The Role of Trust in Knowledge Acquisition, Technology Adoption and Access to Bank Loans: Results from Field Experiments in the Ecuadorian Amazon

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ABSTRACT

Ecuadorian farmers do not play the investment game (Berg 1995) the same with community farmers as they do with agricultural technicians. Women exhibit a preference for trust in agricultural technicians (vertical trust). Using experimental and survey data from 191 farmers we examine factors associated with 1) farmer trust in community farmers, 2) farmer trust in agricultural technicians, and 3) differences between levels of trust in agricultural technicians and community farmers. Then we explore how our measures of trust correlate with pesticide knowledge and purchase of pesticide safety equipment; in addition, we consider how our measures of trust correlate with accessing bank loans. Farmers who place more trust in community farmers score lower on our pesticide knowledge exam and they are less likely to adopt our pesticide safety equipment technology. We find that farmers who exhibit a preference for trusting agricultural technicians score higher on our pesticide knowledge exam; they are also more likely to report having accessed a bank loan.

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I INTRODUCTION

Sustainable, cost-effective pest management strategies may be key to improving the welfare of farmers around the world. Plant pests and diseases damage crops and cause large economic losses to farmers every year. Farmers often use costly pesticides to combat these plant pests and diseases. Many costs are associated with pesticide use, including purchases, equipment, and time costs. Additional environmental and human health costs can also be significant, though often hidden. While the health costs of pesticide use is unknown, in 1990 there were an estimated 3 million acute pesticide poisonings including 220,000 deaths from pesticides worldwide (Jeyaratnam 1990). This figure may grossly underestimate the incidence of acute pesticide poisonings and does not consider diseases and disorders associated with chronic pesticide exposure. According to the Pan American Health Organization (PAHO) surveillance of acute pesticide poisoning is not well executed in both developed and developing countries because generally only registered hospital reported cases are recorded. In a study of seven countries in Central America, PAHO (2002) estimated that all of the countries registered less than 10% of all acute pesticide poisoning cases. They further report that more than 50% of acute pesticide poisonings occur in developing countries even though use of pesticides is far lower than in developed countries (PAHO 2002). Farmers in developing countries often do not take appropriate safety measures when applying pesticides, leading to significant health costs.

Due to the high costs and dangers associated with their use, pesticides are often not an effective means of combating plant pests. Integrated Pest Management (IPM) technologies can be more effective, while incurring fewer health and environmental costs. Unfortunately, it can be difficult to achieve widespread adoption of IPM technologies, partly because they are

complex and often involve a number of linked practices. For the past two decades there have been significant resources invested into the dissemination of IPM knowledge, especially via Farmer Field Schools (FFS) (Feder et al 2004; Godtland et al 2004). Such direct training is costly, and even if an effective pest management strategy exists, many farmers in developing countries have difficulty learning about and then implementing a new strategy (Feder et al 2004; Rola et al 2002).

Farmers in developing countries often face asymmetric information and high search costs, which compound problems associated with information about pest management techniques. Farmers with little knowledge about pesticides or new pest-control technologies are forced to rely on others for information. Trust is a factor that determines whether farmers accept another person's knowledge as useful. If a farmer does not trust an individual as a source of information then he will be required to continue a search for more trustworthy sources. However, search costs must be balanced against the value of trust. When farmers have more trust in others, the costs of search fall because the likelihood of finding someone who is trusted grows. Trust may help overcome the obstacles of asymmetric information and search costs; it can help facilitate the diffusion of knowledge and technology.

In this study we investigate the role of trust in the acquisition of knowledge among naranjilla farmers in Ecuador. The naranjilla, *Solanum quitoense*, is a fruit plant in the nightshade family primarily grown in Ecuador and Columbia and recently introduced in Central America (Heiser 1999). The naranjilla plant is attacked by a number of pests, such as naranjilla vascular wilt (*Fusarium oxysporum)*, a naranjilla fruit borer (*Neoleucinodes elegantalis)*, a root knot nematode (*Meloidogyne incognita)*, late blight (*Phytopthora infestans*) and anthracnose

(*Colletotrichum gloeosporioides*) (Baez et al 2003; Gallegos 2003). Therefore, naranjilla farmers typically use many different types and large quantities of pesticides.

In Ecuador, the majority of commercial naranjilla cultivation is along the Pastaza River, a tributary of the Amazon (Morton 1987). Because naranjilla production is small-scale in nature, most of the estimated 7,125 households (Andrade 2005) producing naranjilla decide which products, methods, and safety equipment they use in production. Since naranjilla experiences so many pest problems it has become a "frontier" crop. Farmers move their crops to regions where the pests are not so prolific, which typically involves cutting down virgin forest. The result is that naranjilla farmers are isolated both from one another and from locations of commerce. Hence, obtaining new products, methods and safety equipment can be difficult. Moreover, Ecuador has no formal agricultural extension service; instead agricultural education is provided through agricultural technicians employed by municipal governments or via non-governmental organizations. These factors make it difficult to spread knowledge or to transfer a new technology to naranjilla farmers. Adverse conditions for technology transfer are common in many developing countries, and our site is thus an ideal location to investigate the relationship between trust and knowledge acquisition and technology adoption.

Knowledge spread may be enhanced by understanding how trust facilitates interactions between farmers and community members and interactions between farmers and agricultural technicians. We refer to the former as horizontal trust and latter as vertical trust. If trust helps farmers overcome problems of asymmetric information, then it would be interesting to identify those factors associated with horizontal trust and vertical trust. Furthermore, it would be interesting to know how horizontal and vertical trust levels are associated with knowledge levels and outcomes such as technology adoption. Trust may facilitate adoption processes in other

ways. The literature on adoption has long recognized that lack of access to credit is a constraint for many farmers who would like to invest in a new technology. Therefore, it would be interesting to identify how social norms of horizontal and vertical trust are related to accessing bank loans.

