisis and it was very difficult to provide for the family? [Yes No]

89. Do you think tea prices will be higher next year? [Definitely Probably Maybe Probably not No]

90. Do you think the tea you're producing will have a good market in the future? [Definitely Probably Maybe Probably not No]

91. If you were to try a new crop, do you think your livelihood would improve, stay the same, or get worse? [Improve Same Worse]

92. Say you had to choose between two ways of tea farming. In the first, you would have a low, stable income. In the second, you would have a high income, but there is a chance that in five years, the market for your tea would crash and you would have no income. Which would you choose? [First Second]

93. In this question I will say numbers and I want you to remember them and say them back. For example, if I say 2 3, please say 2 3. OK, Let's start (circle the longest series of numbers they successfully remember):
    5
    3 7
    8 2 7
    2 9 0 1
    4 8 5 3 6
    0 9 4 2 7 3
    9 2 5 8 0 2 6
    3 1 2 7 6 0 4 5
    6 0 2 5 9 7 1 8 3

I: Time & Uncertainty exercises

94. Here is another game. It also could be played for real money at the end. There are two options and you choose one. Would you prefer to have NRs300 now or NRs500 in two weeks? [Now Later]
95. Would you prefer NRs300 now or NRs700 in two weeks? [Now Later]
96. We would like to know what you think the price of A-grade tea will be in first flush next year. Here are 10 potatoes and five boxes: each box represents a price range. The blue box is price less than NRs35, the purple box price between NRs35 and 40, the pink box price between NRs40 and 45, the white box price between NRs45 and 50, and the green box price higher than Nrs50. Please distribute the potatoes amongst the boxes. For example, if you are certain that the price will be

less than NRs35, put all the potatoes in the blue box. If you have no idea what the price will be, put two potatoes in each box. Do you understand? (discuss with respondent until s/he understands the exercise. Let them discuss and then put the potatoes in the boxes. Note how many potatoes are in each box, and how many people were involved in deciding the allocation of potatoes):

Number of Potatoes @

<NRs35:_____
NRs35-40:_____
NRs40-45:_____
NRs45-50:_____
>NRs50:_____
Number of people discussing:_____

J: Payoff

Game questions number ____ and _____ were randomly selected and played.
For game question number _____, an amount of NRS_____ was won.
For game question number _____, an amount of NRs_____ was won.
A total of NRs_____ was paid to the participant.

Signed,
(enumerator signature) (printed enumerator name) (date)

Chapter 4

Risk Aversion and Certification: Evidence from the Nepali Tea Fields

4.1 Introduction

Agricultural standards have the potential to connect farmers to market requirements, improving livelihoods and sparking rural development. Yet certification to these standards has been far from universal. This paper examines the case of Nepali tea farmers who were offered the opportunity to get certified to the organic standard. On its introduction, organic certification was backed by dramatic assertions that it would improve prices and market access. Given such promising claims, this begs the question: why did some tea farmers refuse to get certified?

A burgeoning literature sheds light on this question. Analysis indicates that land owned (Maertens and Swinnen 2009; Karki et al 2011; Olabisi et al 2015), age (Ayuya et al 2015; Karki et al 2011), access to credit (Ihli et al 2016), education (Ayuya et al 2015), and household labour endowments (Maertens and Swinnen 2009; Kersting and Wollni 2012) might influence whether a farmer decides to adopt the crop production rules in a certification scheme. Yet when a group of Nepali tea farmers were asked about their

decision whether to get certified to the organic standard, many of them cited the risk of productivity changes as a major factor. They feared that organic methods could reduce their output somewhat, but also thought that help from the factory could mitigate some of this risk (Mohan, 2013; 2014; 2016). The farmers' perceived risk regarding organic certification made their individual risk preferences important in their certification decision, which is the main focus of this paper.

There are several reasons to be interested in the role of risk preferences in farmers' decisions to get certified to an agricultural standard[1]. One is that the literature on certification has largely ignored the role of risk preferences, despite extensive evidence that they affect farmers' economic decisions (Feder et al 1985; Rosenzweig 1988; Morduch 1994). Ignoring risk aversion in first stage selection regressions of treatment effects models of certification could bias the estimation of the impact of certification on welfare. Second, the

[1]The terms "standard" and "certification scheme" refer to slightly different phenomenon. "Standard" is a general term referring to a set of rules on how to produce something (Busch 2011). A producer can adopt a standard of his/her own volition and without any external recognition. In other cases, compliance with a standard is verified by an external actor, and then we speak of "certification" to the standard in question, which in turn can also be known as the "certification scheme". The terminological schism roughly follows disciplinary lines: "standard" is used in the trade policy, theoretical economics, and business study literature, and "certification" in the anthropology, development studies, applied economics, political science and non-governmental sector. There are also prolific bodies of work that discuss similar phenomenon using the terms "labeling", "public regulation", "intermediation", and "private sector governance". "Certification" is the preferred term in this paper because it is more specific and captures the fact that the schemes of interest – such as organic, fair trade, HACCP, Rainforest Alliance and ISO standards – are adopted for marketing reasons, that is, to sell produce differently. Obviously, certification also has implications for production functions since it requires adoption of new production practices. Despite the focus on certification, this paper uses the more general "standard" term when referring to the set of production requirements themselves.

direction of the relationship between risk aversion and certification is not immediately obvious. While the technology adoption literature finds that risk averse farmers tend to avoid adopting risky new technologies (Liu 2013; Knight et al 2003; Vargas Hill 2009), and would therefore predict a negative relationship between risk aversion and certification with more risk averse farmers having a lower propensity to adopt, the contract farming literature predicts the opposite. The contract literature suggests that when certification occurs as part of an agricultural contract, adoption can provide access to risk protection that is relatively more appealing to more risk averse farmers (Abebe et al 2013; Cahyadi and Waibel 2016; Ramaswami et al 2009; Simmons 2002). This implies a positive relationship between risk aversion and certification, with more risk averse farmers having a higher propensity to adopt. Lastly, methodological issues have plagued the little empirical research that has been carried out to date that might enable us to evaluate the relative importance of the technology adoption and contract mechanisms in the certification-risk relationship (Ruben and Fort 2008; Lapple and Van Rensberg 2011; Kisaka-Lwayo and Obi 2014; Ihli et al 2016). This paper aims to address this research gap through an empirical investigation of the relationship between risk aversion and certification.

Both the technology adoption mechanism, wherein the risk averse would avoid the new certification technology, and the contract mechanism, wherein the risk averse would seek it out to protect themselves from risk, could be present and relevant. Notwithstanding their different predictions, the two

conceptual frameworks share a set of three assumptions. First, farmers perceive ex ante that certification is more risky, and higher return, than conventional methods. Second, farmers' risk aversion does not change over time. Third, farmers have free choice whether to certify. Each of these assumptions is discussed in more depth later in this paper. If they hold, then the technology adoption hypothesis can be tested against contract theory's opposing prediction through an empirical investigation into which effect dominates the relationship between measured risk aversion and certification status in a population of farmers.

This paper conducts such an investigation using data obtained through primary field research. That is, it seeks to test whether evidence supports the prediction of technology adoption theory – of a negative relationship wherein more risk averse farmers have a lower propensity to get certified – against contract farming theory's opposing hypothesis of a positive relationship, with a higher certification propensity amongst the risk averse. This paper is the first to our knowledge to focus on a rigorous empirical estimation of the relationship between risk aversion and certification.

This paper uses the introduction of organic certification into the orthodox tea sector in Nepal as a means to study how risk aversion affects certification decisions. This certification scheme is well suited for our study since its adoption was proposed to risk averse (Dhungana et al 2004) small-scale farmers (NTCDB 2016) and was adopted by some, but not all of them (Mo-

han 2013; 2014; 2016; Karki et al 2011). The certification scheme was presented to farmers as an opportunity to change production technologies – notably replacing chemical inputs with organic materials – to obtain higher prices[2]. Factory owners, cooperatives, and non-governmental organizations also promised that technical assistance would be provided to converting farmers and suggested that there would be better market access. Yet these actors admitted that conversion could decrease farm output, and estimates of the extent of the productivity drop varied from as low as 5% to as high as 75%. As a result, although farmers perceived that certification would lead to higher returns than the conventional farming status quo, it was also perceived as a relatively risky endeavor. In this context, some of the farmers chose to adopt the organic certification scheme, while others chose to abstain. Their choice provides an ideal setting for the examination of how poor risk averse small-scale cash crop farmers choose whether to get certified to a high-return high-risk standard.

In 2016 I hired a Nepali research team to conduct a household survey and field experiment. The research instrument covered information on household characteristics, tea livelihoods, certification status and attitudes, and included experiments designed to elicit individual risk preferences. It was conducted with 270 orthodox tea farmers in four villages in two Nepali districts.

[2]Interview, Jyoti Adhikari, TEASEC NGO, Fikkal, 12 May 2010.

A field experiment modeled on Binswanger (1980; 1981) and Eckel and Grossman (2008) was used to elicit risk attitudes and respondent choices are converted into a coefficient of relative risk aversion using an Expected Utility (EU) framework. A simple theoretical framework conceptualizes actual certification status as an indicator of the latent propensity to be certified, which is in turn a measure of the utility differential between certified and uncertified production. I used the risk preference parameters derived from the experiments to predict whether farmers decided to get certified. A reduced form econometric model regresses observed certification status on the coefficient of relative risk aversion to obtain an estimate of the effect of risk aversion on certification status.

I find that farmers who made more risk averse choices during the experiment were more likely to be certified organic. That is, the study finds a significant and positive relationship between risk aversion and organic certification amongst small-scale Nepali orthodox tea farmers who faced the option of going organic. This result suggests that the contract farming mechanism dominates the technology adoption mechanism in the risk-certification relationship. It implies that certification may be different from other agricultural technologies insofar as it can be relatively appealing to the risk averse. This is the case notwithstanding its perceived riskiness. Previous research on contract farming, and some supporting evidence in this case study, suggests that this difference stems from the risk protection that can accompany certification. Analysis suggests that the governance of the scheme – and particularly

whether it is adopted at the behest of trustworthy downstream buyers who promise to provide accompanying risk reduction services – affects how it is perceived by risk averse farmers, and indeed whether they choose to get certified.

It should be noted that nothing in these findings contradicts the existence of social learning effects that may help or hinder the certification process. In the case study region, as elsewhere in the rural developing world, those who adopt first are leaders who the more reluctant learn from and follow. This herding process may amplify the small differences in risk aversion between early adopters and non-adopters, thus leading to big differences in adoption outcomes across risk aversion categories. The role of social learning processes are examined in more detail in the robustness section.

The remainder of the paper proceeds as follows. The next section reviews the relevant literature, while section 4.3 presents background on the case study. Section 4.4 presents the data, empirical methodology and econometric approach. Section 4.5 shows the regression and robustness results and section 4.6 discusses them. Finally, section 4.7 offers concluding comments.

4.2 Related Literature

A farmer's decision to get certified can be thought of either as a decision to adopt a particular form of technology, or a decision to enter into a particular type of contract. The rest of this section discusses why risk is important

to certification decisions, presents the literature on technology adoption and contracting in a developing country agricultural context, considers the predictions of these literatures for the certification and risk relationship, and concludes with a brief presentation of empirical work to date on risk and certification.

The conventional approach to understanding the certification decision assumes that risk aversion is irrelevant and excludes it from models of selection into certification schemes. Yet empirical studies of certification highlight that farmers, ex ante, can perceive certification to a standard as more risky than the status quo because of the upfront investment that is often required, higher yield variation, and higher production costs (Bolwig et al 2009; Simmons 2002). At the same time, there is preliminary evidence that farmers who get certified to agricultural standards experience lower ex post price volatility (Bolwig et al 2009; Minten et al 2009; Handschuch et al 2013). The distinct risk profile of certified farming is particularly important for farming households living close to subsistence. Certification may be appealing to them as a marketing strategy to access higher prices. But the rural development literature tells us that poor households craft their livelihoods in part to protect themselves from the risk of drops in income that might push them below subsistence (Chambers 1983; Fafchamps 2003). Farming households in the developing world reduce their exposure to risk in part through decisions about what to produce[3]. As such, one could expect that they consider the

[3]Other risk management techniques may be used – notably crop and livelihood diversi-

relative riskiness of certified farming when making their certification decision.

The technology adoption and contract farming literatures present competing conceptualizations of how risk aversion affects the certification decision. Scholarly interest in technology adoption arose in response to puzzlingly low rates of technology adoption amongst developing country farmers. Following on early theoretical work showing that risk aversion could affect production decisions and outcomes (Sandmo 1971; Feldstein 1971; Ratti and Ullah 1976), it was hypothesized that risk aversion could affect technology adoption decisions. The vast empirical literature testing this hypothesis has shown that relatively more risk averse farmers tend to be less likely to adopt risky new technologies (Feder et al 1985; Knight et al 2003; Liu 2013)[4]. Certification scholars have followed this line of reasoning on the rare occasions that they have looked at risk, assuming that risk averse farmers will see certification as a risky new technology and will shy away from getting certified. For example, one study found that young farmers tend to adopt standards more often than older ones and argued this was because the young tend to be more amenable to risk and thus more willing to try the standard (Ayuya et al 2015)).

Recent papers on technology adoption have shed light on the nature of the

fication and saving and borrowing over time – but research indicates that market failures in rural areas of the developing world, including structural and financial constraints, has made them less prevalent strategies amongst farmers there compared to their developed world compatriots (Morduch 1994; Morduch 1995; Kurosaki and Fafchamps 2002).

[4]A good survey of this literature can be found in Hurley (2010). More broadly, research has shown that risk aversion affects farmers' production decisions, including crop diversification (Hellerstein et al 2013), labour demand (Vargas Hill 2009), contract type (Bezabih 2009), and efficiency (Dhungana et al 2004).

relationship between risk attitudes and adoption decisions. Liu (2013) suggests, drawing on the insights of Prospect Theory (Kahneman and Tversky 1979), that the timing of technology adoption can be influenced not only by risk aversion but also by farmers' disproportionate sensitivity to loss compared to gains. She found that farmers who were more risk averse or loss averse tended to adopt the new technology later. Ward and Singh (2015) hypothesize that farmers may not have full information on a production option, realize that this is the case, and avoid options that expose them to such (Knightian) uncertainty. However, evidence on this subject is mixed (Engle-Warnick et al 2006; Ross et al 2012; Barham et al 2014; Ward and Singh 2015). This literature has not, however, considered how risk aversion affects the adoption of marketing technologies. By examining how risk aversion affects the certification decision, this paper aims to address this research gap.

The literature on contract farming takes a different approach by placing certification within the broader institutional context of agricultural economies. This literature notes that standards are often adopted as part of a contract between farmers and buyers. Certification to such tied standards entails buyer-supplier cooperation during the compliance process that brings the two actors closer together. Economic theory shows that close contractual ties may reduce the suppliers' exposure to risk if the less risk averse principal (the buyer) insures a relatively more risk averse agent (the supplier). Buyers do appear to offer a set of complementary services alongside contract

and certification scheme adoption that can reduce the risk faced by adopting farmers. These services can include subsidies for the initial investment in certification to reduce risk from setup; assistance with operating costs; extension and management input to reduce yield risk; hedging price risk including through price guarantees; and income diversification through access to markets whose price movements are independent of conventional products (Simmons 2002). These services can serve to reduce price, quantity, and income volatility. The fact that adoption of standards within agricultural contracts reduces farmers' exposure to volatility has been found in a variety of settings, including amongst poultry farmers in India (Ramaswami et al 2009), oil palm farmers in Indonesia (Cahyadi and Waibel 2016), and potato farmers in Ethiopia (Abebe 2013)[5].

This contract farming literature highlights that adopting a certification scheme whose new production requirements could increase variability in yields in the short-term could actually be, when adopted as part of a contract, risk-reducing in the long run, provided the contract is offered alongside buyer services that reduce exposure to risk. In such a scenario, farmers who are relatively risk-averse could have a higher propensity to opt into standard-governed contract farming schemes.

In sum, although the technology adoption school argues that risk averse farm-

[5]A good but early survey of the empirical literature can be found in Simmons (2002), which notes that evidence on reduced exposure to volatility, and higher contract adoption by the risk averse, is mixed: see, for example, Wang et al (2011) and Vassalos et al (2016).

ers will not adopt risky standards through certification, research on contract farming suggests that when such schemes are tied to risk-reducing contracts, risk averse farmers may have a higher propensity to adopt. Unfortunately, there is little research that could help us investigate which framework best explains the relationship between risk aversion and certification. Those studies that do exist have serious methodological flaws, including failing to provide real payoffs in risk experiments (which the experimental economics literature suggests may introduce bias into the results) and ignoring the role of cooperatives (Kisaka-Lwayo and Obi 2014; Ruben and Fort 2008; Lapple and Van Rensberg 2011; Ihli et al 2016). The findings from these studies are mixed: the evidence leans towards finding that more risk averse individuals are less likely to get certified, but the relationship is not clear-cut: there is no difference in risk aversion between early adopters and non-adopters (Lapple and Van Rensberg 2011), and there is heterogeneity in the relationship across certification categories (Kisaka-Lwayo and Obi 2014) and risk aversion categories (Ihli et al 2016).

The aim of this paper is to begin to fill this gap in the literature through a rigorous empirical investigation of the relationship between risk aversion and certification. A negative relationship between risk aversion and certification would be consistent with the finding of the technology adoption literature that people with higher risk tolerance are more likely to adopt new technologies. A positive relationship between risk aversion and certification would suggest that the agricultural contracting mechanism dominates this effect:

that despite their risk aversion, farmers seek out certification to obtain accompanying risk reducing services.

This chapter focuses on the relationship between the propensity to get certified and risk aversion, and pays particular attention to addressing potential sources of measurement bias. Analysis of the data sheds light on whether the technology adoption or contracting mechanisms dominates the certification adoption decision. Before methodological and conceptual questions are studied, however, a little background on the case study context is in order.

4.3 Background on the Institutional Setting of Tea in Nepal

[6]

Nepal is a small mountainous landlocked least developed country (LDC) in South Asia, positioned between China and India. Although it ranks just 19th in global tea production, the Nepali tea sector is important to the country's growth and development prospects (Rana 2007; Warakaulle et al 2007; NTCDB 2016; USAID 2011). Thousands of small-scale farmers grow high quality labour-intensive orthodox tea in the foothills of the Himalayan mountains, just across the border from the Indian Darjeeling tea gardens (see map in Figure 4.1[7]). Their tea is processed and exported by private factories.

[6]This section draws heavily on Mohan (2013, 2014, 2016, and forthcoming).
[7]All figures and tables can be found in Appendix 1.

4.3.1 The Introduction of Organic Certification

To improve the quality and reputation of Nepali tea, several of these factories adopted a domestic standard called the Code of Conduct (CoC) in 2004. Marketing and implementation difficulties with the CoC led the first factory to seek organic certification in 2004, and by 2006 several other factories had also sought organic certification for their suppliers. Certification to the organic scheme was conferred by an independent agency such as NASAA (National Association for Sustainable Agriculture Australia) or the IMO (Institute of Marketecology). In order to obtain organic certification farmers have to abstain from using chemical pesticides or fertilizers for at least three years. During those first three years without agrochemical use, they are considered to be "in conversion", and their produce is treated separately from conventional and from non-organic produce. There is a significant up front certification cost that was borne in part by the factory and in part by farmers (via their cooperatives).