This study seeks to add depth to the recent literature on trust and its role in social exchange. Trust has been correlated with economic growth (Knack and Keefer 1997; Zak and Knack 2001), organizational efficiency (Fukuyama 1995), government efficiency (La Porta et al 1997), civic engagement (Brehm and Rahn 1997), increasing village incomes (Narayan and Pritchett 1999) and two-way communication (Fisman and Khanna 1999). Recent experimental studies using the investment game (Berg 1995), also known as the trust game, have found trust measures to be correlated with social distance between truster and trustee (Cardenas 2003; Buchan and Croson 2004; Gatcher, Herrmann and Thoni 2005). Also, experimental trust measures have been associated with lower household log expenditures in rural areas and higher household log expenditures in urban areas (Carter 2003). Individuals living in rural areas may have more horizontal relationships and fewer vertical relationships compared to individuals living in urban areas. According to Carter (2003, p. 32) strong norms of altruism, trust and reciprocity in rural settings, may lead to 'excess sharing' between horizontal relationships; "Platteau suggests [these] may suppress individual incentives, initiative and incomes." At the same time, trust in urban areas may allow individuals to overcome asymmetric information and access vertical relationships with professionals such as bankers, doctors, and agricultural technicians who can provide information yielding high returns (Carter 2003; Szreter and Woolcock 2004).

To date no experimental studies have examined differences between horizontal and vertical trust or investigated factors associated with differences in these two types of trust. Furthermore, no studies have investigated how horizontal and vertical trust may be related to knowledge spread in rural areas of developing countries. Our primary objective is to examine the relationship between trust and farmer knowledge; the secondary objective is to consider associations between trust measures and outcomes including technology adoption and access to credit. We begin with an examination of variables associated with 1) farmer trust in community farmers, 2) farmer trust in agricultural technicians, and 3) differences between levels of trust of agricultural technicians and community farmers. Since there has been criticism of using the investment game to obtain a measure of trust (Karlan 2005) we include a discussion on our measures of trust and important confounding factors such as risk aversion (Schechter 2006). We review the literature on the determinants of trust and discuss the nature of the relationship between trust and knowledge acquisition; new insights may help policy makers and extension services design more efficient outreach programs (Feder et al 2004; Godtland et al 2004; Rola et al 2002). Using a unique data set, we investigate whether the presence of trusting ties between community farmers and professionals is correlated with outcomes associated with higher welfare for farmers. We explore how our measures of trust correlate with pesticide knowledge; in addition, we consider how our measures of trust correlate with adoption of pesticide safety equipment as well as accessing bank loans. We formalize the main hypotheses below.

Hypotheses

1. There is no significant difference in farmers' trust in community farmers compared to the farmers' trust in agricultural technicians.

2. There is no significant difference in pesticide knowledge levels among farmers with different levels of trust in community farmers (horizontal trust).

3. There is no significant difference in pesticide knowledge levels among farmers with different levels of trust in agricultural technicians (vertical trust).

4. There is no significant difference in pesticide knowledge levels among farmers with different levels of trust in community farmers compared to agricultural technicians.

5. There is no significant difference in adoption levels among farmers with different levels of trust in community farmers (horizontal trust).

6. There is no significant difference in adoption levels among farmers with different levels of trust in agricultural technicians (vertical trust).

7. There is no significant difference in adoption levels among farmers with different levels of trust in community farmers compared to agricultural technicians.

8. There is no significant difference in reported bank loan access among farmers with different levels of trust in community farmers (horizontal trust).

9. There is no significant difference in reported bank loan access among farmers with different levels of trust in agricultural technicians (vertical trust).

10. There is no significant difference in reported bank loan access among farmers with different levels of trust in community farmers compared to agricultural technicians.

The remainder of the paper is organized as follows. Section II discusses our experimental trust measures and existing theories on the determinants of trust and the role of trust in knowledge spread. We develop our conceptual framework for building empirical models to identify correlates of trust and how trust may be correlated with knowledge acquisition. We include a discussion of potential concerns in our analysis. Section III introduces our data sources and briefly describes our experimental protocol. In Section IV we provide our econometric identification strategy and in Section V we share our empirical results. We conclude with implications and limitations of the analysis.

II CONCEPTUAL FRAMEWORK: TRUST AND KNOWLEDGE SPREAD

Farmer Field Schools (FFS) and similar types of agricultural training programs are costly because they are time-intensive and require trained professionals to disseminate knowledge and technology. Therefore, the design of efficient programs for knowledge spread is a relevant question; trust levels may inform policy makers and extension services on how to construct more efficient knowledge spread programs. In the following section we discuss some of the theoretical antecedents to our measure of trust and the measure of trust we obtain in our field experiments. We also include a brief discussion of how trust may function in information networks and knowledge spread.

A. Trust

Trust "is an important lubricant of a social system" (Arrow 1974, p.23), because it can help agents' overcome information asymmetries allowing economic transactions to occur that would otherwise not (Durlauf 2002; Karlan 2005). Trust may be partially determined by reputation through repeated interpersonal interactions or may exist due to knowledge about the social contracts and incentives to which agents are beholden (Platteau 1994a, b).

Gambetta (1988, p. 218) states that "trusting a person means believing that when offered the chance, he or she is not likely to behave in a way that is damaging to us." Barr (2003, p. 617) validates these definitions experimentally in Zimbabwe and finds that "trusting behavior is motivated by expectations of trustworthiness." Those in whom we can place trust we call trustworthy. We suggest that agents attach a probability distribution of trustworthiness to each

type of agent with whom they interact. Schechter (2006, p. 2) writes, "a higher level of trust means a subjective [probability] distribution with higher mean and lower variance." Accordingly, an agent will condition their interaction strategy with a new contact on the mean and variance of the probability distribution that they associate with the perceived trustworthiness for the new contact.

B. Economic Field Experiments: Measuring Trust

The economic experiment we employ is called the investment game, commonly called the trust game (Berg 1995). In the trust game there are two players, a truster (also called the sender) and trustee (also called the receptor). Initially, the sender has a given endowment. In the first move, the sender may send part, all or none of his/her endowment to an anonymous person, the receptor. Any money the sender passes to the receptor is tripled; this tripled amount of money is given to the receptor. Then the receptor has the opportunity to return part, none or all of the money they receive to the sender; however, the receptor is under no obligation to return any part of the money. None of these plays are observed by participants; in addition, the participants do not know how much money is returned to them by the receptors until after all plays have been made.

Since the play of the receptor is anonymous and the game is not repeated, we expect the receptor to return nothing to the sender under the assumption that individuals are self-interested. From backward induction the sender identifies the receptor's "return nothing" strategy. Hence, the only sub-game perfect Nash Equilibrium is that the sender sends nothing because he/she expects the receptor to return nothing. However, in both laboratory and field experiments, players rarely play according to this strategy (Barr 2003; Berg 1995; Glaeser, Scheinkman and

Soutter 2000; Schechter 2006). Senders typically send more than nothing. Social scientists often attribute this deviation from expected play to trust[1].

Recently social scientists have questioned whether the action of the sender in the investment game is a measure of trust or just a measure of the propensity to gamble (Eckel and Wilson 2004; Karlan 2005; Schechter 2006). In the laboratory setting, Eckel and Wilson find that experimental measures of trust are not correlated with experimental or survey measures of risk; however, in field experiments, both Karlan and Schechter present evidence that experimental trust measures are partially determined by, or at least associated with, risk behavior. Given that senders in the trust game may, in part, base their play according to risk level, we also have the participants make a risk a decision with monetary rewards at stake; we then control for risk behavior in our analysis to isolate our trust measures.

New research further suggests that trust, measured through the investment game, is correlated with social distance between players (Cardenas 2003; Buchan and Croson 2004; Gatcher et al 2005). Social distance may be measured in a variety of ways. Cardenas (2003) had Columbian students from socially distant academic settings, private and public universities, play the investment game; Buchan and Croson (2004) had students from socially distant cultures, American and Chinese, play the investment game; Gatcher et al (2005) had students from socially different socio-economic backgrounds, rural and urban, play the investment game. These studies capture how trust is correlated with what we might label as horizontal social

[1] The literature also shows that the play of receptors defies game theory's predictions; receptors return money to the senders when we expect them to return nothing. Many social scientists consider the percentage of the money the trustee returns as a measure of the receptor's trustworthiness. Significant debate exists about how to interpret this percentage of money returned; it may be related to the receptor's willingness to reciprocate. Alternatively, we might consider some transformation of this percentage returned as the receptor's value of reputation or honor. In this study we will consider the percentage returned by the trustee as a measure of willingness to reciprocate, which we refer to as 'reciprocity'.

distance because all of the experiments are played between students. Provided that social distance matters, we might wonder how trust correlates with what we might label as vertical social distance. Hence, we have farmers play the trust game with other farmers as well as agricultural technicians. Since the farmers know which class of receptor with whom they are playing, we obtain measures of horizontal and vertical trust. We stress that while participants know which class of receptor they are playing with (community farmer or agricultural technician), the specific identity of the person remains anonymous.

C. Information Networks and Knowledge Spread

Information is known to spread through social networks. Coleman et al (1966) found that physicians who were embedded in medical communities with more interpersonal networks adopted new medical technology before others. Granovetter (1975) showed that information about employment opportunities spread through social networks; individuals embedded in dense social networks improve their chances of obtaining employment. Barr (2000) finds that social networks facilitate flows of technical information among Ghanaian manufacturer enterprises, improving their economic performance.

The idea that knowledge spreads through social networks supports the merits of social capital, but what about when the knowledge is bad? For instance, public health workers in Sub-Saharan Africa might prefer that young women obtain their knowledge about HIV/AIDS and other STDs from a women's clinic rather than from her peers or potential sexual partners. Unfortunately, young women in Sub-Sahara Africa are often embedded in social networks dominated by peers and potential sexual partners; public health workers are typically absent from their social networks. Likewise, agricultural professionals in Ecuador may be frustrated when rural farmers obtain faulty pesticide information from their neighbors or untrained chemical sales

representatives rather than obtaining information about appropriate usage from trained agricultural technicians.

In scenarios such as those described above, trusting ties in an individual's social network may lead to very different outcomes. Trusting ties in horizontal relationships with neighbors or family members, what are sometimes called bonding social capital[2] or bounded social capital[3], may lead to lower levels of knowledge and, hence, poorer welfare outcomes. Trusting ties in vertical relationships with professionals, what is often called bridging social capital[4] or more specifically linking social capital[5], may lead to higher levels of knowledge and, therefore, improved welfare outcomes.