The decision to get certified began at the factory level, where the factory owner in consultation with the factory manager decided to seek organic certification. There are approximately 20 orthodox tea factories in Nepal, but only four[8] of them decided to offer the certified organic option to their sup-

[8]Two additional estates and their associated factories were certified organic, but did not have any certified small-scale farmers. Several factories were in the process of converting to organic at the time of the survey, but these four factories were alone in selling certified organic tea from Nepali smallholders.

plying small-scale tea farmers[9]. Since the farmers who supplied to these four factories were the only ones who faced the option of going organic, they make up our population of interest and are worth mapping out in more detail. The Gorkha factory sources certified and non-certified tea from farmers in Sundarepani and Kolbung villages (see Figure 4.1). The small Green Tea Factory sources certified tea from a handful of farmers in Pashupati Nagar, near Sundarepani. Himalayan Shangri-La is a factory sourcing tea from small-scale farmers in the Sankhejung region. The Kanchenjenga Tea Estate sources tea from farmers from Phakphok and other villages: I call this the "Phidim region", which adjoins Sankhejung. Each factory has a local monopsony: since tea degrades quickly, and has to be delivered to the factory within hours of being plucked from the bush, all the farmers in each area deliver to the closest factory. Each farmer has only one factory it can supply to. Each factory accepts certified, conversion, and uncertified goods. Each factory accepts all the tea that it receives.

4.3.2 Farmer Perception of the Organic Scheme

Interviews with farmers, factory owners and managers, and other stakeholders[10] indicate that organic certification was presented to farmers as means

[9]Factory characteristics – notably a history of exporting overseas and the personality, entrepreneurial spirit and contacts of the factory owner – affected the decision to convert to organic. They facilitated the identification of the organic opportunity; promoted planning to take advantage of it; and helped to muster the finance, buyers, and suppliers to make certification happen.

[10]A set of 85 field interviews conducted in Spring 2010 inform the discussion here as well as analysis in Mohan (2013, 2014, 2016). The 2010 field research included 55 in-depth

to earn higher prices. Once they decided to pursue organic certification, the factory owner or manager made presentations to gatherings of (mostly male) representatives of tea farming households[11]. During these presentations, the owner explained what the organic standard was, promised that farmers who adopted it would access higher and more stable prices, and urged the farmers to get certified[12]. The owner often made a specific price promise at this time, e.g. that organically certified farmers would get double the conventional per-kilogram tea price. Certification was described as a way to get access to lucrative markets overseas that would pay high prices for tea that would be fed back to farmers[13]. Factories promised to provide services to certified farmers, which could include training sessions, organic inputs, record-keeping assistance, subsidies for initial certification costs, factory-hired field extension officer advice, and visits from overseas buyers (Mohan 2013, 2014, 2016). In some locations additional information sessions were run by local NGOs and cooperatives in which the high returns from certification, and its sustainability dividends, were underscored[14].

On the basis of all this information, members of tea farming households began forming an ex ante prior about certification in a process that continued

qualitative interviews and 30 quantitative surveys of farmers, informants, and labourers in the Nepali orthodox tea sector.

[11]Interview, Udaya Chapagain, Owner, Gorkha Tea Estate, Sundarepani, 12 February 2016.

[12]Interview, NN Acharya, Manager, Kanchenjenga Tea Estate and Factory, Phidim, 10 February 2016.

[13]Interview, Lila Mukhiya, Farmer, Sundarepani, 10 May 2010.

[14]Interview, Jyoti Adhikari, TEASEC NGO, Fikkal, 12 May 2010.

when they went home and discussed the prospect of certification with other family members[15]. Although in reality returns from tea farming are influenced by the price received for tea leaf as well as costs and productivity, in practice, farmers consider returns largely in terms of per kilogram prices (Mohan 2013). Factory owner promises of higher prices were thus taken very seriously. These expectations proved crucial in the decision to get certified: as one respondent put it, "there is a rumour that if you go organic you will get a good price. So we're converting."[16] At the time of making the certification decision, households clearly considered certification to be the high return option, particularly because of the high price promises and long-term improved market access, and that was a key reason many of them chose to go organic (Karki et al 2011; Mohan 2013). Quantitative analysis reaffirms that certified farmers in 2010 received a significantly higher price for the tea leaf they sold to the factory, and were more hopeful about their future market prospects than conventional farmers (Mohan 2013).

Yet there was a great deal of uncertainty concerning the impact of organic methods on farm productivity. Factory owners and sector experts acknowledged that organic conversion reduced productivity, particularly in the short term, but farmers heard mixed messages about the degree and duration of the output drop. While some factories said the output only decreased by 5% in the first year or two of organic production and quickly went back to

[15]Interview, Ganesh Kumar Rai, Coordinator, Sundarepani Tea Farmers' Cooperative, 25 February 2016.

[16]Interview, anonymous Farmer, Fikkal, 20 May 2010.

normal, there were also stories of output being cut to a quarter of previous levels and/or never recovering to previous levels (Mohan 2013). Rumours circulating amongst farmers about the extent and duration of productivity drops influenced expectations[17]. For those who were not amongst the first wave of early adopters, demonstration effects from neighbours who adopted organics also influenced expectations about output variation[18]. Experts, the data and experience elsewhere suggests that on average, in the first year of conversion, production drops by 50%, but generally increases again, and within three to four years is 75 to 90 percent of the output of conventional farms[19]. Risk in tea farming comes from several sources – including variation in prices, productivity, the proportion of output sold at full price, costs, and access to technical assistance. The proportion of farmers' output categorized as "A" grade tea could differ between certified and conventional methods, including because organic farmers could have better training and incentives to pluck the two leafs and a bud needed for high quality tea, and the two varieties could similarly have different levels of variation in the proportion of produce that earned "A"-grade top prices. The cost structure of conventional and certified farming differs: certified farmers incur a fixed cost for the initial certification, and although they do not incur the agrochemical variable costs of conventional farming, they do face higher labour variable

[17]Interview, Uma Kanta Aryal, Farmer, Kolbung, 17 May 2010.

[18]Interviews, Madhab Niroula, Coordinator, Eco Tea Cooperative, Kolbung, 20 February 2016; Bandana Shrestha, Farmer, Itabari, 2 May 2010.

[19]Interviews: Pasang Mukhiya, Farmer, Sundarepani, 10 May 2010; Thir Bahadur Raud, Farmer, Sankhejung, Uma Kanta Aryal, Farmer, Kolbung, 17 May 2010.

costs since organic farming is more labour-intensive than conventional farming. Yet the cost of both agrochemicals and labour were quite stable over time, and both modes of production offer little scope for adjusting costs. However, interviews with farmers in 2010 and 2016 underscored widespread concern regarding the risk from productivity variation. Variation in cost and other factors were scarcely mentioned during interviews (Mohan 2013). Ex ante, conversion to organic methods was perceived as risky, particularly in the short run, because of wide variation in the productivity of tea farming using these methods.

At the same time, the factory promised to provide accompanying services that would have ramifications for the risk faced by certified farmers. The promise of better prices suggested a reduction in price volatility, while the factory pledge to provide technical assistance could be expected to reduce output volatility. Finally, the provision of subsidies could reduce income volatility.

In sum, farmers perceived that conversion to organic methods would increase prices and reduce yields, and hoped that prices would increase such that net income would on average be higher. However, they expected yields to be more variable under organic methods, so much so that net income would be more variable. As such, certification itself was seen as a high-return, but high-risk, option. However, services accompanying certification offered the potential to reduce risk through lower price, yield and income volatility.

4.3.3 Institutions

Fourteen tea farmers' cooperatives supported the households in this study. Each was made up of anywhere from ten to fifty farmer-members and was a participatory, local body supporting its members through training sessions, administrative assistance, and liaison with authorities. At the time of fieldwork, 82% of tea farming households in the sample belonged to an organically certified cooperative, 5% belonged to a cooperative in conversion, and 11% did not belong to a cooperative[20]. The popularity of cooperatives in the tea sector in Nepal is typical of their pervasiveness amongst small-scale farmers in the developing world: in fact, since organic and other certification is only conferred on farmer cooperatives, they form an important part of farmers' choice environment. Despite this, cooperatives have to date been ignored by the literature on certification (Ayuya et al 2015; Maertens and Swinnen 2009; Kersting and Wollni 2012; Hansen and Trifkovic 2014; Ihli et al 2016; Karki et al 2011). This paper, and particularly the rest of this section, strives to correct this neglect through an analysis of the role of cooperatives in the Nepali case.

In some study villages the cooperative was formed expressly for the purpose of organic certification after the factory announced it would accept organic tea. Farmers who wanted to get certified joined the new coop, while those

[20]There were also 4 individuals, or 1.5% of the sample, which supplied to the Green Tea Factory and obtained organic certification through the factory yet did not belong to a cooperative.

who didn't stayed independent[21]. Other villages had cooperatives already in place when the factory announced the introduction of the organic option, and these groups voted on whether to get certified[22]. In this case, farmers who did not want to get certified exited cooperatives that voted to be certified and either joined a non-organic cooperative or went independent. A farmer who wanted to get certified, but did not yet belong to a cooperative, entered a cooperative which had decided to get certified[23]. Comments from farmers and informants suggest that there was free entry and exit into the cooperatives[24]. However, there could have been transaction costs of entering or exiting a certified cooperative, for example if incumbents of an organic cooperative charged a prohibitively expensive entry fee[25] or if a member decided it was too much work to de-register from a cooperative that has voted to get certified[26]. Unfortunately, respondents in the survey had very poor recall and cooperative records were sparse, making it impossible to measure the presence and extent of such transaction costs.

If those transaction costs are important, then the decision to belong to the cooperative is important in its own right. It would entail a sequential decision-

[21]Interview, Ganesh Kumar Rai, Coordinator, Sundarepani Tea Farmers' Cooperative, 25 February 2016.

[22]Interview, Rabin Rai, General Secretary, Central Tea Coop.Fed. (CTCF), Ilam Town, 7 February 2016.

[23]Interview, Rabin Rai, Ilam Town, 7 February 2016.

[24]pers. comm., Rabin Rai, 3 September 2016; pers. comm., Miriam Wenner, 5 February 2017; Miriam Wenner, 16 February 2017; Mohan 2013.

[25]Interview, Deo Kumar Rai, Farmer, Pashupati Nagar (Sundarepani), 30 May 2010

[26]Indeed, the decision to leave the coop may be endogenous since relatively more risk-averse people may be more reluctant to leave the cooperative.

making process with two components – the decision to belong to the cooperative and the decision to get certified – wherein actual certification status is influenced by cooperative membership. It would then be difficult to ascertain whether the measured relationship between actual certification status and risk aversion reflects innate certification propensity or rather cooperative processes. Yet there are good reasons to believe that the cooperative and certification decision was singular. The bulk of the case study evidence, as well as expert testimony, suggest that farmers decided on certification, and the cooperative decision followed by implication. Interviews with farmers and cooperative representatives indicate that farmers freely entered and exited the cooperatives according to their interest in certification, suggesting that cooperatives were passive actors[27]. This is supported by analysis in the robustness section of this paper, where I show that the use of data on inherent propensity to get certified – obtained independently of cooperative membership through a discrete choice experiment – yields the same measured relationship between certification and risk as when real certification status data is used. Finally, even if cooperatives have an active role in a minority of cases, it is not clear how one would model all the complexities of sequential decision-making. For all these reasons, it is a good first-shot approximation to model farmers' choice as a simultaneous certification and cooperative-membership decision. In this conceptualization, farmers' certi-

[27]pers. comm., Rabin Rai, 3 September 2016; pers. comm., Miriam Wenner, 5 February 2017; Miriam Wenner, 16 February 2017; Mohan 2013.

fication choice in 2006 was between option one, which consisted of getting certified and belonging to a certified cooperative, or option two, to remain uncertified as an independent farmer or member of an uncertified cooperative[28]. This simultaneous choice is the subject of this study and is reflected in Figure 4.2. The next section discusses the methods we use to study how farmers' risk aversion influences this choice.

4.4 Data and Empirical Methodology

This chapter is based on the analysis of data gathered during fieldwork conducted in February-April 2016 in Ilam and Panchthar districts of Nepal. Since I am only interested in farmers who had the option of getting certified, the farmers who supply to the four factories[29] who buy organic tea are our population of interest. The factories shared lists with the name, location, certification status, land size, and tea sales of their suppliers in 2015. As noted in more detail in the discussion of the sampling strategy in the third chapter of this thesis, a sample of 311 households was drawn from these lists, of whom 270 were successfully interviewed. The sample households are representative of all orthodox tea farming households in Nepal who had the option of getting

[28]The cooperatives that were uncertified in 2006 decided many years later (eg. in 2014) to get certified, and were as such in conversion during fieldwork in 2016. However, their members' initial choice to remain uncertified shows their low interest in certification, and this coupled with the fact they were not fully certified at the time of fieldwork led the study to consider them as uncertified.

[29]The supplier lists of these factories (Himalayan Shangri-La, Gorkha, Green Tea, and Kanchenjenga) make up our sample frame. Only farmers who, according to those lists, supplied a positive non-zero amount of tea leaf to the factory in 2015 are included in the sample frame.

certified. The sample was stratified into the four village-regions with farms meeting that description: Kolbung, Sundarepani, Sankhejung, and Phidim. A team of five locally hired interviewers collected data by going directly to the households in the sample. A household survey (see Appendix to Chapter 3) was carried out which generated data on household characteristics, farming livelihoods, certification, tea economics, and labour. Games administered during the interview generated data on risk preferences. Since illiteracy is common in the region, both the survey and game were administered verbally, in Nepali. Within each household, we interviewed the self-declared household head or the individual whom the household head designated as most knowledgeable about the tea farm[30]. Survey participants were paid according to the payoffs from the games administered during the survey, receiving on average 438 Nepali Rupees (CA$5.23), or approximately two days' wage as a tea labourer.

4.4.1 Survey and Factory Data

More than 15,000 farming households grow tea on small-scale plots in Nepal (NTCDB, 2017). The households in our sample had a diversified livelihood strategy, with some 34% of income coming from tea and the rest coming from other occupations such as other agriculture, running a shop, teaching, or working in a business. The median land size in tea was 0.46 hectares, but

[30]The preponderance of male respondents in our sample reflects cultural norms in Nepal wherein men are more likely to be identified as the household head and thus be the designated survey household respondent.

farmers also had land in other crops such as potato, vegetables, cardamom and corn, and raised livestock. Average annual individual income in the region was US$1260 and the Human Development Index was 0.526[31].

Table 4.1 shows summary statistics for the key variables of interest. Column 1, which has the sample means and standard errors for the whole sample, is discussed here. The average interviewee in the sample is 44 years old and has completed slightly more than the equivalent of an elementary school diploma. However, 12 percent of the sample is illiterate. Of the total sample of 270 respondents, 65% are from the Sankhejung region, 14% are from Kolbung, 11% are from Sundarepani, and 10% are from Phidim. One individual without data on risk aversion was dropped from the sample.

Table 4.2 provides detailed breakdowns of the sample by certification status. In our case study, all farmers who were interested in organic certification adopted it soon after it was introduced, and by the time of this survey, ten years after its introduction, were fully certified. Those with a low level of interest in certification, on the other hand, remained uncertified at the time of the survey. The uncertified either continued to practice conventional methods, or they had decided to follow the trend and began conversion to organic methods a year or two before the survey. This study follows others in the technology adoption literature (Liu 2013) in characterizing the early adopters, who had obtained full certification by the time of the survey, as

[31]2011 figures, GDP per capita PPP (UNDP 2014: 23,99).

having a higher propensity to adopt than the uncertified, reluctant farmers. That is, I measure latent certification propensity using a simple binary indicator of whether the household has actually already obtained full organic certification. This coarse classification reflects that households with a high propensity to adopt certification are more likely to have already obtained it by now, whereas those with a low propensity have not. The first row of Table 4.2 separates respondents simply into the 226 individuals who have obtained full organic certification and the 43 who have not. 84% of the population and our sample are fully certified organic, while 16% is not.

The second row of Table 4.2 shows a more refined 3-way categorization that separates the uncertified farmers out into those who have decided to adopt but are in conversion, and conventional farmers who still refuse to pursue certification. This categorization of conventional, conversion and certified farmers is used in the regression shown in Table 4.6 Column 1. Finally, the last row also distinguishes between early and late adopters of the scheme. This categorization of conventional, conversion, late certifiers and early certifiers is used in the regression of Table 4.6 Column 2.

Section 4.3.3 considered the possibility that institutional factors, and specifically the influence of cooperatives, could make actual certification status data diverge from the latent propensity to get certified. The discrete choice experiment method provides a way to assess respondents' latent preferences

when real data on choices is not available or is biased[32]. It describes a scenario to the survey respondent and asks what they would choose if they were in the situation. In our context, discrete choice experiments enable us to capture a pure measure of the respondents' latent attitudes to certification. Although data obtained through choice experiments is known to suffer from hypothetical bias, the time-saving and other reasons cited for this bias apply less to the production-choice context, where just one choice is made and the choice made does not affect the time taken in the experiment. Furthermore, this bias works similarly across individuals (Harrison and Rutstrom 2008), which implies that hypothetical bias would appropriately sort our population, albeit with a shift factor.

The survey thus included the following question, which following the literature was framed in a context that paralleled how in practice factory owners tend to describe standards to their suppliers. Respondents were asked to "Pretend the factory tells you about a certification scheme. This scheme will take more time for training and your output may decrease somewhat. In return they say that the prices you receive will be more stable from year to year. Do you agree to adopt now?" I define a measure of certification propensity based on this discrete choice experiment which is equal to 1 if respondents replied "yes" to this question, and zero otherwise.

[32]It has been used extensively in the willingness to pay literature (Murphy et al 2005; Harrison and Rutstrom 2008), in transportation and ecological valuation, and in economic research on the determinants of production choices when real data is unavailable (Scarpa et al 2003; Ward and Singh 2015; Wale and Yalew 2007; Birol et al 2015; Christensen et al 2011; Vassalos et al 2016; Hudson and Lusk 2004; Saenger et al 2013).

4.4.2 Field Experiment

4.4.2.1 Design

Empirical researchers have deployed several different experimental designs to elicit risk preferences (Binswanger 1980; Binswanger 1981; Eckel and Grossman 2008; Gneezy and Potters 1997; Holt and Laury 2002; Brick et al 2012; Tanaka et al 2009). The Holt and Laury (2002) experiment (hereafter referred to as the "HL" approach), which presents respondents with a list of paired lotteries, has emerged as the most popular method to elicit risk attitudes in developed countries. However, several studies have shown that in populations with low numeracy, the structure of the Holt-Laury game can be difficult to understand. Indeed, it has been accompanied by confusion with noisy and inconsistent choices (Dave et al 2010; Ihli et al 2016; Engle-Warnick et al 2006). When working with low-literacy populations, including in rural areas of the developing world, simpler games (Binswanger 1980; Binswanger 1981; Eckel and Grossman 2008; Brick et al 2012; Gneezy and Potters 1997) generate behaviour that is significantly more consistent and less noisy than behaviour in more complex risk elucidation tasks (Dave et al 2010; Ihli et al 2016; Charness and Viceisza 2016). This is particularly relevant for the present study given evidence of the limited numeracy and literacy of rural Nepali farmers (UNDP 2009; Mohan 2013; Mohan 2014; Mohan 2015).

This paper thus relies on data from a relatively simple experiment developed by Binswanger (1980, 1981) and refined by Eckel and Grossman (2008) (here-

after referred to as the "EGB" approach). The EGB approach is relatively easy to understand and has become a popular risk elicitation experiment for use with rural populations in the developing world (Engle-Warnick et al 2006; Ruben and Fort 2009; Yesuf and Bluffstone 2009; Dhungana et al 2004; Vargas Hill 2009; Bezabih 2009; Kisaka-Lwayo and Obi 2014)[33]. The EGB game offers decision-makers a single choice among 6 gambles, each of which has a 50% probability of winning a higher prize. Since the gambles differ in their riskiness, and subjects choose which of the 6 gambles they wish to play, each respondent can be attributed to one of six risk categories. In order to measure ambiguity aversion, the research instrument also included Holt-Laury modified Price List games following Barham et al (2014) and Ward and Singh (2015)[34]. In order to measure loss aversion, and given the limited time

[33]Other experimental methods that have been deployed amongst rural populations in the developing world are more complicated and less commonly used than the EGB method, and were thus eschewed here. The methods of Tanaka et al (2009) and Gneezy and Potters (1997) involve the use of the concept of probability, which respondents in the study would have difficulty understanding. Tanaka et al (2009) has varying probabilities which can generate confusion amongst developing world farmers (Brick et al 2012); the game proposed by Gneezy and Potters (1997) requires explanation of the concept of an investment in which the principal could be won or lost; and the Brick et al (2012) method still requires multiple rounds of choices and probabilities that differ between lotteries.