D. Modeling the Role of Horizontal and Vertical Trust in Knowledge Spread

Our interest is in determining how social capital contributes to the flow of knowledge in information networks via horizontal and vertical trust. If community members have less training and high levels of misinformation about pesticides and agricultural technicians have more training and are less likely to share misinformation, then we would expect that trust in community members is negatively correlated with pesticide knowledge while trust in agricultural technicians is positively correlated with pesticide knowledge. More precisely, we expect that farmers who exhibit a preference for vertical trust over horizontal trust defer to agricultural technicians for knowledge when given the choice; hence, they demonstrate higher levels of knowledge. In addition, if trust is associated with pesticide knowledge, then it would be

[2] Bonding social capital refers to the social cohesion within a similar socio-demographic community (Putnam 1993).
[3] Bounded social capital refers to "highly localized ties based on family and other close relationships" (Carter 2003).
[4] Bridging social capital refers to the social cohesion within a dissimilar socio-demographic community (Putnam 1993).
[5] Linking social capital refers to "the norms of respect and networks of trusting relationships between people who are interacting across explicit, formal or institutionalized power or authority gradients in society" (Szreter and Woolcock 2004).

interesting to know which characteristics are associated with horizontal and vertical trust as well as differences between the two, trust preference.

Discussion of Potential Concerns

While our field research design has afforded us a unique data set, there are potential concerns that should be addressed before laying out our empirical identification strategy.

1. Is trusting someone in the trust game equivalent to trusting their farming competence?

We make the assumption that trust in an individual (individual trust) is a proxy for trust in an individual's knowledge (knowledge trust) of farming practices and new technology. We admit that this assumption may be cause for concern; however, we do not require a perfect correlation between individual trust and knowledge trust. Individual trust is a necessary but not a sufficient condition for seeking an individual's advice about farming practices. If a farmer has no individual trust in an agricultural technician then the farmer is unlikely to seek out their farming advice even if he/she has knowledge trust in the technician—individual trust is a necessary condition. Alternatively, a farmer may have individual trust in his/her father, but if he/she does not have knowledge trust then it is unlikely that the farmer will utilize the father as a source of farming advice—individual trust is not sufficient.

We contend that if the condition for individual trust is satisfied for an agricultural technician then it is highly probable that the condition of knowledge trust will be satisfied; farmers recognize agricultural technicians have more education and experience related to pest management and will thus have knowledge trust in them. Also, we contend that if a farmer trusts other community members then it is likely that they will be able to find a community member among many in whom they can place knowledge trust. Considering this discussion, it is

reasonable to assume that individual trust is a proxy for knowledge trust, both in agricultural technicians as well as in community members.

To summarize, our thread of thought is predicated on the following assumptions:

(i) Individual trust is a proxy for knowledge trust which is correlated with whom farmers seek out for farming advice;

(ii) Community members generally have low levels of knowledge;

(iii) Agricultural technicians have high levels of knowledge.

Given (i), (ii) and (iii) we expect:

(iv) Horizontal trust is negatively correlated with knowledge scores;

(v) Vertical trust is positively correlated with knowledge scores;

(vi) Farmers who have stronger preferences for vertical trust over horizontal trust have higher knowledge scores.

2. If rural farmers do not have access to vertical trusting ties, i.e. they have never interacted with professional agricultural technicians, then how would our study detect vertical trust being associated with levels of knowledge?

Approximately 60% of the farmer participants came from Santa Clara County where farmers widely reported that they had never attended training or workshops on naranjilla farming; our workshop was their first experience with formalized training. The other 40% came from Triunfo County where many farmers reported having had previous opportunities to attend workshops.

In locales such as Triunfo, where training workshops have occurred, we expect vertical trust to be positively correlated with pesticide knowledge. Those who trust agricultural technicians have had opportunities to access these professionals for knowledge. Alternatively, farmers who have accessed agricultural technicians may have received good knowledge from these professionals and so now exhibit higher levels of trust in agricultural technicians. In areas such as Santa Clara, where few training workshops or other opportunities for farmers to access professionals have occurred, we expect to find no relationship between vertical trust and pesticide knowledge.

When we consider our samples as a whole, we still expect vertical trust to be positively associated with knowledge and horizontal trust to be negatively associated with knowledge after controlling for county. Even without training workshops or regular visits by agricultural technicians to a community, vertical trusting ties may still lubricate social exchange between farmers and more informed individuals. Farmers with more vertical trust and or a preference for vertical trust may defer to individuals who are even slightly more knowledgeable. For instance, when farmers go to Ecuador's main trade and distribution center for naranjilla, they may acquire information from the distributors or other semi-qualified professionals. Alternatively, farmers who have had positive experiences with distributors or semi-trained professionals may have higher vertical trust levels. These information channels are hard to identify, but they exist, and cumulatively they may have a significant association with knowledge.

III DATA SOURCES[6]

[6] Please see Appendices A and B for the complete experimental protocol.

We have experimental observations from 191 naranjilla farmers from two areas in the Ecuadorian Upper Amazon Basin. These farmers played the sender role, truster, in the trust game (Berg 1995) against other farmers and then against agricultural technicians. Participants also played a risk game designed by Schechter (2006) and were asked to complete an extensive survey on demographic, socioeconomic and other characteristics; they also completed a pesticide knowledge exam.

We collected data from five sites in two adjacent counties of the Pastaza province in the Eastern slopes of the Ecuadorian Andes over a period of seven days. In one site we had three experimental sessions, and at the others we had two each. Each workshop day began by randomly dividing the farmers into experimental groups ('Group 1' and 'Group 2'). In the morning, Group 1 attended a 3 1/2 hour seminar given by an agricultural technician on IPM and appropriate pesticide use; Group 2 attended a 3 1/2 hour session where they participated in economic experiments designed to measure trust, reciprocity and risk[7,8]. While they waited to participate in the experiments, attendees completed a one-on-one survey, which included a knowledge exam. In the afternoon the groups switched activities. At the end of the day the farmers were given the opportunity to purchase protective gear such as masks and goggles. Their purchases were recorded.