[34]Unfortunately the EGB game only measures risk aversion, and it is not apparent how to modify it to measure ambiguity aversion while retaining its simplicity. The method of EEL requires the respondent to understand the idea of paying varying amounts of money to have information revealed, which would be very difficult for our respondents to comprehend. The experimental method of Barham et al (2014), which was also used in Ward and Singh (2015) and is similar to the approach of Brick et al (2012), was instead deployed for this study to elicit ambiguity aversion attitudes and is discussed in more detail in the second chapter of this thesis. Ongoing work by the author shows that while this experiment is simpler than Engle-Warnick et al (2006) and traditional ambiguity aversion elicitation methods, the choices made by respondents in our study during this game exhibit significantly higher rates of confusion and noise compared to the EGB game. For this reason, this study uses the EGB data for its risk aversion measure. For lack of

available in interviews, the research instrument included a blunt measure of loss aversion through a question offering a hypothetical choice between two ways of tea farming: a stable, low-return way, and a high-return way with a risk of loss.

There is evidence that cognitive ability affects the choices an individual makes in risk games (Huck and Weizsacker 1999; Burks et al 2009; Dave et al 2010). As such, the survey included a digit span exercise as a proxy for respondent's cognitive ability. Digit span is a measure of short-term or working memory. It is a sign of sequential processing ability that measures how able a person is to take in and process information in an orderly fashion (Dempster 1981), and is widely accepted as a proxy of cognitive ability (Barham et al 2014).

4.4.2.2 Procedures

Participants were told that the game they were about to play could be randomly chosen for a real payoff at the end, so they should make each choice as if it were for a real payoff, and asked them if they understood they would be getting real cash as a result of their choices. The participant was shown a board divided into six different coloured squares. On each square were two photographs, one of which showed Nepali Rupee bills amounting to a winning payoff, one of which showed the losing payoff. Participants were told that each coloured paper on the board showed a lottery where there was a 50/50

a better measure of ambiguity aversion, I use the choices from the game derived from Barham et al (2014), as well as the parameter calculation method presented in that paper, for measuring ambiguity aversion.

chance of each outcome. A practice game was demonstrated and discussed to ensure the participant understood the game. Then the participant was asked to choose one of the six lotteries. The interviewer recorded which colour the respondent chose on the interview paper.

The payoff matrix to the game is shown in Table 4.3. Extremely risk averse subjects chose lottery 1 (Green), which had no risk whatsoever: subjects were guaranteed a payoff of 200. The least risk averse subjects chose lottery 6 (purple), which offered both the highest expected value and highest standard deviation in payoffs.

At the end of the interview, the respondent was asked to draw two chips from a bag containing numbered chips corresponding to each of the games in the research instrument. The two games thereby chosen were actually played. If the chip with the game number corresponding to the EGB game was chosen, the interviewer consulted the written record to see which colour lottery the respondent chose. A coin was then taken out and the respondent was asked which side would represent a "win". The coin was tossed: if the winning side came up, the respondent would be paid in cash for the larger amount on the lottery they chose. If the losing side faced up, the respondent was paid in cash the lower amount shown on the coloured square they chose.

The digit span exercise was modeled on that used by Barham et al (2014). The interviewer read out a number and respondents were asked to repeat the number. This exercise started with one-digit numbers and continued up to

a maximum of 9 digits. If a farmer made a mistake at a certain level, the exercise ended. The last level successfully completed was that farmer's score for the exercise.

4.4.2.3 Game Results

The distribution of lottery choices is shown in the 6th column of Table 4.3. In our sample, almost forty percent of farmers chose the lowest-risk, lowest expected value lottery, indicating a high degree of risk aversion. Nonetheless, there was a wide dispersion of respondents across the different risk choices. Table 4.4 reports shows the number of people in each certification category who are in each risk choice category: 8 conventional farmers, for example, chose the no-risk lottery option one. Respondents performed poorly on the digit test exercise, indicating lower average cognitive ability relative to international norms. The average digit span for an average adult in the USA was seven plus or minus two (Miller 1956): in our sample, it is 4.5 plus or minus 1.4. Approximately 6% of the sample was unable to recall three digits, indicating very low cognitive ability.

4.4.2.4 Choice of Risk Variable

The actual numbered choice made by the respondents in the game is the least transformed and most disaggregated measure of risk aversion available, and is closer to the actual decisions made by respondents. Several scholars thus choose to use it as their measure of risk aversion (Engle-Warnick et al 2006;

Mosley and Verschoor 2012; Ruben and Fort 2009). The inclusion of the full set of choice dummies may, however, include too much detail, obscuring the forest for the trees. It may also be that people who are not most nor least risk averse choose amongst the interior risk options (neither the most nor least risky ones) using non-economic criteria, such as how many bills are shown or randomly. Including each choice dummy can capture this noise, throwing into stark relief bumps from measurement error and thereby obscuring the big picture structure of responses.

Instead, several scholars group responses into high, medium and low risk choice categories (Bezabih 2009; Kisaka-Lwayo and Obi 2014; Ihli et al 2016). In Bezabih (2009), for example, choices in the risk game generated six categories of farmers, ranging from most to least risk averse, and the author grouped these into three categories of risk preference as severe, moderate, and slight.

Still others object to the ordered nature of the choice data and transform it into a risk aversion parameter using an assumed utility function and choice of midpoints (Vargas-Hill 2009; Mosley and Verschoor 2012). Transformation of risk choices into a continuous risk aversion parameter can be criticized, including because it introduces artificial gaps into the data which could skew the results; suggests unrealistic levels of risk aversion in transactions involving larger amounts of money; treats discrete experimental data as continuous; is based on an assumption about the functional form of utility; and is contingent

on the choice of midpoints. In practice, most scholars show their results both in terms of untransformed risk choices/categories, and in terms of a transformed risk parameter, choosing one measure as their baseline and the other as a robustness check.

We follow this practice and – in light of the well-founded critiques of a parameter measure – present our baseline estimates in terms of categories of risk choice, using the other measures as a robustness check. Following Bezabih (2009), Kisaka-Lwayo and Obi (2014), and Ihli et al (2016), we create a new Risk Category variable that assigns each respondent to low, medium, and high risk aversion categories. The least risk averse chose option 6 in the Binswanger game, and as per the practice in previous papers, are default category 0. The moderately risk averse, who chose options 2-5 in the game, belong to risk category 1. The extremely risk averse, who chose option 1 in the game (which had no risk), belong to risk category 2. The baseline risk categories measure enables us to minimize bias introduced from transformation of the risk choices into a risk aversion parameter, and grouping all those who chose an interior choice within a medium risk aversion category allows us to avoid the noise. It also follows the literature on the relationship between risk and certification, which found that the nature of the relationship varies across risk aversion categories (Kisaka-Lwayo and Obi 2014).

4.4.2.5 Estimation of Risk Parameter

The common approach to estimating risk preferences assumes that individuals maximize their Expected Utility (EU) given the risk parameter in their constant relative risk aversion (CRRA) utility function. In this framework, an agent's CRRA parameter summarizes his or her risk aversion and entirely explains the curvature of the utility function[35]. Following Eckel-Grossman (2008) and the applied literature on risk aversion, I use the iso-elastic utility function that displays constant relative risk aversion (CRRA) and decreasing absolute risk aversion (DARA)[36]:

$$U = \frac{x^{1-\sigma}}{1-\sigma} \tag{4.1}$$

Where σ corresponds to the coefficient of relative risk aversion and x corresponds to wealth. Individuals with $\sigma > 0$ can be classified as risk averse, $\sigma < 0$ as risk loving and $\sigma = 0$ as risk neutral. Table 4.3, column 7 contains intervals for the risk coefficient corresponding to each chosen gamble. The intervals are determined by calculating the value of σ that would make the

[35]Prospect theory has critiqued this analytical framework, arguing contrary to EU theory that the curvature of a utility function is jointly determined by risk aversion, loss aversion, and nonlinear probability weighting (Liu 2013). Furthermore, scholarship in behavioural and development economics has shown that even if we accept EU as a framework, the assumption of constant relative risk aversion is unlikely to hold in practice. De Brauw and Eozenou (2011), for example, reject the hypothesis of CRRA behaviour amongst a population of Mozambican farmers, finding instead evidence of power risk aversion preferences and rank dependent utility. Notwithstanding these critiques, we adopt the conventional EU-CRRA framework since it is the standard approach and generates a good first baseline analysis of the risk-certification relationship.

[36]When $\sigma = 1$, this expression is undefined; instead, at this point, $U = \ln(x)$.

individual indifferent between the gamble she chose and the two adjacent gambles. For example, a choice of Lottery 3 implies a risk coefficient in the interval of (0.81, 1.32): indifference between Gambles 2 and 3 corresponds to σ=1.32, and indifference between 3 and 4 to σ=0.81.

Following Vargas Hill (2009), a unique value of σ was calculated for each alternative as the geometric mean of the two endpoints, except for the most risky alternative that has an endpoint of 0 (assuming no farmer was risk loving) where the arithmetic mean was used. For the no risk option, the value of the lowest endpoint was used as the unique value of σ. Column 8 has these point estimates of the coefficient of relative risk aversion. The last row of Table 4.4 shows the average relative risk aversion coefficient for respondents, grouped by certification category. Conventional farmers have the lowest average risk aversion coefficient, at 1.825, and the average risk aversion increases by certification status, with the group of farmers who were the first to be certified having the highest average risk aversion level.

4.4.3 Empirical methodology

The propensity to get certified can be modeled as a latent variable in a utility maximization framework (see Appendix B). This framework is operationalized using the observed data in a reduced-form model of the effect of risk aversion on observed certification choice:

$$Y_i = \beta_0 + \beta_1 R_m + \beta_2 R_h + \beta_3 D + \beta_4 W_i + \beta_5 X_i + \epsilon_i \tag{4.2}$$

The binary dependent variable Y reflects the respondent household's actual organic certification status: it is equal to 1 if the factory database indicates the household is fully organically certified, and 0 otherwise. Alternative specifications of the model are presented in the robustness section that disaggregates certification status. Coefficients β_1 and β_2 measure the impact of risk aversion on certification status Y. Recalling that respondents who chose the least risk averse lottery are the default group, β_1 measures how moving from the least to moderately risk aversion choice affects the probability of being certified while β_2 measures the impact of moving from the least to extreme risk aversion choice affects the probability of being certified.

Place-based social and geographical factors may influence risk attitudes: lest such factors bias our measure of β_1, the model includes village fixed effects in vector D[37].

Risk theory suggests that individuals make production choices taking into account not only their innate risk preferences, but also their perception of their exposure to risk and the risk management strategies they have available to them. Risk management capacity should thus be controlled for in studies with risk choices. We follow Liu (2013) in emphasizing wealth as a major determinant of risk management capacity. In the eastern Nepali mountains,

[37] Although the farmers living in what we've defined as Sankhejung and Phidim villages supply to different factories, there is geographical overlap amongst them, and they are similar socio-economically and agro-ecologically. Sankhejung and Phidim are thus grouped together in one baseline region and dummies are included for the other two regions, namely Kolbung and Sundarepani.

size of landholdings is the main sign of wealth, and land can be leased or used as collateral when cash is needed to cope with shocks. The total land owned in hectares is thus included here as proxy of wealth and risk management capacity W.

Previous studies on certification and development have indicated that propensity to get certified depends on a gamut of demographic and economic characteristics, including the education of the household head, sale quantities[38], land size, migration, household size, gender, cognitive ability, and age. However, analysis presented later in the chapter suggests that education and migration are statistically significant drivers of risk aversion but do not affect certification, which suggests that including these control variables could lead to misspecification bias. As such, they are excluded from the regression model[39]. Gender, age, land size, household size, cognitive ability and sale quantities are included in the vector of household characteristics X. Finally, based on the argument in section 4.2.1, and following other similar studies that make inclusion in the analysis conditional on satisfaction of a basic cognitive ability test (Liu 2013) or include it as a control (Barham et al 2014), this paper makes inclusion in the regressions conditional on ability to recall and repeat three numbers.

[38]Previous literature has included quantity of sales, citing it as a measure of size of the farm business and risk measurement capacity, and so it is included as a covariate here. However, it is likely to be endogenous since organic methods reduce yield. The estimates for this variable are thus tentative.

[39]Note that neither education nor having a family member who has emigrated overseas are significant in any specification of the model, nor does their inclusion significantly change the results.

One potential concern regarding the analytical strategy of this paper is that it assumes the direction of causation runs from risk aversion to certification choices. If a farmer's ex ante certification status affected their ex post risk aversion, however, reverse causality could bias a regression based on real certification data that ignored this effect. An extensive literature on technology adoption and risk aversion takes as a given that risk aversion is an inherent characteristic whose influence on production decisions does not change significantly over time (e.g. Knight et al 2003; Wale and Yalew 2007; Bezabih 2009; Engle-Warnick et al 2006; Liu 2013; Barham et al 2014)[40]. This approach is borne out for the Nepali tea farmers in this study, amongst whom entrepreneurial attitudes (and by extension interest in risk) are closely tied to individual personality, which is unlikely to vary in the short time frame between obtaining full certification and the survey. Following this evidence and the literature, this paper assumes risk aversion is an innate and exogenous characteristic of the respondents, and so it cannot be affected by past certification choices.

4.5 Risk and Certification: Empirical Results

I begin by estimating equation (1) with a linear probability model (LPM) using 2016 data for orthodox tea farmers in Nepal who have the opportunity to

[40]Evidence in support of the commonly made assumption that risk aversion is an inherent characteristic that does not vary over time is found in Jaeger et al (2010), Harrison et al (2005), and Love and Robinson (1984).

get certified[41]. The dependent variable is binary and equal to one if factory records indicated the household was fully organically certified. The main independent variables are two dummy variables indicating moderate and extreme risk aversion choices in risk experiments conducted during fieldwork, where low risk aversion is the default category. As extensively discussed by Wooldridge (2003) and Cameron and Miller (2015), standard errors should be clustered when the errors could be correlated within groups of observations, such as cooperatives or villages in our case. Since coops are entirely nested within villages in our data set, any intra-coop error correlation will be picked up by within-village error correlation[42]. Therefore, all the regression results presented in this paper are clustered at the village level. To compute the correct p-values using the adjusted standard errors, and given that there are relatively few clusters, I use the Wild Cluster Bootstrap of Cameron et al (2008) implemented in Stata using the "cgmwildboot" command.

The first column of Table 4.5 features a simple regression of certification status on risk. It suggests that there is a positive and statistically significant relationship, with relatively more risk averse tea farmers more likely to be certified organic[43]. Column 2, which includes village fixed effects, shows similar results, but the difference in likelihood of certification between the

[41]Inclusion in the regression is made conditional on a result of 3 or greater on the cognitive test exercise, which excludes 16 people, or 6% of the sample. Findings do not change substantially if these individuals are included, as shown in the next subsection.

[42]Pers. Comm., Prof. Matt Webb, Carleton University, 29 September 2016.

[43]A complete interpretation of coefficients is presented for the baseline regression in column 4.

low and moderately risk averse groups is no longer significant. In Column 3, a wide range of demographic and economic variables are included that can affect the propensity to get certified, as well as the proxy for risk management capacity. The coefficient on extreme risk aversion remains positive and statistically significant.

Finally, column 4 shows the final baseline regression, where the gender and land ownership covariates have been retained since they were significant in the previous specification of the model. The coefficient on extreme risk aversion is positive and significant at a 5% level of significance, suggesting that individuals with a higher degree of risk aversion had a higher propensity to choose certification[44]. This indicates that if an individual went from the least to the most risk averse attitude, this would lead to a statistically significant 14% increase in the probability that the individual is certified[45]. The economic effect is not negligible: in our sample, if all the risk lovers become risk haters it would lead to a 2.6% increase in the proportion of the population which is certified.

[44] $R^2 = 0.07$ in this regression. While R^2s in the regressions in this chapter are rather low, they are consistent with those found in the literature on the determinants of certification, where the R^2 figures run from 0.02 to 0.6 (Kersting and Wollni 2012; Bolwig et al 2009; Handschuch et al 2013)

[45] Note that results in all columns of this table are robust to sample size changes and that multicollinearity tests were negative

4.5.1 Robustness Analysis

This subsection investigates whether the empirical results are robust to different specifications of the empirical and conceptual model. First, it investigates whether results are simply the result of stark differences between the certified and uncertified farmers. The role of confounding factors, including wealth, gender and education, is then analyzed. Next, alternative measures of certification status and risk aversion are used in regression analysis. An additional set of robustness checks examines how alternative models of risk behaviour, econometrics, and social learning affect the result. A final robustness check uses data from the discrete choice experiment to measure latent certification attitudes.

4.5.1.1 Comparing Certified & Uncertified Farmers

Are those who adopt certification schemes so different from those who refuse as to defy comparison? Table 4.1 columns 2-4 compare those who are certified to those who are not. A larger share of certified farm households are male-headed and the household head is older as compared to non-certified households. Emigration is less prevalent amongst certified households, who also own more land in total than non-certified households. This evidence suggests that certification could be an agriculturally focused livelihood strategy alternative to outmigration of the male household head. This hypothesis is supported by the fact that the inherent characteristics of households belonging to the two groups are similar in several key dimensions. Estimates

suggest that we cannot statistically reject the hypothesis that the two groups have similar household size, education, area of land in tea and quantity of tea sold at conventional levels of statistical significance[46].

4.5.1.2 Potential Confounding Factors: Gender, Wealth, Education & Migration

This latter result implies that there are significant gender differences in certification: female respondents were significantly less likely to be certified organic than male respondents. Furthermore, t-tests on gender differences in risk choices indicate that consistent with previous research, female respondents were significantly more risk averse. Given these results, one would think that the relationship between risk and certification is even stronger for a male-only group. However, regressions of risk on gender as well as certification on gender find that gender does not have a significant independent effect on either risk attitudes or certification status, suggesting that women tend to have different average levels of risk aversion than men, and different propensities to be certified, because of other aspects of households which happen to be led by women.

To verify that our certification-risk estimates are independent of gender, the baseline regression was re-run separately for only the male respondents in our

[46]The t-test comparing risk aversion between certified and non-certified groups finds that the difference is not significantly different from zero, likely because factors that influence both risk aversion and certification status are not controlled for here and are confounding the comparison. When such factors are included in the regression analysis above to separate their effect from that of risk aversion, there is a significant difference

sample. Risk aversion once again had a positive and statistically significant impact on certification status. When the sample was constrained to just the female respondents, similar results were obtained, although the estimates were no longer significant[47]. Taken together, these results indicate that the core finding of a positive and significant relationship between risk aversion and certification status is independent of gender.

Risk is measured here through a measure of risk aversion that is assumed to be constant across absolute money amounts. Yet this assumption is questionable. Indeed, if risk attitudes are affected by wealth, and wealthier people are more likely to get certified, then the estimates of risk aversion will be biased: the risk aversion of wealthy households will tend to be underestimated and that of poor households overestimated. Econometric analysis of our conditional sample shows that wealth, as measured by the land owned by the household, is not correlated with the household relative risk aversion (RRA) coefficient: the correlation between the two is a very small 0.0656. Regressions of risk on wealth in our conditional sample show that the latter is not a large nor statistically significant driver of risk attitudes in linear nor nonlinear frameworks. Finally, a simple regression of certification status on wealth yields an estimate that is virtually identical to the multinomial context. In sum, these findings suggest that wealth and risk attitudes are

[47]It appears that the size of the effect of risk aversion on certification is stronger for men than women: the coefficient is 0.014 in the regression with the full sample, 0.017 in the men-only sample, and 0.012 in the women-only sample. Similar results were obtained when risk aversion was interacted with gender in regressions with the full sample.

independent in our sample. These findings allow us to be confident that our RRA measure is not simply picking up wealth effects, and rather reflects stable underlying risk preferences.

Could the risk aversion and certification relationship be confounded by education and migration status? There are very low levels of correlation between education and risk attitudes, and between education and certification. A household's emigrant status – namely whether it has an emigrant overseas – similarly has low correlation with both risk attitude and certification. However, a regression of risk on wealth, education, gender, age and migrants does find that households with more education or someone living overseas are less risk averse, and it is a statistically significant difference. Although education and migrant status appear to affect risk aversion, neither are significant explanatory variables in a regression for certification status without risk aversion in the equation. As such, it is best to exclude them from regressions of certification on risk to avoid misspecification bias.

4.5.1.3 Disaggregated Measures of Certification Status and Risk Aversion

Our finding that more risk averse individuals have a higher propensity to be certified is robust to the choice of measure of the independent variable of interest, risk aversion. An alternative specification of the model was run in which the simple choice of lotteries was the measure of risk aversion. The regression shown in table 4.6 column 1 uses this risk aversion measure, where the default category is the least risk averse choice (6), and the top

row shows the most risk averse choice (1). The positive coefficients on this variable reinforce the result found earlier: more risk averse people are more likely to get certified. Furthermore, when risk choices are transformed into a continuous coefficient of relative risk aversion σ using the procedure outlined in section 4.4.2.5, and that σ is used as the measure of risk aversion in the regression shown in Column 2, results once again indicate that relatively more risk averse farmers are significantly more likely to be certified organic.

This categorical risk measure can be used alongside a disaggregated certification measure to shed light on possible non-monotonicities in the relationship between risk aversion and certification. Table 4.7 shows the results of multinomial logit regressions of certification status on risk categories. Although I would like to deploy a clustering method appropriate for my sample (which includes few clusters, some of which are small), unfortunately there is no econometric method that fits the situation[48]. Despite this, we would like to know more about how the relationship varies across a disaggregated certification categorical variable. As such, we use a standard clustering approach within a multinomial logit regression, cognizant that the p-values resulting from applying this approach to our data will be flawed since the standard approach assumes many clusters, while we have only few. Specifically, we

[48]The Cameron et al (2008) methodology used elsewhere in this paper and the Webb (2014) method can not be used for non-linear models besides the simple binary LPM. Furthermore, the standard clustering modules are compatible with non-linear models but require high numbers of clusters. Finally, the work of Esarey and Menger (2016) to extend the method of Ibragimov and Muller (2010) to multinomial contexts with few clusters depends on large numbers of individuals being in each cluster.

would expect that the p-values are over-estimated here.

Table 4.7 Column 1 shows the results of a multinomial logit regression where the dependent variable is separated out into conventional, conversion, and certified farmers, and the main independent variable is separated into low, moderate, and extremely risk averse farmers. The coefficients in the table reflect the marginal effect (of going from the default low risk aversion category to the higher-risk category specified in that row) on the probability of moving from the default uncertified status to the certification status described in that column. The coefficient on extreme risk aversion in column 1b of Table 4.7, for example, suggests that the probability of an extremely risk averse person being certified instead of uncertified is 115% higher than the corresponding probability of her low risk aversion neighbour. The insignificance of estimates in Column 1a, which compares the risk aversion of uncertified and conversion farmers, reflects more the low sample sizes of these two groups than any economic difference.

The size of the estimates in this table are much larger than in the baseline and column 2 of Table 4.6, suggesting that there are important differences between each of the two uncertified categories of farmers, on the one hand, and certified farmers, on the other. This finding is affirmed in Table 4.7 Column 2, which features an even more disaggregated measure of certification status. The dependent variable separates certified households into those that were amongst the first wave to be certified and those that were not (see Table

4.2, last row). The default category of farmer in this column is once again uncertified low risk averse farmers. Once again, I find large, positive and significant effects of risk aversion on certification[49]. As a further robustness check, an alternative specification set the default category as the certified and moderately risk averse farmers, who are the largest group in the sample. The results from a multinomial logit regression with this default, shown in Table 4.8, are consistent with other findings: the significant and positive coefficient on low risk aversion in column 1a of Table 4.8, for example, suggests that a low risk averse person was much more likely to be a conventional farmer than her moderately risk averse neighbour. The significant and negative coefficient on extreme risk aversion in column 1b highlights that an extremely risk averse person was much less likely to be in conversion than his moderately risk averse neighbour – instead, this very risk averse person was more likely to be part of the default organic group. Unfortunately, the small sample sizes of a number of the subcategories in this table render several of the coefficients insignificant.

4.5.1.4 Alternative Risk, Econometric, and Social Learning Models

Results appear to be sensitive to the model of risk behaviour, as regressions using uncertainty-based and Prospect Theory-based frameworks show.

[49]Could the inclusion of farmers in conversion be distorting the estimation of differences between conventional and organic farmers? I investigated this by dropping conventional farmers and re-running the baseline specification of the model. The results (not shown here) are virtually identical to the baseline specification, indicating that the inclusion of conventional farmers is not distorting the results.

Analysis of the data on ambiguity aversion and loss aversion does not yield statistically significant findings. In Table 4.6 Column 3, I find that the respondent's ambiguity aversion has a small and statistically insignificant impact on the probability of being certified[50]. This result is unsurprising given the poor quality of the data (see footnote 36). Similarly, the results of a regression using our data on loss aversion, shown in column 4, indicate that the influence of this measure on certification is not statistically different from zero.

The findings are robust to a variety of different econometric models. Column 5 of Table 4.6 uses an alternative method for clustering with few clusters proposed by Webb (2014) and once again finds a positive relationship, although it is only significant at a 10% level. Column 6 includes individuals with low cognitive ability, and shows that there continues to be a positive and significant relationship.

In the presence of social learning, early certification leaders may be followed by others who join up to the scheme because of their tendency to imitate the leaders rather than their risk attitudes. While the adoption choice of leaders would in this situation reflect the influence of their risk aversion on their decision, the measure of risk aversion's influence on subsequent adoption would be biased by herd behaviour. Specifically, farmers who got certified early on

[50]Following evidence that ambiguity aversion is a compound gamble (Klibanoff et al 2005), risk aversion is included in this regression and is not collinear with the ambiguity measure.

could have low risk aversion, while farmers who certified later on could have had high risk aversion but a high tendency to follow leaders. Unfortunately, data on herding propensity is not available, making it difficult to explicitly disentangle herding and risk attitudes. However, analysis of the evidence at hand sheds light on the matter. The last line of Table 4.4 indicates the average coefficient of relative risk aversion for respondents classified by certification status. Respondents who were the first to be certified in each village were assigned to a group entitled "early certifiers": as the table shows, they have the highest level of risk aversion in the sample. Late certifiers are the followers, who are less risk averse, with the level of risk aversion decreasing monotonically in the conversion and conventional groups. The fact that risk aversion is increasing monotonically in certification propensity is also supported in a regression context, where for example the multinomial logit regressions in Table 4.7 column 2c second row indicates that early certifiers were more likely to be extremely risk averse than late certifiers[51]. The weakness of the quadratic specification of the model (not shown here), where the squared risk score was included but was insignificant, is additional proof of the monotonic relationship between risk aversion and certification propensity. Furthermore, farmers may well have learned about standards through

[51]Unfortunately the small subsample of early adoptors in the regression Table 4.8 Column 2c, and the disaggregated risk categories, makes it difficult to accurately and significantly measure the difference between early and late adopters. A multinomial logit regression was run with the setup as Table 4.8 column 2 modified to measure risk aversion with a singular relative risk aversion coefficient. That regression, not shown here, finds that the first certifiers were more risk averse than late adopters (p=0.13).

social networks[52], which seem to have extended fairly evenly amongst farming households. In rural Nepal, individuals with more extensive social networks tend to be more entrepreneurial, interested in new schemes, less risk averse and more interested in certification. As such, the results presented here may in fact be conservative.

4.5.1.5 Discrete Choice Experiment

The last robustness check, shown in Table 4.6 column 7, replaces the measure of latent certification propensity. Thus far this propensity has been measured by actual certification status, but as noted in section 3.3, institutional factors can make this measure diverge from latent propensity. Section 4.1 discusses in more detail the discrete choice experiment used to measure respondents' underlying interest in adopting a hypothetical certification scheme. Column 7 of Table 4.6 shows a regression in which the dependent variable is equal to 1 if respondents chose to immediately adopt the certification scheme proposed to them in the discrete choice experiment. I control for actual certification status since this affects interest in new certification schemes[53]. We find that more risk averse individuals have a higher probability of adopting the certification scheme, as before. While the estimate was statistically significant at a 5% level prior to clustering, once clustered it becomes not significant,

[52]Although the research instrument included a question designed to measure the extent of the respondent's social network, the quality of responses was poor and the variation low and so this data was not used.

[53]Excluding the actual certification control generates regression estimates that are virtually identical to those with the control.

indicating that there are important village-level influences on the error term. Interestingly, results indicate that men were more likely to adopt the scheme immediately.

4.6 Discussion

Analysis of the evidence in this case study consistently indicates that farmers who made more risk averse choices during an experiment were significantly more likely to be certified organic. Recall that there are two competing explanations of the certification-risk relationship: on the one hand, the literature on technology adoption predicted that risk averse farmers will see certification as a risky investment and refuse to adopt it. On the other hand, the contract farming school argued that even if the standard is perceived as risky, if it is part of a contract package that provides access to risk protection, it may be relatively more appealing to the risk averse. The positive relationship between certification and risk aversion found here supports the hypothesis that the contract farming mechanism is dominant. It suggests that in the case study data, the positive relationship induced by the contract farming mechanism is more important than the negative relationship induced by the technology adoption mechanism, which had predicted the risk averse would avoid certification.

Although these are reduced form results, they establish that there is indeed a relationship between risk aversion and certification, albeit in the reverse

direction that is commonly supposed. Why would farmers who are more afraid of risk find certification more appealing? The contract farming literature suggests that it may be because farmers perceive certification as going hand-in-hand with contracts that reduce exposure to risk. There is some evidence of this phenomenon in the case study. As described in section 3.2 above, Nepali factory owners promised that farmers who were certified to the organic standard would get training, input subsidies, and improved access to markets in the long run.

These results, and the contract school's explanation of them, underscore the importance of the governance of the standard in determining its attractiveness to farmers. Tied standards, where farmers get certified to a standard at the urging of downstream buyers, are a quite different strategy than certification to an untied standard, which farmers adopt of their own volition. In the latter case, farmers choose to get certified independently, as a brand differentiation strategy that can liberate them from dependence on existing buyers and open access to alternative markets. In Morocco, for example, female olive oil producers sought Fair Trade certification to bypass local wholesale buyers in favour of direct sale to Fair Trade retailers in Europe (Chohin-Kuper and Kemmoun 2010). The choice to invest in certification to an independent standard may be a leap into the unknown that is relatively similar to the decisions studied in the technology adoption literature.

When a farmer gets certified to a standard that ties them to a buyer via a

contract, on the other hand, it can be a means to get closer to the buyer and obtain associated risk protection. This vision echoes the value chain literature approach, which sees standards as a tool for economic governance across chain nodes (Mohan 2014). In this framework, standards reduce the transaction costs of sharing information and monitoring compliance across nodes that may be organizationally and geographically dispersed.

At the same time, research on contract farming has highlighted that it can entrench monopsony power. A single buyer could use its market power to force contract farmers to accept disadvantageous conditions, including low prices or costly changes in production practices, without benefits to the farmers themselves (Sivramkrisna and Jyotishi 2008). While the existence of monopsonistic exploitation is ultimately an empirical matter in each case, the fact that farmers' consent is required for participation in an externally-validated certification scheme indicates that the buyer must take steps to make the scheme appealing to its farmers and viable in the long run. Marketing of produce from successful certified farmers can generate lucrative rents for their buyers, which gives buyers extra incentives to support their farmers. This suggests that certification could actually increase the leverage of farmers in the farmer-buyer relationship by putting a premium on farmer-supplied quality that is contingent on buyer support of farmers. The existence of cooperatives as mediators of the certification process may also mitigate the exercise of monopsony power (Sivramkrisna and Jyotishi 2008). Taken from the perspective of these literatures on value chains and monopsony, the find-

ings here suggest that farmers may implement the demanding production practices associated with the standard in the hopes that it will enable them to join a well-coordinated, lower-risk global value chain thread which is better supported by buyers.

By implication, the relationship between risk aversion and certification truly depends on how the standard is presented to and perceived by farmers. A certification scheme that seems risky will, in the absence of accompanying risk reduction services, tend to deter the risk averse. More interestingly, the analysis of this paper highlights that the content and credibility of the presentation accompanying the scheme is crucial to its adoption. In the case study, the standard was perceived[54] as a relatively high-risk and high-return strategy but was presented alongside promises about future prices and the sustainability of production. The content of this promise affected farmers' expectations regarding the risk-reduction services that could accompany the standards and ultimately encouraged the risk averse to adopt. They only took the promises seriously, however, because they trusted the actor making

[54]It should be noted that how the scheme is portrayed and understood ex ante by farmers may not be borne out in reality. In our case study, although conversion to organic was seen ex ante as relatively high return and high risk, ex post it appeared to lead to relatively low returns and low risk, at least in the short run. Analysis of 2009 data indicates that organic farmers had significantly lower revenues than conventional farmers because of lower productivity, and high costs may have further hurt them, although they experienced lower price volatility (Mohan 2013). A similar analysis of 2015 data indicates that organic farmers had slightly higher revenues than conventional farmers, although the difference was not significant. Organic farmers had significantly lower price volatility. The finding of an ex post lower risk exposure bears out the hypothesis that contract attributes associated with the standard reduce risk. It also underscores the importance of portrayal and perception, rather than reality, in decision making.

them and took his utterances to be credible statements (Mohan 2013). Liu (2013) notes that even if agricultural extension officers share the truth about the benefits of adoption, farmers may not trust the officers and thus refuse to accept their statements. This, in turn, can lead to a subjective expectation about the technology that diverges from the objective reality. Amongst Nepali tea farmers trust in tea experts and factory owners is not a given (Mohan 2013), but in the case of promises concerning the organic standard, farmers generally made a leap of faith and decided to trust them and take their promises about the impacts of certification as credible.

On a different note, the high estimated levels of risk aversion in this study seem to pose a problem since they would suggest unrealistic levels of risk aversion in transactions involving larger amounts of money. This problem is well known: indeed, theoretical (Rabin 2000) and empirical work, including in the developing world (Cox et al 2013; De Brauw and Eozenou 2011), has shown that when the expected utility framework is used to analyze experiments involving modest stakes, it generates estimates of risk aversion that imply absurdly high aversion to risk in higher stakes situations. This critique of the EU framework implies that the scale of the risk aversion estimates in this paper is provisory. However, so long as the ordering of risk aversion generated by the estimates is correct, this critique does not necessarily undermine the findings in this study for the following reason. This paper is interested in a relative ordering of individuals by risk aversion to large stakes payoffs, but obtains the closest proxy: an ordering by aversion to small stake

payoffs. According to the above critique, the small-stakes EU risk aversion estimates will consistently over-estimate the scale of large-stakes risk aversion, but this distortion applies equally to all individuals, so the ordering of individuals will be the same from our small-stakes experiment as it would be in the large-stakes real world. That is, so long as the ordering we obtain from small stakes is the same as the actual ordering of individuals by aversion to large stakes, then our conclusions are robust to the small-scale measures critique[55].

More fundamentally, the weak empirical foundation for several other EU assumptions – including the assumption of symmetry of preferences and per-

[55]If, however, individuals differ in the extent to which their small-scale stakes EU risk aversion differs from their large-scale stakes attitudes to real business decisions, then individuals' small-stakes risk aversion will be distorted from the large stakes risk aversion to different degrees, and thus the ordering at a small scale could be different from the large scale. There is some evidence on this from Fehr-Duda et al (2010), who find that choice behaviour with small stakes differs from large stakes not only because of the way that individuals value different amounts of money, but also because probability weighting is sensitive to stake size. Specifically, they find that a majority of respondents in their Beijing experiments assign a lower probability of winning when the stakes are higher than when the stakes are low. A minority, on the other hand, do not change their probabilities regardless of the stakes and operate as expected-utility maximizers. Other studies affirm that probability weights vary by stakes (Krawczyk 2015) and that behaviour is heterogeneous, with for example half of respondents in one study acting as EU maximizers (Santos-Pinto et al 2015). If there are in this manner multiple types of decision-makers in our data set, and each type has a different manner in which their real large-stakes preferences are distorted by small-stakes symmetric-preference EU games and analysis, then the ordering could indeed be different between our small-stakes risk aversion measures and respondent's large stake risk preferences. This study follows others in the technology adoption literature in abstracting away from this phenomenon here. In general, empirical risk research methods that captures a more finely-grained nonparametric measure of risk attitudes – which could include games with small and large stakes, giving respondents a chance to behave differently towards wins and losses, and to express their probability weightings – are more likely to accurately represent true risk preferences in the population (Dickhaut et al 2013; Santos-Pinto et al 2015).

fect knowledge of risk – suggest that other frameworks, including the loss and ambiguity perspectives analyzed briefly here, can be usefully deployed to complement an EU-based analysis of risk behaviour[56].

4.7 Summary and Conclusions

This study examined a population of small-scale tea farmers in Nepal with a view to understanding the relationship between their risk aversion and the decision whether to be certified organic. Results suggest that in the case study, more risk averse farmers had a higher likelihood of choosing certification. The robustness of the finding of a positive and significant relationship between risk aversion and certification across a variety of specifications at the very least questions the assumption of a negative or nonexistent relationship found in the certification literature to date.

The positive relationship between certification and risk aversion found here suggests that farmers may see certification as a risk-reducing technology. Since other technologies (e.g. new crops, GM cotton, or pesticides) do not appear to be perceived in this manner, this begs the question of what is dif-

[56]Studies have shown that in practice, individuals are more sensitive to losses than they are to gains, respond more to changes in income than to wealth, and that they are averse to bets where the probabilities of outcomes are uncertain. The EU framework deployed in this study fails to accurately model these phenomenon. Empirical studies have shown that other models of risk attitudes, including rank dependent utility theory (Quiggin 1993) and prospect theory (Kahneman and Tversky 1979), are a better empirical fit with actual decision-making behaviour (De Brauw and Eozenou 2011; Liu 2013). Future research could examine the relationship between certification decisions and risk behaviour using these models, but would need to pay particular attention to simple experimental procedures when working with low-literacy populations in developing countries.

ferent about certification. Is it how the scheme is presented to farmers, or its direct link to marketing opportunities, or indeed the fact that certification is undertaken for cash rather than subsistence crops? It may be that certification schemes whose adoption is tied to buyers through contract could actually provide insurance to farmers, but more research is needed to evaluate this possibility.In this case, the contracting mechanism may be relatively more important in determining the nature of the risk-certification relationship, while the choice to get certified independently may be dominated by the traditional technology adoption mechanism. Additional research is warranted into the actual and perceived impact of certification on volatility and how that impact varies depending on the governance of the scheme.