The set up of our field experiments has allowed us to make contributions to the literature of field experimental economics. First, for each farmer we have a measure of trust in other farmers and a separate measure of trust in agricultural technicians, which we call horizontal and vertical trust respectively. Second, approximately half the farmers played the trust game

[7] Like other field experiments (Barr 2003; Karlan 2005; Schechter 2006), our experiments were not run double-blind in order to make sure that farmers understood the game.
[8] In each game farmers received an endowment of five fake one dollar bills. We divided their winnings by four at the end of the day so their true endowment in each game was $1.25.

immediately following an IPM seminar where they interacted with an agricultural technician; the other half played with no such interaction prior to the trust game. Finally, we gave farmers the opportunity to purchase pesticide safety equipment at the end of the day; this in itself is a form of technology adoption. Through purchase decisions, we observed the farmers' behavior rather than relying on self-reporting of technology adoption decisions.

IV EMPIRICAL METHODS

Our empirical methods consist of econometric models to (i) investigate levels of trust and (ii) explore how trust levels relate to knowledge levels, technology adoption and access to bank loans. Per Carter (2003) we begin with a 'tangible assets model', which includes physical and human capital variables, basic demographic variables, and farm-level and field day variables. Then we develop a 'social norms model', which includes those variables from the tangible assets model as well as variables from our field economic experiments that measure behavioral social norms[9].

Correlates of Trust

In equations (1) through (3) we present econometric models identifying the correlates of horizontal and vertical trust[10]. We then take the difference between these two measures to identify characteristics associated with differences in horizontal and vertical trust. The OLS specifications of the econometric models for the trust measures are:

[9] Unlike Carter (2003) we do not present an 'Associational Model' with variables for group memberships although we analyzed such a model with no interesting results.

[10] For brevity we only present social norms econometric models; the tangible assets model is identical except that the behavioral social norms variables, Y_i, are removed.

$$HTrust_i = \beta_{H_0} + \beta_{H_1}^{'} X_i + \beta_{H_2}^{'} Y_i + \beta_{H_3}^{'} Z_i + \varepsilon_{i,H} \quad (1)$$

$$VTrust_i = \beta_{V_0} + \beta_{V_1}^{'} X_i + \beta_{V_2}^{'} Y_i + \beta_{V_3}^{'} Z_i + \varepsilon_{i,V} \quad (2)$$

$$VTrust_i - HTrust_i = Diff_i = \beta_{D_0} + \beta_{D_1}^{'} X_i + \beta_{D_2}^{'} Y_i + \beta_{D_3}^{'} Z_i + \varepsilon_{i,D} \quad (3)$$

where $HTrust_i$ (horizontal trust) is the number of dollars passed from the i^{th} sender to an unknown community member, $VTrust_i$ (vertical trust) is the number of dollars passed from the i^{th} sender to an unknown agricultural technician. The right hand side variables are identical in each of these regressions; X_i is a vector of physical and human capital variables, basic demographic and farm-level variables; Y_i is a vector of experimental measures controlling for risk behavior and reciprocity levels; Z_i is a vector of field day characteristics[11].

Correlates of Farmer Outcomes: Knowledge, Technology Adoption and Bank Loans

In equations (4) and (5) we present econometric models of the correlates of knowledge and technology adoption. We estimate knowledge according to household and field day characteristics, experimental measures of risk behavior, and reciprocity and trust levels as well as history of pesticide use. The OLS specification of the econometric model for knowledge is:

$$Knowledge_i = \beta_{K_0} + \beta_{K_1}^{'} X_i + \beta_{K_2}^{'} Y_i + \beta_{K_3}^{'} Z_i + \beta_{K_4} (Pesticide_i) + \varepsilon_{i,K} \quad (4)$$

[11] We control for two field day characteristics, 'Seminar' and 'Argue'. The variable 'Seminar' is a dummy variable for whether or not the farmers attended the seminar given by an agricultural technician before participating in the economic experiments. We hypothesize that those farmers who attended the seminar first are more likely to trust agricultural technicians more than those who participated in the experiment first. The variable 'Argue' is dummy variable for whether or not the farmers were involved in an argument with the enumerators. On the second day of field experiments there were so many attendees that we had to divide them in to three groups; they were sent to three different buildings. In the group of farmers that started in the seminar first and then the surveys second, began an argument with enumerators and refused to complete the surveys. They demanded to meet with me to discuss why they were filling out the surveys. I was able to resolve the situation and the angry farmers became friendly with me and the enumerators. They were embarrassed for causing the disturbance and reconciled themselves by being extra-cooperative.

where $Knowledge_i$ is the percentage of correct answers on the knowledge exam[12]. In equation (4) we have X_i as before; Y_i is a vector of experimental variables controlling for risk behavior, reciprocity and trust levels; Z_i, controls for *Seminar*; *Pesticide* is a dummy variable for whether or not farmers started using pesticides more than five years ago. To better isolate the role of trust in knowledge spread for each county we also run separate regressions of (4) for each county, Santa Clara and Triunfo.

As with many studies of social capital there exists the concern of reverse causality. Does trust enable farmers to overcome asymmetric information and seek out farming advice, or do interpersonal interactions with others increase knowledge and farming outcomes, which then increase levels of trust? Identifying the direction of causality between social capital and related outcomes is an on going problem in the social sciences. Recent studies on social capital admit that identifying appropriate instrumental variables to solve the endogenous variable problem is difficult (Carter 2003; Durlauf 2000; Miguel, Gertler and Levine 2006). In many cases, causality probably functions in both directions. Positive experiences with agricultural technicians that provide useful information develop a farmer's trust in agricultural technicians. At the same time, farmers with more trust in agricultural technicians (or who prefer trusting agricultural technicians over other farmers) may be more likely to defer to agricultural technicians as sources of information.

We unfortunately are not able to identify adequate instrumental variables for our analysis. This is due to the fact that it is difficult to find variables that are correlated with the trust measures, but are not correlated with knowledge. However, our study design allows us to elicit some evidence that causality can go from vertical trust to seeking out agricultural technicians

[12] The knowledge exam was comprised of 12 basic questions about the two most common pesticides in the Upper Amazon Basin of Ecuador, Monitor and Furadan.

and, hence, more knowledge. We have some farmers attend the seminar first and then take the knowledge exam and other farmers take the knowledge exam first and then attend the seminar. If vertical trust leads farmers to seek out agricultural technicians then farmers with high levels of vertical trust who attend the seminar first might have higher knowledge scores. The underlying argument is that a high level of trust in agricultural technicians would create more incentives to pay attention during the seminar and, thus, acquire knowledge. Likewise, farmers taking the knowledge exam before attending the seminar might not exhibit as strong a relationship between vertical trust levels and knowledge scores, because they would have had no opportunity to operationalize their vertical trust. To test our theory we run separate regressions of (4) by seminar group.

Finally, we investigate the relationship between trust and adoption of safety equipment technology as well as the relationship between trust and access to bank loans. The probit specification of the econometric model for adoption is:

$$Adoption_i = \beta_{A_0} + \beta_{A_1}^{'} X_i + \beta_{A_2}^{'} Y_i + \varepsilon_{i,A} \qquad (5)$$

where $Adoption_i$ is a dummy variable for whether or not farmers purchased one of four safety equipment items at the end of the field day. We estimate adoption according to X_i as before and Y_i, experimental measures of risk behavior, and reciprocity and trust levels[13]. The Probit specification of the econometric model for *Loan* has the same right hand side variables and functional form as the model for *Adoption*.

[13] We also ran a regression that included a dummy variable for whether or not the farmer had experienced pesticide poisoning; however, the coefficient was close to zero and statistically insignificant.

Table 1. Description of Variables

VARIABLE	Description
Male	1=Male; 0=Female
Age	Age in years divided by 100.
Basic Education	1=Graduated 6th grade, but not secondary school.; 0=Did not graduate 6th grade or did graduate secondary school.
Advanced Education	1=Graduated secondary school; 0=Did not graduate secondary school.
Household	Number of members in the household.
Wealth	Sum of dummy variables for running water, electricity, gas, refrigerator, stove/oven; takes on values between 0 and 5.
Medium Farm	1=20-60 hectares; 0=Less than 20 hectares or more than 60 hectares
Large Farm	1=More than 60 hectares; 0=Less than 60 hectares
County	1=Triunfo; 0=Santa Clara
Seminar	1=Attended the seminar first; 0=Attended the experiment first
Argue	1=In the experiment group that argued with me; 0=Not in the group that argued with me
Bet	Amount out of five dollars bet in the risk game; may take on integer values from 0 to 5.
Reciprocity	Computed by adding the shares a farmer reported they would return to an anonymous farmer if they received 3, 6, 9, 12, or 15 dollars in an envelope. This sum is then divided by 45=(3+6+9+12+15); then we multiply by 5 to compute level of reciprocity on a five point scale.
Pesticide	1=Adopted pesticide use more than five years ago; 0=Otherwise.
HTrust	Amount out of five dollars sent in the trust game to an anonymous farmer; may take on integer values from 0 to 5.
VTrust	Amount out of five dollars sent in the trust game to an anonymous agricultural technician; may take on integer values from 0 to 5.
Diff	VTrust minus HTrust; may take on integer values from -5 to 5.
Knowledge	Farmers were asked twelve basic questions about the two most common pesticides (Monitor and Furadan). We asked simple questions such as, "Does this kill the fruit worm?" and "Does this kill fungus?". The knowledge scores are reported as percentages and so may take on values from 0 to 100.
Adoption	1=Adopted a technology; 0=Did not adopt a technology. At the end of the day the farmers had the opportunity to purchase safety equipment including goggles, gloves, ponchos and masks. This in itself is a form of adoption; farmers 'adopted' if they purchased any one of the items.
Loan	1=Accessed a loan from a bank; 0=Have not accessed a loan from a bank.

V RESULTS

A. Summary Statistics

Our sample of farmers is diverse in age, education, wealth and family size, and a significant portion of farmers were female (28%) and attended high school (17%). Approximately 60% of our participants came from Santa Clara County while the rest were from

Triunfo County. About 60% of the farmers attended the seminar before participating in the experiments and completing the pesticide knowledge exam.