One policy implication of this work is that certification schemes could be advantageous even if the short-term impact on prices and profits are ambiguous or even negative. If they give risk-averse farmers more stable long-term prices or quantities, then they provide these farmers with a less risky option whose adoption improves their welfare. Unlike other interventions, certification is (according to the findings here) particularly appealing to the risk averse, who may view certification as reducing their exposure to risk. As such, encouraging factories to adopt certification schemes, development agencies to support them, and consumers to buy from them, can improve the welfare of small-scale farmers in developing countries.

4.8 Appendix A: Figures and Tables

Figure 4.1: Map of Nepali Tea Factories & their Cooperatives

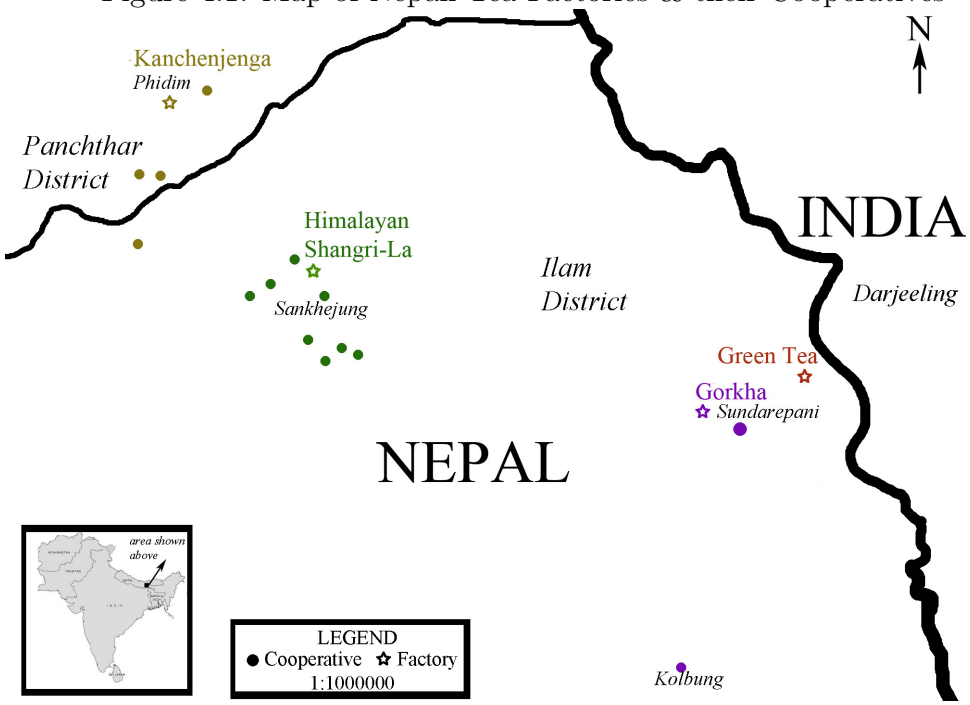


Figure 4.2: The Organic Certification and Cooperative Choice

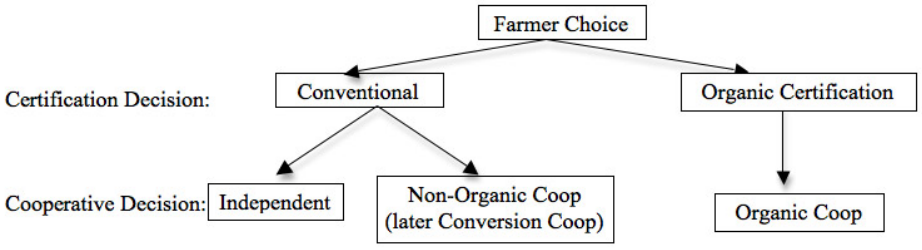


Table 4.1: Summary Characteristics

	(1) Sample	(2) Certified#	(3) Uncertified#	(4) Difference
Age	44.17	44.88	40.40	4.49**
	(0.82)	(0.89)	(2.10)	(2.24)
Male	0.70	0.72	0.58	0.14**
	(0.03)	(0.03)	(0.08)	(0.07)
Education (Years)	7.06	7.07	7.02	0.04
	(0.27)	(0.30)	(0.68)	(0.75)
Literacy	0.88	0.88	0.88	0.01
	(0.02)	(0.02)	(0.05)	(0.05)
Household size	4.38	4.35	4.58	-0.23
	(0.11)	(0.13)	(0.27)	(0.31)
Emigration	0.32	0.29	0.46	-0.17**
	(0.03)	(0.03)	(0.08)	(0.08)
Total land owned (hectares)	1.79	1.86	1.39	0.47**
	(0.08)	(0.08)	(0.19)	(0.21)
Tea Land operated (hectares)	0.63	0.65	0.52	0.13
	(0.04)	(0.05)	(0.08)	(0.11)
Quantity Tea Sold 2015 (kg)	1158.67	1117.45	1370.50	-253.05
	(139.92)	(146.96)	(412.28)	(379.32)
% household income from tea	34.62	34.59	34.76	-0.17
	(1.53)	(1.66)	(4.02)	(4.20)
Coefficient of Relative Risk Aversion	2.05	2.08	1.90	0.19
	(0.10)	(0.10)	(0.24)	(0.26)
Cooperative Member	0.87	0.98	0.33	0.65***
	(0.02)	(0.01)	(0.07)	(0.04)
Proportion of food from own farm	43.66	44.17	40.96	3.22
	(1.42)	(1.59)	(3.00)	(3.89)
Number of observations	269	226	43	

Note: Standard errors are in parentheses. # certified is defined as those respondents who were fully certified organic in factory records at the time of the survey. ** significant at the 5% level. *** significant at the 1% level.

Table 4.2: Certification in the sample

	uncertified		certified	
	conventional	conversion	late certified	early certified
Binary categorization	43		226	
3-way categorization	29	14	226	
4-way categorization	29	14	133	93

Table 4.3: Binswanger-EG game choices, values, CRRA, and distribution

1. Choice	2. low payoff	3. high payoff	4. expected value	5. standard deviation	6. fraction subjects	7. Implied CRRA range	8. CRRA, point
1. GREEN	200	200	200	0	37%	$3.94 < r$	3.94
2. PINK	175	250	212.5	37.5	14%	1.32<r<3.94	2.28
3. BLUE	150	300	225	75	15%	0.81<r<1.32	1.03
4.YELLOW	125	350	237.5	112.5	5%	0.57<r<0.81	0.68
5.WHITE	100	400	250	150	12%	0.44<r<0.57	0.50
6.PURPLE	75	450	262.5	187.5	17%	0<r<0.44	0.22

Table 4.4: Risk Choices By Certification Category of Respondent

	conventional	conversion	late certified	early certified	total
Lottery 1 (most risk averse choice)	8	4	44	34	90
Lottery 2	6	3	12	11	32
Lottery 3	2	2	21	14	39
Lottery 4	2	1	8	4	15
Lottery 5 (least risk averse choice)	9	3	19	15	46
Total	28	14	123	88	253
Average Relative Risk Aversion Coefficient	1.83	1.89	1.96	2.10	1.99

Table 4.5: The Effect of Risk Aversion on the Probability of Nepali Tea Farmers' Organic Certification, Linear Probability Model, Low Risk Aversion Default

	(1)	(2)	(3)	(4)
Moderate Risk Aversion	0.11**	0.10	0.10	0.10
	(0.05)	(0.17)	(0.17)	(0.17)
Extreme Risk Aversion	0.13**	0.12**	0.12**	0.14**
	(0.05)	(0.05)	(0.05)	(0.05)
Male			0.06**	0.06
			(0.05)	(0.17)
Total land owned (hectares)			0.003**	0.002
			(0.05)	(0.17)
Age			0.001	
			(0.79)	
Household Size			-0.02	
			(0.43)	
Quantity Tea Sold 2015			-0.00001	
			(0.18)	
Digit Test Score			0.006	
			(0.55)	
Village Fixed Effects	No	Yes	Yes	Yes
R^2	0.0151	0.0354	0.0901	0.0664
Number of observations	253	253	242	248

Note: The dependent variable in these regressions is equal to one if the respondent has obtained full organic certification, and is zero otherwise. p values are in parentheses, calculated using standard errors clustered at the village level. Note that one individual failed to complete the EGB risk game, and as such is excluded from these regressions, and 16 people were excluded who had a score lower than 3 in the cognitive ability test, resulting in a working sample of 253 of the original 270 individuals interviewed. * significant at the 10% level ** significant at the 5% level.

Table 4.6: Alternative Regression Specifications to Evaluate the Robustness of the Effect of Risk Aversion on the Probability of Nepali Tea Farmers' Organic Certification

	(1) Risk Choices#	(2) Risk Coefficient	(3) Ambiguity	(4) Loss	(5) Webb	(6) Uncondtnl	(7) Hypothetical
Lottery 1 (Green)	0.140**						
(most risk averse choice)	(0.05)						
Lottery 2 (Pink)	-0.005						
	(0.96)						
Lottery 3 (Blue)	0.156						
	(0.17)						
Lottery 4 (Yellow)	0.003						
	(0.90)						
Lottery 5 (White)	0.201**						
	(0.05)						
Relative Risk Aversion Coefficient		0.014**	0.016**		0.014*		
		(0.05)	(0.05)		(0.07)		
Ambiguity Aversion			0.017				
			(0.17)				
Loss Aversion				0.016			
				(0.33)			
Moderate Risk Aversion						0.114	-0.13
						(0.17)	(0.55)
Extreme Risk Aversion						0.146*	0.050
						(0.06)	(0.17)
Male	0.06	0.05	0.06	0.05	0.05	0.056	0.15**
	(0.17)	(0.17)	(0.17)	(0.17)	(0.12)	(0.17)	(0.05)
Total land owned	0.002*	0.002	0.002	0.002	0.002	0.002	-0.0001
	(0.06)	(0.17)	(0.17)	(0.17)	(0.07)	(0.17)	(0.92)
Real Certification Status							0.004**
							(0.05)
Village Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.0949	0.0528	0.0597	0.0492	0.0528	0.0610	0.0806
Number of observations	248	248	230	248	248	264	247

Note: The dependent variable in these regressions is equal to one if the respondent has obtained full organic certification. The main independent variable is risk aversion. All regressions, except for column 6, include only those who could recall 3 numbers on the digit test exercise. Column 6 includes the full sample for which we have data on both risk, certification, gender and land ownership (264). # The rows in this regression correspond to dummies for each choice in the EGB game (see Table 3 for the cash amounts and implied RRA coefficient for each choice). The top row is for individuals who chose the least risky lottery, and each successive line below indicates less and less risk averse choices. Farmers who chose lottery 6, the least risk averse choice, are the default category. Coefficients thus indicate the effect of higher risk aversion. p values are in parentheses, calculated using standard errors clustered at the village level. *significant at the 10% level ** significant at the 5% level. *** significant at the 1% level.

Table 4.7: Multinomial Logit Robustness Regressions, Low Risk Aversion Conventional Default Group

	(1) (Multinomial)		(2) (Multinomial+)		
	(a) conversion	(b) certified	(a) conversion	(b) late certified	(c) early certified
Moderate Risk Aversion	0.911 (0.70)	0.957** (0.31)	0.874 (0.70)	1.030*** (0.28)	0.812* (0.47)
Extreme Risk Aversion	0.412 (0.30)	1.15** (0.43)	0.417 (0.26)	1.129** (0.47)	1.216*** (0.43)
Male	-0.91 (0.68)	0.403** (0.07)	-0.12 (0.72)	0.478*** (0.03)	0.254 (0.19)
Total land owned	-0.002 (0.01)	0.021** (0.00)	-0.003 (0.01)	0.022*** (0.00)	0.018*** (0.00)
Village Fixed Effects	(Yes)		(Yes)		
Pseudo R2	(0.0902)		(0.1889)		
Number of observations	(248)		(248)		

Note: The dependent variable in these multinomial logit regressions is certification status, and the default category is uncertified. The main independent variable is risk categories, where the default value is low risk aversion. The sample is limited to those who could recall 3 numbers on the digit test exercise. p values are in parentheses, calculated using standard errors clustered at the village level. *significant at the 10% level ** significant at the 5% level. *** significant at the 1% level

Table 4.8: Alternative Multinomial Logit Robustness Regressions, Moderate Risk Aversion Organic Default Group

	(1) (Multinomial) (default: certified, middle risk)		(2) (Multinomial+) (default: late certified, middle risk)		
	(a) conventional	(b) conversion	(a) uncertified	(b) conversion	(c) early certified
Low Risk Aversion	0.957***	0.047	1.030***	0.157	0.219
	(0.31)	(0.98)	(0.28)	(0.94)	(0.22)
Extreme Risk Aversion	-0.195	-0.694**	-0.098	-0.555*	0.307
	(0.18)	(0.32)	(0.25)	(0.34)	(0.29)
Male	-0.403***	-0.494	-0.478***	-0.597	-0.224
	(0.07)	(0.64)	(0.03)	(0.70)	(0.20)
Total land owned	-0.021***	-0.023***	-0.022***	-0.025***	-0.004
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
Village Fixed Effects	(Yes)		(Yes)		
Pseudo R2	(0.0902)		(0.1889)		
Number of observations	(248)		(248)		

Note: The sample is limited to those who could recall 3 numbers on the digit test exercise. p values are in parentheses, calculated using standard errors clustered at the village level. *significant at the 10% level ** significant at the 5% level. *** significant at the 1% level

4.9 Appendix B: Theoretical Framework

I model farmers' participation in a certification scheme using a random utility framework. Utility, U, is determined by a set of socioeconomic variables and contextual factors, X, which also influence the farmers' ability and propensity to get certified. I assume farmers maximize utility:

$$\max U = f(X) \tag{4.3}$$

I postulate that farming household i ($i = 1, 2, 3, ..., n$) will choose to participate in a certification scheme j if and only if the utility associated with the certified market, U_{ij}, is greater than the utility U_{im} obtained via the status quo conventional market m. This relationship can be represented by the farmers' latent propensity to get certified, y_i*, defined as the difference in utility derived by individual i from participation in the certification scheme compared to the status quo:

$$y_i* = U_{ij} - U_{im} \tag{4.4}$$

where y_i* reflects the benefit of participating in the certification scheme. The extent of those benefits, and thus the latent propensity to get certified, will vary with personal characteristics, as the following latent equation indicates:

$$y_i* = X_i\alpha + \epsilon_i \tag{4.5}$$

Where α is a conformable parameter vector and the error term ϵ is independent and identically distributed as standard normal. Although y_i* itself is unobserved, we can observe the type of marketing channel the farmer chooses. The observed variable (Y_i) relates to the latent variable (y_i*) such that:

$$Y_i = \begin{cases} 1 & \text{if } y_i* > 0, \\ 0 & \text{if} y_i* \leq 0. \end{cases} \tag{4.6}$$

Where $Y_i = 1$ if the farmer chooses to get certified and $Y_i = 0$ if they do not. Consequently, the probability of adoption is given by:

$$Pr\left\{Y_i = 1|X_i\right\} = Pr\left\{y_i* > 0|X_i\right\} = 1 - \Phi(-X_i\alpha) \tag{4.7}$$

Where Φ is the cumulative distribution function of the standard normal. Estimation is based upon a binary choice maximum likelihood model where these probabilities enter the likelihood function. The interpretation of the regression coefficients can thus be made in terms of the underlying latent variable model.

Chapter 5

Institutional Change in Value Chains: Evidence from Tea in Nepal

[1]

5.1 Introduction

Under what conditions do small-scale firms in developing countries benefit from deepening their participation in global value chains? The diversity of evidence brought to bear in the academic and policy debate on the matter suggests that the impact of participation in global value chains is by no means uniform (cf. McCullough et al 2008). Suppliers in developing countries have adopted upgrading strategies in an effort to improve their position in the chain and capture more value added in production. Although it is often assumed that upgrading strategies will be advantageous to those who adopt them, evidence suggests that this is not always the case. Studies indicate that upgrading can adversely affect the welfare of chain participants (Ponte and Ewert 2009; Rossi 2013). More generally, upgrading efforts interact with local institutions and strategies in a process that generates heterogeneous

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welfare outcomes for chain participants. A product upgrade that improves quality and prices, for example, interacts with local labor institutions and internationally defined product quality rules, which in turn affect profitability.

Owing to the weak conceptualization of institutions in the global value chain framework, however, we know relatively little about the interplay between institutions and value chain upgrading (Neilson and Pritchard 2009). The importance of the institutional context has been acknowledged in the literature, where it is considered the fourth pillar of analysis (Gereffi 1999), yet theoretical and empirical work on institutions in value chains has been neglected. Indeed, on the basis of their review of the literature, Neilson and Pritchard (2009) argue that institutional analysis within the global value chain framework "tends to appear wooden and simplistic" (p. 47). The research presented here aims to remedy this failure by examining how institutional context mediates between value chain upgrading and the livelihoods of chain participants.

A growing literature has highlighted how local conditions influence whether value chain upgrading impacts positively or negatively on the welfare of upstream suppliers (Mitchell and Coles 2011; Ponte and Ewert 2009; Rossi 2013). Institutional theory allows us to characterize local conditions not simply as particularistic oddities but rather as elements of an institutional matrix that constrains and facilitates economic interactions (North 1990).

This chapter contributes to the literature on institutions in value chains by building a stylized typology of how value chain upgrading changes the local institutions that govern the livelihoods of suppliers in developing countries. This theoretical contribution to the value chain literature is based upon an institutional analysis of dozens of field interviews with producers whose livelihoods have been affected by upgrading. When a buyer decides to upgrade to higher-quality strands of the value chain, for example, this can affect their rules for purchase and payment frequency, which in turn affects the sale options of suppliers. Institutional change can thus have knock-on effects on livelihoods, such as through wastage of suppliers' agricultural product or unemployment of garment workers. Indeed, these unintended effects may be so negative as to generate an overall negative livelihood impact from the upgrading effort in a process this chapter dubs "immiserizing upgrading". When livelihoods are compromised, household welfare can bear the brunt of the impact; as such, the rest of this chapter uses a livelihood perspective to understand welfare. The typology provides a framework to analyze such processes that is also of use to development practitioners seeking to understand the conditions under which upgrading worsens or improves the welfare of value chain participants.

The analysis is developed by examining how insights from economic theories of institutional change resonate in a value chain case study of small-scale tea farmers in Nepal. Findings suggest that upgrading sparks a cycle of change. Firstly, it induces changes in the institutions that govern the livelihoods of

upgrading farmers. This in turn encourages the crafting of new livelihood strategies, the formation of organizations to support these strategies, and shifts in informal norms. This transformation affects whether value chain participants benefit or lose from upgrading. Yet it also generates new opportunities that can lead to another cycle of upgrading and institutional change. Analysis thus indicates that suppliers' institutional context, and their strategies, influence commodity system dynamics.

The following section develops the conceptual framework for the chapter through an exploration of the relevant literature on value chain upgrading and institutional change. Section 5.3 provides background on the case study of the tea value chain in Nepal and methodology. In section 5.4, institutional data from the case study is analyzed, discussing the process of change in Nepal. Section 5.5 derives a general typology for institutional change in value chains and analyzes. The last section concludes and draws policy lessons.

5.2 Value Chain Upgrading and Institutional Change Theory

Shifts in the governance of global trade flows are reconfiguring the livelihoods of small-scale producers in the global south. In addition to producing for local markets, or for wholesale markets, small-scale firms face opportunities to participate in coordinated international supply chains. The Global Value Chain (GVC) literature (Gereffi 1994; Gereffi 1999; Gereffi et al 2005) has studied these chains, tracing the interactions between actors along a prod-

uct's trajectory from its conception and design, through production, retailing and final consumption (Leslie and Reimer 1999: 404). According to Gereffi's classic framework (1994), chains are characterized by how their input-ouput relationships are structured across space, as well as how they are governed. Subsequent scholarship in the GVC tradition has focused on governance, and particularly how product and information exchange is coordinated by lead firms. Gereffi et al (2005) identify a range of types of chain coordination, with uncoordinated spot market-type exchange on one end and on the other the very tight, vertically integrated exchange that occurs within a corporation. Between these two extremes are forms of coordination that address the particular informational demands and supplier capacity of the chain. When the chain involves the exchange of highly complex and easily codified information from buyers to weak suppliers, then the authors suggest that a "captive" form of coordination will emerge. In captive chains, suppliers are dependent on buyers, who in turn monitor their suppliers intensely.

Recent value chain literature has highlighted that there may be synergies between the type of chain coordination and the tendency of chain actors to adopt strategies to improve their position in the chain. These strategies, which are known as "upgrading" efforts in the global value chain literature, are initiated because a rent has been identified, or because actors see an opportunity to mitigate risks or avoid volatile international prices (Kaplinsky and Morris 2001). In their study of aquaculture in Asia, for example, Ponte et al (2014) find that captive coordination tends to encourage process up-

grading, wherein inputs are more efficiently transformed into outputs, as well as product upgrading, when agents shift to a new, higher-value thread of the value chain. Other types of upgrading, including to new roles (functional) and products (inter-chain), are found in other types of chains. Although early scholarship focused on upgrading to improve market power and thereby access higher incomes, subsequent work has highlighted how it can also alter the control and decision-making power producers have over the terms and conditions of their participation in value chains (KIT, Faida MaLi and IIRR 2006; Riisgaard 2009) and the rights and entitlements of workers (social upgrading) (Barrientos et al 2011; Rossi, 2013). Impacts of upgrading range from income to poverty (Mitchell and Coles 2011), gender (Laven and Verhart 2011), and livelihoods (Neilson and Pritchard 2009), and not always for the better. Downgrading, such as moving to a downstream function or less demanding thread of the chain, could actually be advantageous (Ponte and Ewert 2009). Adopting different managerial models, supplying different end markets, improving efficiency, and meeting social and environmental standards could also yield benefits (Ponte et al 2014). Upgrading could also worsen welfare, including by worsening some livelihood aspects while improving others; as noted in the discussion later in the text, these strategies can be described as immiserizing upgrading efforts.

When firms undergo product upgrading, they can find themselves in tightly coordinated chains driven by strong lead firms. Lead firms in value chains use governance mechanisms such as production standards to exert control

over the transmission of knowledge, information, product, and finance to and from suppliers. Yet at each node of the value chain, standards, as institutions for coordination in value chains (Henson and Humphrey 2010; Bingen and Busch 2006; Busch 2011), intersect with local economic institutions. As such, upgrading, governance and institutions have to be seen together in order to understand welfare impacts (Ponte and Sturgeon 2014).

Unfortunately, the institutional dimension of analysis has been neglected in the value chain literature, obscuring our view of this interaction (Neilson and Pritchard 2009; Ponte et al 2014). Indeed, one researcher has suggested that Gereffi saw the institutional framework surrounding the value chain as the conditions under which control over market access and information are exercised on a global plane (Gibbon 2001: 347). Conceiving of the institutional framework in which the value chain is embedded in this passive fashion is problematic[2]. A richer conceptualization of institutions is offered by Global Production Network (GPN) theory. According to GPN thought, each stage of the production process is embedded in a web of networks and institutions across the social, economic, political, and environmental spheres. In this vision, commodity systems are multi-dimensional, multi-layered lattices of economic activity (Henderson et al 2002: 442). Other conceptual approaches

[2]While more recent work has assigned an active role to the institutional context surrounding GVCs (Neilson and Pritchard 2009; Ponte et al 2014; Herath and Weersink 2008; Kersting and Wollni 2012), it has overwhelmingly focused on meso and macro-level institutions, particularly government regulations, national policies, and organizations. Other, micro-level local institutions mediate production in developing countries – and as such are important to how actors at particular nodes of the chain engage with upgrading – yet have been neglected in the GVC literature.

to commodity production similarly deploy non-linear multi-dimensional systems frameworks (Lazzarini et al 2001; Neilson and Pritchard 2009; Mohan 2014; Levy 2008). This research yields insights into how to conceptualize the embeddedness of commodity chains within society.

Notwithstanding their spatial sophistication, these bodies of thought fall short when it comes to analyzing how chains change over time. GPN theory moves beyond a value chain theory's exclusive focus on the chain by highlighting how a broad range of place-based networks and institutions interact with chain governance over time (Henderson et al 2002; Yeung and Coe 2015). Similarly to GVC research, however, GPN research tends to focus on market power; chain transformation is initiated to obtain control over the chain and the economic rents that accrue to dominant chain actors. Changes in chain governance then interact with local institutions (Henderson et al 2002; Levy 2008; Coe et al 2004; Neilson and Pritchard 2009). Extensions of GPN and GVC research have investigated the nature of such interactions in more detail. The interface between the chain and social institutions can be analyzed as a site of political contestation, including over the hegemonic ideology and governance structures of globalization (Levy 2008). Other literature takes up the question of how changes in chain governance play out at a local level. Neilson and Pritchard (2009), for example, suggest that such changes incite "struggles" in particular locations. During these struggles, local institutions "configure", "sculpt" and "negotiate" outcomes in the chain. The chain thereby "coexists in an iterative nexus" with its institutional con-

text in which both are "co-produced and in a state of perpetual dynamic transformation" (pp. 8-10, 56).

Economic theories of institutional change can shed light on these dynamics. Virtually all institutional economics scholars see change as an evolutionary process. The process starts with a trigger from within the economic system, and continues as agents envisage an alteration to an existing institution or a different institution entirely (Holm 1995; Seo and Creed 2002). Agents mobilize via organizations (Olson 1965) to bring the new institution into being, and competition of some sort ensues amongst old and new institutions for adoption. Old institutions are destroyed or decayed, while new ones are adopted. Stability ensues – until the cycle begins again.

Different schools of thought diverge when it comes to analyzing the process in more depth. For example, several New Institutional Economics scholars assume that the change process is determinate and that optimal institutions will necessarily emerge that are efficient and maximize welfare (Williamson 2000). This would imply that upgrading necessarily improves outcomes for participants. In what we will call scenario one, they depict institutional change operating like a Darwinian evolutionary process, wherein exogenous parameter change in relative factor prices, demand, technologies (Hayami and Ruttan 1985; North and Thomas, 1973) or preferences (North 1990) changes economic conditions. A variety of different rule sets are proposed to address the new conditions, and these institutions compete amongst one another to

get the most economic agents using their set of rules. This competition amongst institutions will induce convergence around the lowest transaction cost institution (Alchian 1950). The question then becomes how the initial exogenous change was instigated; in the context of value chain analysis, this begs the question of what makes suppliers decide to upgrade.

Endogenous theories of institutional change do not have this problem. Instead, they highlight how change is instigated from within the system. In contrast to the instrumental and determinate approach described above, in this approach institutional change arises in a complex environment wherein institutions and individuals co-evolve by influencing one another. Multiple equilibria, some of which may be inefficient or indeed harmful, are possible in these theories[3].

Such endogenous theories generate three additional institutional change scenarios. In scenario two, the ongoing operation of institutions over time changes parameters which are not essential to the rules of the game, but nonetheless affect the payoffs experienced by the actors. As these "quasi-parameters" shift over time – one can imagine, for example, changes in a

[3]In this they concur with research in other disciplines on the suboptimality of a given institutional framework. The political economy perspective of North (1990) and historical institutionalists (Immergut 1998) stresses that the powerful can change rules for their own benefit, so there can be institutions, and institutional change, that do not enhance efficiency or overall societal welfare. Sociological institutionalists (Berger and Luckmann 1966), and equilibrium view institutionalists (Aoki 2001), view the existing set of institutions as one amongst many possible equilibria. In the setting of the chapter, this implies that upgrading can result in suboptimal outcomes that can undermine livelihoods. More generally, as one reviewer pointed out, there is no consensus on which institutions are crucial to a well-operating economy; indeed, many empirical studies are of single institutions.

region's overall level of technical knowledge or soil organic content over time – they can lead to institutional disequilibrium and affect the benefits from institutional change, triggering action (Grief and Laitin 2004; Canales 2010). In the third scenario institutional participants seek to marginally change the rules through institutional additions and alterations (North, 1990). This predicts that change is likely to be incremental. In the fourth scenario, institutional entrepreneurs set out strategically to change institutions. Since agents are shaped by existing institutions, however, they must step outside their constraints to change things. Seo and Creed (2002) suggest that for this to happen, agents must become aware that institutional contradictions exist, which depends on how profound the contradictions are and mechanisms of communication, and they must also see that they stand to benefit by rectifying these contradictions.

Interactions between upgrading and institutions are relevant to development particularly insofar as they affect the welfare of upstream producers. In this study, welfare outcomes are understood from a livelihoods perspective. Livelihoods have been defined by Ellis (2000) as "a combination of assets (...), activities and access to these (...) that together determine the living gained by the individual or household" (p. 10). Unlike other welfare measures used in value chain upgrading studies, a livelihood framework captures all the data about the well-being components that matter to the research subject. This includes income as well as income fluctuations, assets that insure against risk, and expectations for the future.

How does value chain upgrading interact with institutions to affect the livelihoods of chain participants? This broad question is taken up empirically through a case study of the Nepali tea value chain.

5.3 The Nepali Tea Value Chain

5.3.1 Methods

Fieldwork was conducted in Spring 2010 in Nepal by the author and a Nepali translator/research assistant. A set of 85 field interviews informs this study[4]. In the first stage of research, 16 informant interviews were conducted in Kathmandu (the capital city) and Ilam district using an exploratory, informal conversational interview format (Patton 2001). The second and third stages focused exclusively on upstream actors. In the second stage, 20 semi-structured guided interviews were conducted with farming (15) and laboring (5) households. To start, the interviews used a short list of questions (the "guide") that were based on findings in the first stage. An emergent, iterative approach was then used such that once a topic was mentioned in an interview, it was included as a question in subsequent interviews (Patton 2001). A full interview guide consisting of a list of questions[5] emerged inductively

[4]The field data was complemented by desk research from Nepal and elsewhere, three follow-up interviews, and a verification fieldwork phase.

[5]Questions pertained to, inter alia, land holdings; household composition; amount of land planted to tea; revenue from tea; costs incurred; net income from tea; sources of risk; degree of agricultural and occupational diversification; mechanisms used by the household to respond to shocks; motivation for converting to organic/CoC production; pride, confidence in the future, and other subjective factors; education and training; cooperative membership and politics; interaction with government and NGOs; factory practices, in-

through this process. It elicited information from participants regarding the livelihood factors and institutions they deemed relevant to their well being and how these factors had changed over time.

Since no pre-existing lists of farmers in each region existed, and the respondents were hard to identify in the densely forested, mountainous terrain, snowball sampling methods were used in this and the next stage. Informants in the first stage suggested a few key households. These respondents, in turn, suggested other households, who then suggested others. Suggestions that permitted inclusion of hard-to-reach groups, such as landless laborers, female-headed households, and tribal households, were followed with a view to reflecting the demographic and ethnic distribution in the region.

In the third stage, a quantitative survey was conducted with 30 households in order to measure the factors identified in the second stage. Quantitative data and findings are discussed in a separate policy paper (Mohan 2013). Data from the second stage and, to a lesser extent, the first stage, form the backbone for the analysis in this chapter. Analysis was conducted using Grounded Theory methods (Strauss and Corbin 1998) deployed using QSR NVivo 9 software.

Research was conducted largely in three villages in Ilam, namely Sundarepani,

cluding frequency of payment, grading, and rules concerning chemical usage and quality of leaf plucking; household expenses; payments to laborers; and how revenue, income, and other factors have changed since conversion (if applicable). The survey in the third stage quantified a similar list of livelihood and institutional factors through a standardized questionnaire (more information available upon request).

Kolbung, and Sankhejung. Criteria for selection included the importance of village production in gross district output as well as the presence of both organic and conventionally certified production. A few additional interviews were held in other villages including Borboté (Fikkal), Daragoun, Jasbiri, Horcoté, Iroté and Kanyam.

5.3.2 Input-Output, territoriality, and governance aspects of the tea value chain

The tea sector in Nepal connects thousands of small-scale farmers to millions of discerning tea consumers worldwide. Unlike tea grown to the south and west, which is largely grown on plantations and processed according to cut-tear-and-curl (CTC) methods, orthodox tea production in Nepal is concentrated in the east, in Ilam district as well as neighboring Dhankuta and Panchthar districts, in the lush foothills of the Himalaya, just across the border from India's famous Darjeeling tea gardens . For the remainder of the chapter, unless noted otherwise, "tea" refers to orthodox tea grown by these farmers. Although the roots of tea production in Ilam stretch back to the 1860s, when the first tea seeds were planted, it wasn't until the 1960s and 70s that small-scale farmers started planting their own tea plots (Rana 2007). In 2009/10, these farmers produced 1,425 tons of tea on 4,987 hectares[6] of land, most of which was exported to India and overseas.

The Nepali orthodox tea value chain typically starts when a smallholder

[6]These figures are for combined orthodox and CTC tea. (USAID 2011: 15)

farmer buys a tea seedling from a government nursery. Inputs including fertilizers and pesticides are applied and five years later, the farmer hires laborers to pluck the tea leaf. It is then transported by the laborer, farmer or a local truck or horse to the processing factory. The factory grades and processes the tea leaf, and then sells it to a buyer. There are two kinds of buyers: on the one hand, there are buyers who will accept almost any quality of tea, such as Nepali and Indian buyers. On the other hand are premium buyers that require compliance with food safety and quality rules, including European wholesalers and retailers. The factory sells the processed tea to one of these buyers, who blends and sells it to a retailer. At the retail store, it is bought by consumers. Between each node, the tea leaf is transported and stored.

This input-output structure of the tea value chain is shown visually in Figures 5.1 and 5.2[7], which correspond to the conventional and organic threads of the chain respectively. As is evident from casual observation, the organic value chain is more streamlined than the conventional chain. However, the pattern of industry concentration has an hourglass shape in both cases, with a large number of upstream farmers, a few processors and traders in the middle, and many retailers and consumers. International trade in conventional tea is dominated by a handful of large global agri-food firms such as Unilever, who buy tea at auctions, blend it, and retail it via brands such as Twinings or Lipton's. Organic tea, on the other hand, is generally sold relatively directly

[7]See Appendix.

to small-scale retailers in developed countries. The tea value chain is buyer-driven, and the conventional and organic threads are coordinated through spot and captive governance respectively. The lead firms in the high quality segment of the tea market are specialized retailers or wholesalers in developed countries; while in the low quality segment, international tea blenders use auctions, including in India, and exert little control over upstream production (Larsen unpublished; Loconto 2012; Herath and Weersink 2008). Power in the Nepali segment is centralized in the 20 large and medium-sized factories[8] processing and exporting orthodox tea leaf in Nepal (USAID 2011) whose production ranged from 10 to 800 megatons of made tea. Villages in Nepal had one, or at most two, such factories nearby; each factory thus had a virtual monopoly, capturing all the supply in the region. The producers who grew the tea, on the other hand, were numerous, relatively poor, and small in scale. More than 7,000 tea farming households toil on small-scale plots in Nepal (NTCDB 2009), average individual incomes in Ilam were US$1344[9], and in our sample, the average farm size was 0.77 hectares.

5.4 Institutional Change Amidst the Tea Fields

These input-output, territorial, and governance characteristics of the Nepali tea value chain intersected with the institutional context at each node of the chain. For the sake of analytical clarity, the rest of this chapter focuses on

[8]There were, in addition, several small-scale processing works that did not export their product.

[9]2006 figures, GDP per capita PPP. (UNDP 2009: 149)

this intersection at the farmer node of the chain[10]. Interviews with small-scale farmers revealed a set of institutions that framed their livelihood efforts. Their testimonies affirmed that institutions used for vertical governance of the chain, such as standards and grading rules, were relevant for their livelihoods. Yet other local rules and informal norms guided their behavior. In order to understand how upgrading induced a process of institutional change, we first need to comprehend these rules in depth. For that reason, we will now consider a static view of the institutions governing the production of tea by farmers in the rolling hills of Ilam, Nepal.

5.4.1 A snapshot of institutions at the farmer node of the tea value chain

The "rules of the game", in the case of tea farming in Nepal, can be roughly grouped into three categories. Chain governance institutions were set by downstream actors to control the flow of product, information, and finance. Labor institutions set out the ways in which farmers could access workers for their fields. Finally, financial institutions affected farmers' access to capital. Several other elements made up the institutional environment of the farmer: informal norms guided their valuation of different livelihood options, organizations provided support, and they had pre-existing livelihood strategies. The rest of this section explores each of these elements in more detail.

[10]The research project set out to examine the institutions and livelihoods of farmers, and thus by construction the treatment of labor in this chapter is limited. As such, although data was gathered from and about laborers, owing to both space constraints and the need for analytical focus it has been analyzed so as to shed light on institutional change at the farmer node of the value chain. Other research has examined institutions at other nodes, notably labor (Rossi 2013).

5.4.1.1 Chain Governance Institutions

In each village, the local factory told farmers how tea was to be produced and sold. They did so through three institutions: standards; payment modalities; and grading rules. In the first category were certification schemes specifying, inter alia, how much leaf was to be plucked from each bush and how much chemical use was permitted. In Ilam, each village had only one local factory, which accepted tea produced according to one or more standards. Two such standards will be examined in depth in this chapter: the Code of Conduct, a domestically-driven set of voluntary rules for tea production and processing; and Organic certification[11].

Payment frequency rules set out when farmers could expected to be paid for the tea they delivered, which could be monthly, every other month, quarterly, or annually. Crucially, each factory had a system of rules for the grading of tea. When a farmer dropped off tea leaf at the factory, the manager classified it as either A-grade, high-quality tea that was paid the standard rate, or B-grade, lower-quality tea, which was paid a lower rate or not at all[12]. Yet it

[11]Other standards which may be relevant for some parts of the chain, at some point in time, include HACCP rules (Hazard Analysis and Critical Control Points), which require record-keeping all along the chain, including regarding farmer suppliers to each processing batch. Other rules include the Codex Alimentarius standards for safe pesticide and fertilizer use; EcoCert; Fair Trade; private supermarket chain rules; and EUREPGAP rules.

[12]In some cases, the farmer is told on the spot how much is A and how much is B grade. In other cases, it is only at payment time months later that the farmer is told how much is A and how much is B grade. At payment time, the farmer is either paid for both A and B grade tea on the spot; or, payment is made for A grade tea, and B grade payment only comes months later. In some cases, farmers receive no payment for B grade tea whatsoever.

was the factory that decided which tea made the grade.

5.4.1.2 Labor Institutions

The labor institutions farmers described as most relevant to their own livelihoods were payment modality, allocation rules, and availability rules. Workers were paid either a piece (per kg) or time (daily) rate. Daily rates ranged from US0.80*to*1.61, and piece rates ranged from US$0.09/kg to $0.17/kg, but were virtually fixed in each village. Labor was allocated through customary obligations (i.e. landlord-tenant relations), by verbal contract from one season to next, through the community labor sharing system (porma), by the discretion of mobile labor groups, or on a spot market. The last two modes of labor hiring were preferred by laborers, and were used particularly when labor was scarce and wielded market power. However, they were problematic for farmers, who found that these modalities led to difficulties in accessing labor at the right time, when the quality of the tea leaf was at its peak. A majority of respondents described acute labor scarcity as a problem. This shortage arose in part from increased outmigration of young men, often to jobs in the Middle East.

5.4.1.3 Financial Institutions

Financial institutions, including banks and microcredit groups, constrained and assisted farmers by setting out rules for access to loans, loan forgiveness, and interest rates.