Table 2. Summary Statistics

VARIABLE	Mean/%	Min	Max
Age	38.88	14	80
Education (years)	6.67	0	15
Wealth	2.54	0	5
Male	72.2%		
Basic Education	61.6%		
Advanced Education	17.2%		
Medium Farm	62.1%		
Large Farm	8.0%		
Santa Clara Canton	62.3%		
First Seminar Group	58.9%		
Argument Occurred	9.7%		
Pesticide[1]	38.0%		
Bet	2.3	0	5
Sent in Trust Game w/ Farmer	2.20	0	5
Sent in Trust Game w/ Ag. Tech.	2.29	0	5
Share returned by Trustee	37.9%	0%	89.0%
Knowledge Score[2]	55.0%	0.0%	100.0%
Adoption	49.0%		
Loan[3]	26.8%		
No. of Obs.	194		

1 No. of Obs. 162, 2 No. of Obs. 145; 3 No. of Obs 162

In our economic experiments we obtain similar results as those of Schechter (2006), who played the trust and risk game in Paraguay. In the Paraguay study participants played the risk game and both roles in the trust game. An important difference between these two studies is that our study has farmers play the trust game with agricultural technicians in addition to playing the trust game with people from their own community. In the Paraguay study participants sent about 46% of their initial endowment, in our study participants sent to other farmers about 44% of their initial endowment; to agricultural technicians they sent 46% of their initial endowment. In the Paraguay study, participants bet about 43% of their initial endowment; in our study they bet 46%

of their initial endowment. Schechter's study, like ours, found that "trust did pay;" participants returned on average about 38% of what they were sent. It is also interesting to note that both studies found that receptors returned more when they received more from the sender; however, when receptors were given more they returned a smaller percentage of what they were given. As Schechter points out "it seemed much easier for the trustees to be 'fair' when the stakes were small, but when they were faced with splitting two days' wages (especially women who seldom have access to money of their own) they were tempted to keep a larger share" (2006, p. 6). The comparability of the Paraguay and Ecuador data supports the validity of the field experiments among Ecuadorian farmers.

Table 3. Comparison of Investment Games

	Paraguay[1]	Ecuador
Number of Players	188	191
Initial Endowment Size (US$)	$1.67	$1.25
Mean Investment in Farmer[2]	0.46	0.44
Mean Investment in Ag. Technician		0.46
Mean Response of tripled investment	0.43	0.38
Mean Bet	0.43	0.46

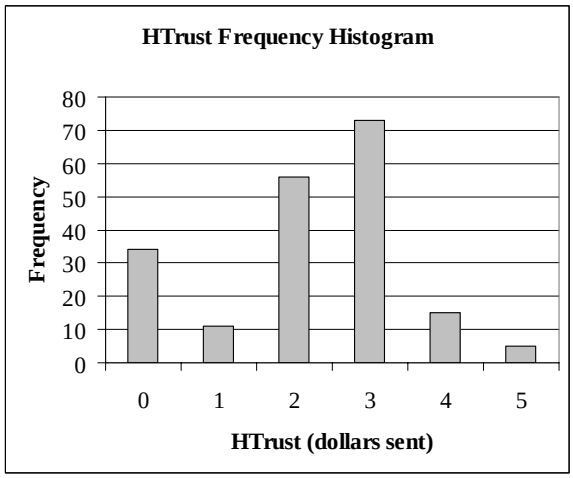
[1]Results from Schechter 2006. [2]Results are shown as a proportion of the initial endowment

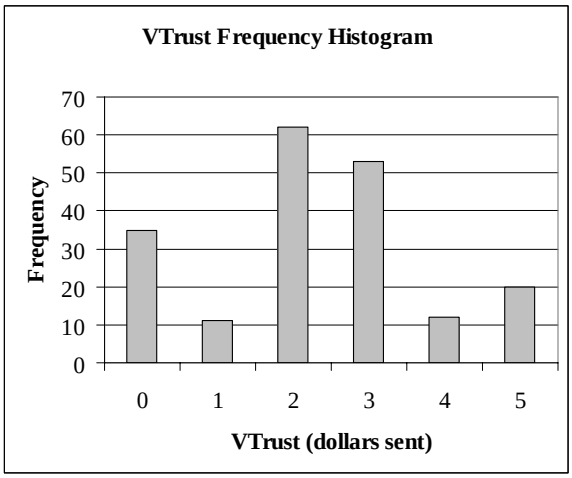
In further analysis of the experimental data from Ecuador we find the following. When farmers played the trust game with an anonymous farmer from their community an average of 2.20 dollars was sent; 17% of the farmers sent nothing while less than 3% sent all five dollars. When farmers played the trust game with an anonymous agricultural technician an average of 2.30 dollars was sent; 18% of the farmers sent nothing while over 10% of the farmers sent all five dollars. While a Wilcoxon-Signed Rank Test can not reject the null hypothesis that the median value sent to farmers was identical to the median value sent to agricultural technicians, we find that less than 30% of the farmers played the trust game the same with an agricultural technician as they did with a farmer from their community. Moreover, an Epps-Singleton (1986)

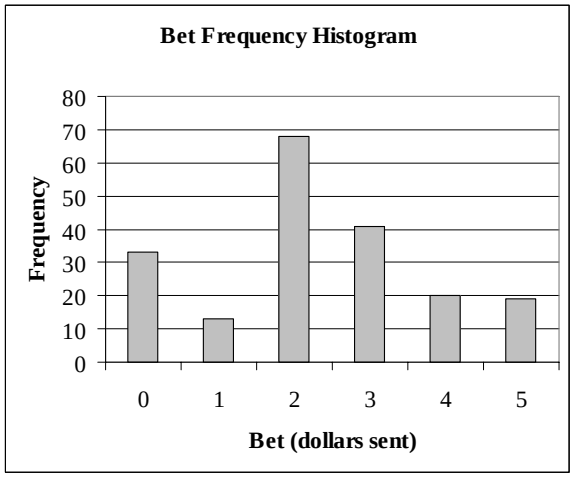
test indicates that the difference in distribution is significant at the 5% level (p-value 0.012). This suggests, despite no significant difference in play of the two trust games across the sample, farmers may not view the trust game with farmers as the same as the trust game with agricultural technicians.