5.4.1.4 Informal norms

The informal norms of market participants conditioned what was feasible for farmers. Norms about gender, the valuation of the future, and environmental awareness particularly influenced decision-making. Women were often responsible for coordinating field practices, including coordinating labor and inputs, yet men were responsible for participating in cooperative training sessions. Those training sessions disseminated norms about the future that influenced how farmers evaluated non-financial benefits from upgrading.

Informal norms also existed regarding the acceptable level of risk in household production. As this convention changed toward a higher acceptable level of risk, farmers and their organizations were more willing to experiment with new production methods. Social convention demanded that parents send children and youth away to school.

5.4.1.5 Organizations

The activities of non-governmental organizations (NGOs) and industry groups affected farmers' livelihoods indirectly, including by strengthening cooperatives, affecting informal norms, and augmenting international demand for Nepali tea. HOTPA (the Himalayan Orthodox Tea Producers' Association) was created in 1998 to represent and coordinate the interests of the factories. By 2003, several processing factories had opened, development organizations including JICA and Winrock International were active in the sector, and a

Tea Development Alliance was formed to coordinate development work in the sector. In 2006, in order to complement HOTPA's coordination role with income generation activities, a marketing body was created HIMCOOP, the Himalayan Orthodox Tea Producers' Cooperative. The government affected multiple elements of household economics, including through education, loans, and national strikes.

5.4.1.6 Other strategies

Farmers were pursuing a variety of their own livelihood strategies well before the product upgrading began. In reaction to risks, farmers were diversifying their livelihoods and their crops. In reaction to shifting conventions regarding outmigration and schooling, farmers adopted all sorts of innovative methods to access labor. In reaction to the perceived unfairness of factory rules for grading, payment frequency and pricing, farmers attempted to functionally upgrade by starting up their own small processing factories or hand-dryers. Many were sending children for higher education and a potential office job, in the hopes of the family eventually leaving the farm. There was also substantial emigration: male household heads migrated away to earn money to send the children to school, and then the educated children no longer wanted to work the farm. These factors influenced the course of institutional change and thus how upgrading was received in the region. To see this in more detail, we now turn our attention to the processes at play in Ilam in 2004, when the Code of Conduct was introduced.

5.4.2 Upgrading alters institutions, Part I: the CoC

The process of institutional change at the farming node of the Nepali tea value chain began when the Tea Development Alliance and HOTPA recognized that they would capture more profits if they improved the reputation and quality of Nepali tea. They thus created a Code of Conduct (CoC) between 2004 and 2006. The CoC is a self-enforcing, voluntary code, modeled on ISEAL, Codex, and International Federation of Organic Agriculture Movements (IFOAM) standards. There are four components to the CoC: respect for nature, which requires that farmers reduce pesticide and chemical use by 25% in the first year of participation, by 50% in the second year, and bring chemical use to zero in the third year; respect for people, including reducing child labor[13]; transparent processes, including making factory sales more open for farmers; and assured quality, including encouraging the plucking of high-quality tea leaf (two leafs and a bud from each bush). In creating the CoC and implementing it, they instigated a process of product upgrading.

The CoC scheme was implemented at a field level by participating factories with NGO assistance. Two aspects of the standard were emphasized in implementation: the reduction in chemical use and plucking higher-quality leaf.

[13]Although the "respect for people" (including reducing child labour) and "transparency" (opening factory books to farmers) elements were included in the CoC, evidence from interviews suggested that these two aspects of the Code were less operationally relevant. Analysis of data from fieldwork in 2016 indicates that child labour is not prevalent amongst small-scale Nepali tea farms.

Factories were tasked with creating a separate processing line for CoC tea and paying farmers a US$0.04 premium per kg of CoC tea sold; an auditor was hired to inspect compliance with the standard; trainings were provided by NGOs and development agencies; farmers kept record books; they reduced pesticide and fertilizer use; and factories stamped tea with the CoC logo.

The creation of the CoC in turn created a new set of livelihood choices for farmers. Farmers had the option of participating in the CoC, and indeed some altered their livelihood strategies and opted into the upgrading process. As concerns farm-level practice, the new strategy notably required a reduction in use of chemical pesticides and fertilizers, increased record-keeping, and participation in training sessions and cooperatives.

The new strategies gave rise to new organizational forms in the value chain. The CoC induced the formation of, firstly, a coordinated network of value chain actors wherein farmers, factories, buyers and other actors exchanged information, product, and payment to support their trade in tea. Secondly, NGOs and development agencies provided input into the upgrading process, particularly through training sessions, and in the process helped increase national expertise in tea production and in rural organizing. Perhaps most importantly, and thirdly, the CoC strengthened cooperatives. Nepali NGO Teasec provided trainings to the cooperatives in organization, ecological agriculture, and the CoC components, with support from donor development agencies.

These three organizational forms in turn acted to change norms and informal conventions. As noted above, NGO training encouraged farmers to consider the impact of their decisions on long-term soil fertility and sales, and this shifted norms regarding sustainable farming. This was reflected in how several respondents spoke about the need to improve the fertility of the land for future generations. As one respondent put it, "We are doing this for the next generation. For our children's children, so they don't face hard times in the future." [Farmer, Sudung, Sundarepani]

During interviews, respondents were asked to reflect back on the livelihood outcomes from the CoC. They recalled the extensive record keeping and training requirements of the initiative, and noted that they had been proud that their tea was "sustainable" and was selling overseas, but were skeptical about the benefits they received. In most households, tea production per hectare fell in the months after the CoC's restrictions on chemical fertilizers and pesticides were imposed. This short-term drop in productivity stemmed from low producer capacity along with a shortage of field-level technical assistance on use of organic fertilizer and pesticides.

Factories faced significant difficulties in marketing CoC tea to overseas buyers who were not familiar with the national scheme. As a result, in virtually all the cases, they failed to deliver the promised price premium to farmers. Several factories stopped using the CoC scheme, that is, they stopped running a segregated CoC production line and told farmers not to bother separating

CoC and non-CoC leaf.

The CoC's elaborate rules of participation, low productivity, and absence of price premiums bode badly for farmer livelihoods. Farmers took to disobeying the strictures of the CoC by using chemical pesticides and fertilizers, making excuses to the factory when confronted. The scheme gradually faded into obscurity: less than 15% of our sample was still using the CoC in 2010. Although the CoC did not generate the hoped-for financial gains for farmers or factories, it did improve capacity, including in ecological farming techniques, collective organizing, expert training, and operating multiple production lines. Indeed, one informant described the Tea Development Alliance as a mother that gave birth to a baby, the CoC, which in turn gave birth to organic upgrading, to which we now turn.

5.4.3 Upgrading alters institutions, Part II: Organic

In reaction to the shortcomings of the CoC upgrading process and the burgeoning market in organic tea, in 2008 several factories investigated opportunities to convert to organic production. Organic certification is conferred on factories and cooperatives by an external certifying agency if they comply with the requirements of the international binding organic standard, notably that they have not used any chemicals on the farm for three consecutive years. Although certification was conferred on the cooperative, the produce of its members was certified by association, and indeed field-level testing and implementation was done at the member level. Using their own finan-

cial resources and those of overseas donors, tea factories in Ilam encouraged cooperatives to convert to organic production, along with their farmers.

Many farmers decided to convert to organic via cooperatives, particularly on the basis of promises from the factory that organic production would garner higher prices and high future demand. The new livelihood strategy was more labor and planning intensive: households spent many hours making organic pesticides and fertilizers and seeking out labor. There was qualitative evidence that some households changed their livelihood strategies in reaction to conversion by reducing their financial and human investment in alternative occupations and investing more in the farm and the organic project, but the survey found limited quantitative evidence for a reduction in diversification. Both qualitative and quantitative data made clear, however, that organic farmers had more livestock assets and were more indebted. This indicates that conversion involved a more capital-intensive livelihood strategy in which investments were made in the hope of future gains.

Organic upgrading also altered the organizations involved in tea production. Factories and local NGO experts facilitated conversion, with the help of overseas organic certifiers, and development agencies were relatively less important. Factories hired Nepali experts developed in the previous cycle of change to provide training sessions through the cooperatives, and they hired the same consultant to audit participating farmers. At the same time, the terms of membership in the cooperative became very important for farmers

wishing to obtain an organic premium. One farmer spoke critically of the old guard members in the local cooperative, lambasting the high entrance fees required to join and the politics in obtaining membership, while the factory refused to get involved in farmer-cooperative disputes.

The organic conversion process shifted informal norms in the villages. Pride, environmental and health sustainability, and long-term prospects became important ways farmers evaluated their own livelihoods. Converting farmers increasingly saw tea farming as a viable way of life in the future, and indeed were empowered by the connection to overseas trade, foreign visitors, and improved knowledge about organic farming techniques. As one respondent put it, their tea "is earning not only a good price; it is also generating pride." [farmer, Kolbung] Others said the market for tea in the long term was organic, and so it was necessary to convert. At the same time, a culture of surveillance arose in many certified areas given that one farmers' transgression of the organic rules would threaten the market access of all the farmers in the area.

This process produced livelihood outcomes for participating farmers that differed from those of non-organic farmers. As noted in section 3.2, the research method asked farmers which livelihood factors were relevant to them, gathered more in-depth qualitative data, and then measured the same factors. This process generated the following evidence on the livelihood outcomes that farmers deemed relevant and how they were affected by the upgrading and subsequent institutional change process.

Conversion to organic farming increased the prices received by farmers. Organic farmers received, on average, NRs40 per kg of tea sold in first flush 2010, while conventional farmers received on average a lower NRs22. Change over time was different for the two livelihood strategies, and in favor of organic farmers: the change in pay per kg of tea 2005-2010 was a positive NRs6.65 for organic tea, while prices had decreased by NRs1.42 for conventional farmers. The two groups also experienced different degrees of price volatility: the conventional group experienced prices that fluctuated 38% on average, while the organic farmers saw just 20% price volatility over the same time. These consistently high, and more stable, organic prices were an important livelihood benefit, and can be explained by the fact that the standard was well aligned with downstream market demand, it successfully conveyed downstream demand to upstream producers, and that there was more finance available to the factory to smooth short-term cash flow issues.

Affirming qualitative evidence on the matter, the productivity of organic farmers in the sample was lower, at just 2.3 kg per hectare per year, than conventional farmers, who on average had 5.9 kg/hec/yr. These productivity outcomes depended on the institutional conditions in each subvillage. In villages where organizations were stronger, training was more informative for field-level practice and so productivity, quality, and profits tended to be higher. In locations where local norms supported early adoption of innovation, farmers were more likely to adopt new standards and experiment until they yielded benefits.

On average, organic farmers were less profitable. Profit is defined here as short-term marginal revenue (the price paid by the factory per kg) minus marginal cost (the per-unit expenses of production) times total production, as reported by the household head. Although organic farmers earned more average profit per kg for the tea they grew (NRs9 as opposed to NRs5.6 in 2010), because their productivity was lower, their total average profit per year was lower. In 2009, for example, the total average profit of organic farmers was NRs9,200 as opposed to NRs15,700 for conventional farmers.

These profit figures arose in part because of the different cost structures. Costs associated with tea production included, for nonorganic farmers, fertilizers, pesticides, labor for plucking, labor for pruning, own work time, and transportation. For organic farmers, costs included own labor time for coordination, collecting organic pesticide ingredients, making organic pesticides and fertilizers, as well as the cost of hired labor plucking and pruning time. Organic farmers pointed out that they experienced increased stress from the increased time and coordination required for production according to the new standard. For example, during an interview in Kolbung village, one female farmer described hours of collecting plants to produce organic fertilizers and pesticides, and the pressure to find extra laborers. She said, "when I'm sleeping, I think, I'm doing such hard work, when will I get the profit from all this? I think when [the price is] NRs200! Sometimes the production is low because of the sun, then because of labor. Some days ago I opened this drum to apply pesticide, and I got a headache, the smell was so strong."

The benefits of upgrading were reduced by how the high labor intensity of organic production intersected with rigid labor institutions and shortages. Wage rates were social rules and didn't adjust upwards to meet the increased demand. Other livelihood strategies, namely outmigration, reduced the labor supply. In villages where the labor shortage was more acute, farmers were less able to mobilize the increased labor required for organic conversion and were thus less likely to benefit from upgrading. Farms seemed to prosper under the organic scheme if they had more family members, more family working the land, had a smaller farm, if they used a labor exchange system, had laborers living on the land, or had found a way of securing guaranteed laborers in advance.

There were higher supervision costs under the organic scheme. Under the conventional standard, laborers could be paid on a per-kg basis, and if they plucked large quantities of poor quality, that could still be sold. Under the organic standard, such low quality leaf would not garner full price under the factory grading institutions, and so laborers had to be paid according to a daily rate that incentivized good-quality plucking. Unfortunately, such a time-based payment modality demanded intense supervision to prevent labor shirking, and the increased supervision time had its opportunity costs.

Several other financial aspects of tea farming affected household livelihoods. Farmers' understanding of the prosperity of their farm extended to how insulated they were from risks such as drought, strikes (bandhs), and suddenly

low prices. The evidence on how organic upgrading affected this is not clear, apart from a possible reduction of diversification. Finally, as noted earlier, Organic farmers had on average NRs10,000 more in outstanding debt than conventional farmers.

Farmers spoke often about how they felt when they went to sell their tea, and how that feeling affected their well-being. This reflected the process of informal norm change that took place concurrently with upgrading. The quantitative survey thus asked each respondent to choose the term that best expressed how they felt when they went to sell their tea. Results indicated that organic farmers felt less satisfied than conventional farmers, but were more hopeful for the future. Organic farmers described a sense of pride that their tea was being sold overseas and shared optimism that their market prospects in the future would be good. Indeed, there was a difference in how farmers described the future market for their tea: Organic farmers described that market as very good, while conventional farmers described the future market just as "OK". The long-term health of the soil was also described as important to well-being, and organic farmers were more confident that the tea they were growing was good for this objective.

Outcomes from the second, organic conversion-induced process also appeared to be giving birth to yet another cycle of institutional change. The factories had difficulties selling all the tea grown according to organic standards on organic markets, which highlighted that upgraded product might need to be

certified to several different standards in order to address the requirements of several different export markets. The process also increased knowledge regarding the importance of the quality of the tea and that improved plucking, transportation and processing was needed to access niche high-value markets. Finally, stronger cooperatives delivered more sophisticated training that empowered farmers to become active in organizing region and nation-wide in lobbying for change in policies.

5.5 A Typology of Institutional Change in Value Chains

This institutional history of upgrading in Ilam highlights how, in practice, institutional change unfolded around the CoC and Organic initiatives. The processes of change that followed each of these upgrading initiatives seem to share common elements. Analysis of the case study data through grounded theory methods (Strauss and Corbin 1998) employed a progressive, iterative approach which triangulated the evidence from different upgrading initiatives, methods, and stakeholders. The framework that emerged from this analysis suggested that each upgrading initiative launched a process of institutional change that followed a series of general phases. This process can be summarized in a general typology, which abstracted from this particular case study yields insights into how institutional change works in value chains. The rest of this section presents this typology and derives implications. The first subsection presents and analyzes the typology, while the second and third analyze implications for institutional and value chain theory respectively.

5.5.1 A proposed typology

The institutional change typology that emerged from this research can be conceived of as an iterative cycle that operates at each node of the chain, but for the sake of pedagogy, it is presented here at the farmer's node and as starting with the upgrading decision.

The cycle begins when an actor in the chain decides to upgrade. Institutional change theory teaches us that this first stage depends crucially on the chain actor being able to "see" that a new way of participating in the chain is possible, a vision that might be enabled by seeing chains in other places or hearing expert advice. A governance lens on this stage highlights how multiple actors at a controlling node in the chain build consensus around the decision to upgrade. Their ability to make their vision a reality depends on collective action dynamics. Furthermore, only relatively powerful chain actors, such as lead firms and controlling nodes, have the market power to induce upstream actors to follow their lead. To do so, they seek out mechanisms by which to impose their decision on upstream actors.

These efforts lead to the second stage in the typology, when the governance of the value chain shifts as actors at the controlling node in the chain impose a governance institution on other chain actors to facilitate upgrading. Upgrading calls for more tightly coordinated value chain interactions, and standards can be used to impose rules that precisely define flows of information, knowledge, and product. In the case of the Nepali product upgrade, factory owners

adopted certification standards to govern quality improvements and interactions in the chain. A shift in the vertical institutions that govern the product along the value chain thus flows from the decision to upgrade.

In the third stage of institutional change, actors at a given node in the value chain craft new livelihood strategies in view of the change in chain governance. They may decide to participate in upgrading; on the other hand, the strategy phase of the cycle may include a downgrading strategy, or a path that is not readily explained as a change in position in the chain, such as a diversification of livelihoods or an investment in education. In the case of product upgrading in Ilam, some farmer-suppliers decided to improve their production processes and get certified, while others decided to continue to produce using conventional methods. Still others decided on other strategies, including leaving the tea sector entirely or diversifying to other crops. In deciding on this strategy, actors at the node consider not just how the chain governance has shifted, but how the new opportunity interacts with existing livelihood strategies and institutional constraints.

The fourth stage is characterized by the creation of new or altered organizations. These organizations may be created by in the first phase by lead firms to build consensus, in the second phase or third phases to implement the new governance mechanisms, or they may arise at the behest of less-powerful actors to pursue success with their new set of strategies. They may help resolve market failures, including for communication along the chain and for

technical assistance at particular nodes. Existing organizations may experience a rebirth as they are retooled for the purposes of participation in altered value chains.

As these organizations take on a life of their own, and develop their own voice and advocacy practices, and as actors are shaped by their new strategies and organizations, the informal norms at the node of the value chain shift, marking out the fifth stage in the cycle. This may involve the rise of a sense of pride in the quality of the product, and the local terroir for which the region has become known. It may include increasing trust for actors at other links of the chain. As such, informal institutions in particular places are in part the product of the history of chain transformation, as per Neilson and Pritchard (2009). However, as these authors also suggest, institutions also act upon value chain governance: informal norms that are developed through the institutional change cycle are used by chain actors to understand their reality and decide how to act.

This is evident in the sixth stage of our cycle, where the new horizontal institutions, organizations, and strategies generate a new set of livelihood outcomes. Livelihood strategies, including upgrading plans, come up against constraining and enabling factors in actors' institutional environment, including aid by organizations. Norms are important in motivating participation in the strategy, improving performance, but also in constituting evaluation criteria. Actors at a given node of the value chain see the livelihood outcomes

emerging from the complex interplay of upgrading, strategies, and all the institutional factors outlined in the cycle above. Indeed, these outcomes are generated over time throughout the cycle. However, once the outcomes from a cycle of change spurred by upgrading become more clear to the chain actor, they also often notice new opportunities, thereby re-launching the cycle. The adoption of a new standard throughout the chain can highlight a constraint to future growth, such as a shortfall in technical knowledge, creating opportunities to profit through the creation of institutions and organizations that provide technical training. Efforts to capture these rents through upgrading then launch a new cycle of change. This is highlighted in the Nepali tea case study, when upgrading to the Code of Conduct laid the foundations for a new cycle, launched with upgrading to Organic. The breakdown of the process of change according to the typology in that case is presented in Figure 5.3 in the Appendix.

Although the typology has been presented for clarity as a single, bounded process, shown in its general form in Figure 5.4 below, it is better conceived of as a repeated, iterative cycle in which outcomes beget more upgrading and institutional change (see Appendix, Figure 5.4).

Furthermore, in a given case, the cycle can start at any stage, and the direction of causation may be different. For example, a chance event may lead to a change in an organization that in turn encourages a shift in norms and a decision to upgrade. More profoundly, one can see each of the "stages"

as a domain of change in itself, and the local system is made up of interactions between these domains over time within the value chain node. Finally, while the analysis has focused on how this process takes place at a single node, processes of institutional change are also occurring at other nodes of the chain; shifts in chain governance, often induced by upgrading, tie these worlds of local change together, in a system not unlike the "multi-dimensional, multi-layered lattices of economic activity" of GPN theory (Henderson et al 2002: 442; Lazzarini et al 2001). The combined effect of these concurrent change processes affects subsequent cycles of change and livelihood outcomes throughout the chain.

5.5.2 Implications for Institutional Change Theory

The case study and its analysis via the typology generate empirical support for some, but not all, of the institutional theories presented earlier. The typology affirms that an evolutionary process guides adjustment as multiple cycles alter the system over time. However, the vision of an exogenous trigger spurring Darwinian competition does not resonate in light of the field data. Rather, the trigger comes from within the system, namely when value chain agents decide to change institutions in order to capture rents and reduce risk. The new institution emerged not because it is optimally suited to reduce transaction costs, but rather because it benefitted one actor, and since other actors could not effectively resist the change, affirming that political economy struggles are important determinants of the course of change.

As concerns the question of how and why agents step outside of existing constraints, this research suggests that change agents take initiative because they see opportunities for profit. This depends on their ability to see alternatives (Seo and Creed 2002), which in this case involved envisaging certification schemes that could increase value-added capture. Exposure to different ideas from outside the local context (Canales 2010) gave factory owners ideas about potential improvements they could undertake, while for farmers, the practices of neighbours and NGO discourse did the same. The model espoused by the data is thus an endogenous one in which institutions do condition agents, but where agents then re-affect institutions – that is, institutions and agents co-evolve.

The second ideal-typical institutional change scenario has more empirical support and appears to be a superior framework to analyze value chains. The profitability of reducing chemical use and the level of knowledge of agents were akin to quasi-parameters that gradually changed. Major parameters like input or output prices didn't change significantly; instead, shifts in these quasi-parameters opened up rents, which then changed the benefits from instigating change via upgrading. As per scenarios two and three, however, upstream value chain actors were not passive recipients of change: they crafted strategies whose execution affected outcomes.

Finally, there appeared to be important complementarities among sets of formal and informal institutions. For example, the organic standard worked

alongside labor payment modalities and norms about sustainability. The failure of a given upgrade may thus be at least partially attributed to constraints to the establishment of complementary institutions elsewhere in the system (Mohan 2014).

5.5.3 Implications for Upgrading theory

The analysis in this chapter has suggested that deciding to upgrade to a higher-quality thread of the value chain is a particular sort of livelihood strategy. Yet as far as terms go, "value chain upgrading" obscures the reality of livelihood strategies. It incorrectly presumes that such a strategy will eventually lead to functional and/or inter-chain upgrading and an improvement in market position (Ponte et al 2014). It only sees that aspect of the strategy that overlaps with the value chain: for example, a move to reduce quantity supplied into the chain is only seen as that, and is labeled as "downgrading" (Ponte and Ewert 2009), rather than being seen as part of a process of diversification or emigration. Perhaps most problematically from the perspective of this article, the upgrading lens obscures the broader institutional context in which livelihood strategies sink or swim, including how upgrading strategies are born as part of broader livelihood strategies, how they are constrained by intransigent local rules, or how they are made possible by organizations that are themselves the product of earlier livelihood strategies. One implication of the research in this chapter is thus that a broader livelihood strategy lens, embedded in an understanding of institutions, is a more

comprehensive way to understand change in value chains.

The typology presented above stresses that the welfare impacts of upgrading emerge as the cumulative result of how upgrading interacts with institutions over time. There is nothing in the typology nor in the data that suggests that this process always yields outcomes that are efficient and improve welfare. Indeed, in the case study, some upgrading farmers experienced adverse impacts on selected livelihood metrics. Rather than describing welfare effects as "social upgrading or "social downgrading (Barrientos et al 2011), or emphasizing how "downgrading to a less demanding thread of the chain can be beneficial (Ponte and Ewert 2009), this chapter instead finds the notion of "immiserizing upgrading, which hurts the actor who undertakes it, to be more informative.

In the terminology of Bhagwati (1958), and how it was applied to a value chain context by Kaplinsky et al (2002) and Kaplinsky (2004), "immiserizing growth" occurs when a country or sector increases the quantity it produces, but actually earns less profit since the price it receives per unit has gone down. In the macroeconomic perspective of Bhagwati and Kaplinsky, the actor has tried to improve its well-being by changing one economic variable (here output) that it has control over: but this changed strategy has had a knock-on effect on another variable (here price) and the intended and unintended effects combine to hurt, or "immiserize", the actor. Likewise, immiserizing upgrading can be defined as a strategy of a value chain actor

which targets improvement in a chain-governed livelihood factor (such as market power, position or price) yet has adverse implications on other livelihood factors (such as gender, productivity, or risk) such that the net result of the strategy is worsened welfare. In the Nepali case, farmers upgraded to try and access better prices in the short and long term, but upgrading led to higher labor costs, stress, and lower productivity, all of which commiserated to reduce overall welfare in some cases.

Furthermore, insofar as one welfare-reducing cycle of change can lay the basis for subsequent welfare-improving cycles of change, isolating the impact of a single upgrade may be misleading. Instead, the impact of change on the adaptive efficiency of the economic system may be important. For example, one respondent recounted how the local factory's sudden decision to stop buying tea leaf one year, and the concomitant adverse impacts on farmers' livelihoods, triggered the creation of a new cooperative. The cooperative fomented an entrepreneurial approach which encouraged farmers to rise to future challenges: they "learned how to learn", seeing each new problem as an opportunity to extend their eco-agricultural, marketing, and organization techniques. As per Aoki (2007), such chance moves early on in the process seem to influence the path taken by the local economy. If this is the case, then particular locations can "lock in" to certain trajectories of economic development through path dependent participation in value chains.

5.6 Conclusion

Participation in global value chains has been characterized alternatively as an opportunity or as a threat to the well being of small-scale firms in developing countries. The research presented here highlights how downstream firms' decision to upgrade affects the welfare of the upstream poor. As in other studies, outcomes spring in part from the certification standards that are used to govern the upgrading process. Yet this chapter suggests that upgrading is not imposed on passive victims in the south; rather, the Nepali case highlights how upgrading interacts with local institutions, strategies and organizations to deliver outcomes in the short and long run. Institutional analysis can thus help us understand impacts of these policies and improve their development dividend.

This study yields support for endogenous theories of institutional change in value chains. Exposing potential change agents to different institutional arrangements can help to kick-start the process of change. Future research could examine how certain such paths of change are more or less conducive to positive livelihood outcomes as well as growth-inducing future phases of change. Additional research is also needed to consolidate the literature on immiserizing upgrading within the broader gamut of commodity systems analysis.

Value chain upgrading can yield benefits for small-scale firms in developing countries, and particularly so if local institutions are conducive. In our case

study of the Nepali tea value chain, the status of labor, factory, and informal institutions conditioned whether small-scale farmers benefited from upgrading to organic production. The typology of institutional change that emerged from the field data suggests that upgrading encourages value chain actors to craft new livelihood strategies and organizations, which in turn contribute to shifts in informal norms at that node of the value chain. The combined effect of the new institutions, strategies, organizations and norms is felt as livelihood outcomes for chain participants which, in generating new profit opportunities, spur future cycles of change. One upgrading intervention can thus trigger several cycles of institutional change that promote growth and long-term benefits. At the same time, upgrading can yield negative livelihood impacts, at least in the short term, in a process of immiserizing upgrading. This lets lay theories of institutional change and value chain upgrading which presume that these interventions can only improve efficiency and welfare.

Heterogeneity in outcomes from upgrading can thus at least in part be attributed to differences in the institutional setting, and evolution, in different places. Business and development policy-makers could thus enhance the development dividend from upgrading by first assessing institutional constraints and opportunities related to proposed upgrading initiatives, and designing accompanying policies to address these conditions. For example, in the Nepali case, firms upgrading to organic production could have adopted policies to foster immigration of laborers that would have helped households harvest good-quality tea leaf to address labor constraints. Instead of assum-

ing that upgrading is beneficial, such a pragmatic approach could help ensure that disadvantaged suppliers reap the benefits of participation in global value chains.

5.7 Appendix: Figures

Figure 5.1: The Conventional Nepal Orthodox Tea Value Chain

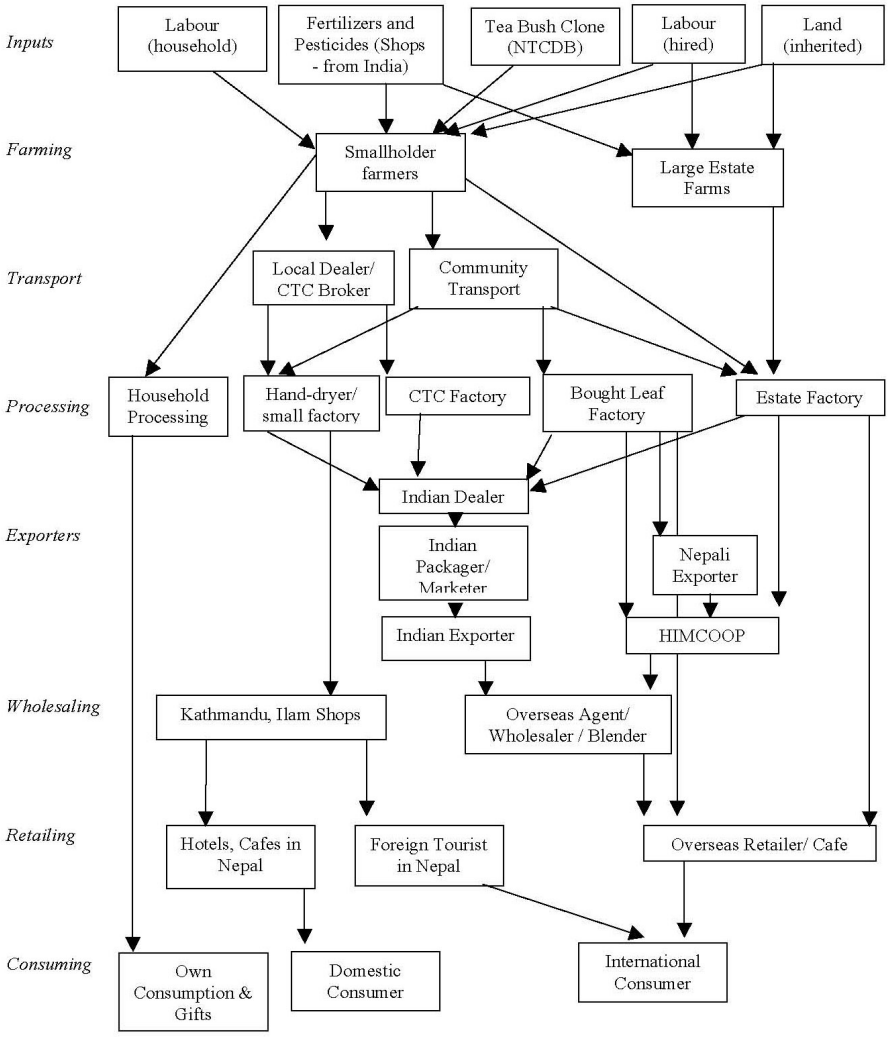


Figure 5.2: The Organic Export Nepal Orthodox Tea Value Chain

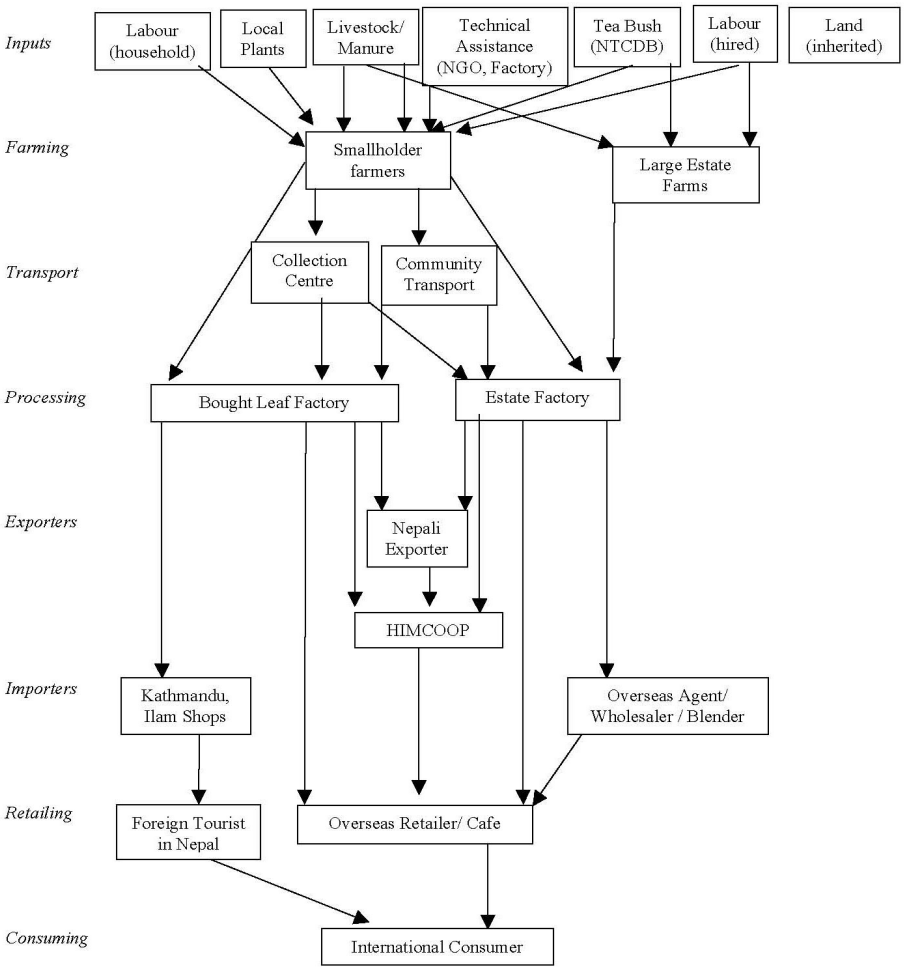
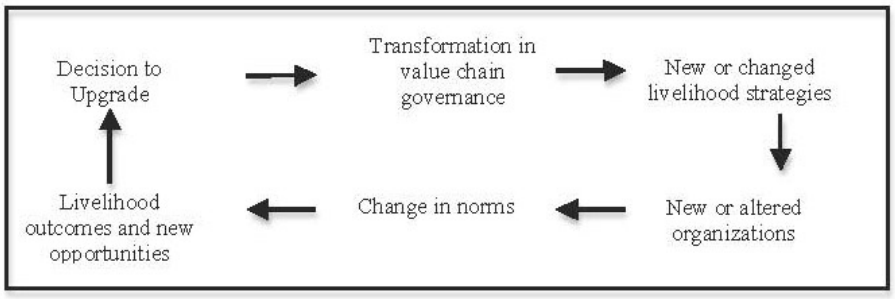


Figure 5.3: The typology of institutional change in the case of the Nepali tea value chain: highlights

Stage	Code of Conduct	Organic
1. Decision to Upgrade	TDA decides to upgrade to eliminate middle men and capture value-added in chain: draft CoC	Factory owners take advice of industry experts, decide to adopt organic standard
2. Governance Shifts	NGOs, factories, cooperatives, auditor all help to implement CoC, including through training	Factory invites cooperatives to get certified, strict rules and three-year conversion process initiated
3. New/Changed Strategies Chosen & Adopted	Some farmers decide to participate in the CoC, others do not; participating farmers notably have to reduce fertilizer/pesticide use & pluck better quality tea leaf	Cooperatives get certified, some farmers choose to join and get certified. Organic strategy includes absolute elimination of chemical use, more labor time, increased investment in livelihood assets, debt
4. New/Changed Organizations	More coordinated network of chain actors; rise of NGOs and development agencies to support the sector; and strengthened cooperatives.	Factories hire NGO experts and staff to provide training and conversion support; cooperatives become key organization mediating between factory and farmer
5. Shift in Informal Norms	Shift towards sustainability norms, particularly long-term soil health.	Pride, environmental and health sustainability, and long-term prospects became important. Culture of peer surveillance arises as bulwark against forbidden chemical use.
6. Livelihood Outcomes Emerge	Productivity decreases in short-term; financial premium nonexistent in most cases; lack of market support	Higher prices; increased stress from high coordination requirements; household burden to acquire inputs, include green fertilizers, more labor; more stable prices; more pride in farming, hopeful for future.

Figure 5.4: Institutional Change Cycle in Value Chains



Chapter 6

Conclusion

In this thesis, I have focused on the economic dynamics of certification to agricultural standards in developing countries. The first part of this work studied the relationship between risk and certification, with a particular focus on how risk aversion affects small-scale farmers' decision to get certified. Chapter 2 provided an analytical framework in which to understand this choice. Results indicate that a relatively risk-averse population of farmers will tend to adopt a high-quality standard in greater numbers. However, changes in the relative profitability of adoption, the degree of consumer differentiation between the two varieties, and the difference in their rejection rates can reverse the direction of this relationship. The presence of the high-quality standard yields positive welfare benefits for farmers so long as the high and low quality products are sufficiently differentiated and the difference in rejection rates is not too high. This analysis sheds light on a positive impact of certification that has been ignored to date, namely that certification can help risk-averse, vulnerable small-scale farmers in the developing world get secure, stable market access to lucrative markets.

Despite sensitivity to market conditions, several general implications remain. Risk aversion has a monotonic impact on farmers' choice of standards in

a closed economy. Another is that producer welfare is increasing in the degree of differentiation of certified and uncertified goods. Lastly, the relative profitability of certified and uncertified markets is shown to be a crucial ingredient affecting risk averse farmers' choice calculus. Indeed, high certified profits can actually amplify the riskiness of getting certified and deter the risk-averse from adopting.

Chapter 4 analysed data from small-scale tea farmers in Nepal to understand the empirical relationship between farmer risk aversion and their certification decision. It found that more risk averse farmers had a higher likelihood of choosing certification in the case study data. These results support the contract farming approach, which predicted that even if the standard is perceived as risky, if it is part of a contract package that provides access to risk protection, it may be relatively more appealing to the risk averse. Risk-averse farmers may be attracted to certification because they perceive it as going hand-in-hand with contracts that reduce exposure to risk. For example, in the case study, Nepali factory owners promised that farmers who were certified to the organic standard would get training, input subsidies, and improved access to markets in the long run. This underscores that how certification is governed influences its risk profile and whether risk averse farmers see it as attractive. The robustness of the finding of a positive and significant relationship between risk aversion and certification across a variety of specifications at the very least questions the assumption of a negative or nonexistent relationship found in the certification literature to date. The

technology adoption hypothesis, which predicted the risk averse would avoid certification, is not borne out by the data. Instead, findings suggest that certification schemes may provide a benefit not yet considered in the literature: that of providing risk-reduction opportunities to risk averse farmers in developing countries.

The second part of the thesis took up the question of the role of certification in sparking processes of institutional change. Chapter 5 analyzed case study data from Nepal and found that endogenous theories of institutional change best reflect the reality of value chains. Results indicate that upgrading to certified organic production triggered a process of institutional change that affected livelihood outcomes. A typology of institutional change in value chains emerges from this research that suggests that agency, organizations, and informal norms affect whether certification yields benefits in a particular place. Analysis highlights how certification is not imposed on passive victims in developing countries; rather, the Nepali case highlights how the standard interacts with local institutions, strategies and organizations to deliver outcomes in the short and long run. The combined effect of the new institutions, strategies, organizations and norms is felt as livelihood outcomes for chain participants which, in generating new profit opportunities, spur future cycles of change. Certification can thus trigger several cycles of institutional change that promote growth and long-term benefits. At the same time, upgrading through certification to standards can yield negative livelihood impacts, at least in the short term, in a process of immiserizing upgrading. This lets lay

theories of certification and value chain upgrading which presume that these interventions can only improve efficiency and welfare.

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