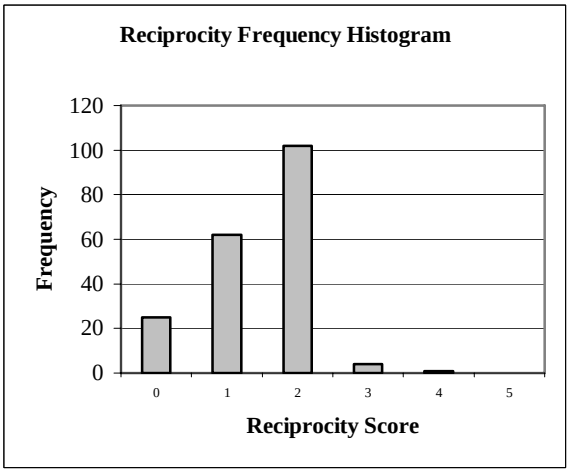
In the risk game an average of 2.30 dollars was bet; 17% of farmers bet nothing and just under 10% of farmers bet everything. A Wilcoxon-Signed Rank Test can not reject the null hypothesis that the median value bet in the risk game is identical to the amount sent in either of the trust games. However, we find that only 32% of the farmers played the risk game the same as they played the trust game with farmers, and only 26% played the risk game the same as they played the trust game with agricultural technicians. Although the average amount sent in each of the trust games and risk game are similar, less than 11% of the farmers played the same in all three games and over a third did not play the same in any of the three games. Despite the finding that farmers played the games similarly across the sample, individually, they may have played the games differently. An Epps-Singleton test for equality of distributions rejects the hypothesis that there is no difference in the distribution of play in the risk game and play of the trust game with farmers. This is evidence that farmers are not treating the trust game with farmers and the risk game the same. However, the same test could not reject the hypothesis that there is no difference in the distribution of play in the risk game and play of the trust game with agricultural technicians. This suggests that farmers may be framing the trust game with agricultural technicians and the risk game as the same. If this is the case then we expect play in the risk game to be predictive of play in the trust game against agricultural technicians; we test this in the next subsection.

Figure 1a,b,c,d.









B. Regression Results for Trust Measures

Horizontal Trust

In table 4 we present our results from the regressions on *HTrust*, *VTrust*, and *Diff* (*Vtrust-HTrust*). In column (1) we present the tangible assets model and find that the only statistically significant correlates of horizontal trust are *Male* and *Large Farm*; none of the other variables including *Age*, *Basic Education*, *Advanced Education*, *Wealth*, or *Household* are significant. Previous research has found that men trust more than women in the trust game (Chaudhuri and Gangedharan 2002; Eckel and Wilson 2000), although Schechter (2006) attributes difference in play to risk behavior. Results for the social norms model, with risk behavior included, are

presented in column (2). The results verify Schechter's finding that play in the trust game is related to risk behavior. Similar to Schechter we find that after controlling for risk behavior that women and men do not trust differently. However, after controlling for risk behavior we still find that participants with larger farms trust other farmers more. During the interviews many of the participants with larger farms reported hiring local farmers for labor. Perhaps hiring laborers is a way to develop personalized trust with local farmers. These findings may also reflect power relations: larger farm owners may feel that neighbors respect them and return this respect with trust.

Vertical Trust

In column (3) we present the tangible assets model and find that the only statistically significant correlates of vertical trust are *Age*, *County*, *Argue*; none of the other variables, most notably *Male*, are significant correlates of vertical trust. In column (4) the social norms model regression results are presented. Contrary to the results in the previous subsection that suggests farmers may frame the trust game with agricultural technicians as the same as the risk game, we find that risk behavior does not explain variation in play of the trust game against agricultural technicians. In the regression on *Vtrust* presented in column (4), *County*, *Argue*, and *Reciprocity* are the only significant correlates of vertical trust. It is not surprising that *County* is significant when we consider that farmers from Santa Clara report that they have never participated in farmer field days or workshops with agricultural technicians; farmers in Triunfo have participated in such events. Perhaps farmers in Triunfo have more vertical trust because of positive past experiences with agricultural technicians.

Table 4. Trust Regressions

VARIABLE	Horizontal Trust (1)	Horizontal Trust (2)	Vertical Trust (3)	Vertical Trust (4)	Diff (VTrust-HTrust) (5)	Diff (VTrust-HTrust) (6)
Male	0.480**	0.332	-0.317	-0.429	-0.797	-0.760
	0.031	*0.145*	*0.232*	*0.101*	*0.010*	*0.016*
Age	0.235	-0.077	1.575*	1.254	1.340	1.330
	0.768	*0.926*	*0.053*	*0.135*	*0.183*	*0.185*
Basic Edu.	0.242	0.238	0.033	0.001	-0.209	-0.237
	0.451	*0.433*	*0.920*	*0.998*	*0.624*	*0.575*
Advanced Edu.	-0.089	0.058	-0.152	-0.046	-0.063	-0.104
	0.833	*0.885*	*0.714*	*0.910*	*0.907*	*0.847*
Household	0.013	0.005	-0.006	-0.013	-0.020	-0.019
	0.692	*0.871*	*0.855*	*0.709*	*0.666*	*0.686*
Wealth	-0.050	-0.052	-0.013	-0.009	0.037	0.043
	0.412	*0.395*	*0.841*	*0.893*	*0.629*	*0.573*
Medium Farm	0.358	0.407*	-0.173	-0.150	-0.531	-0.557
	0.124	*0.078*	*0.511*	*0.561*	*0.084*	*0.067*
Large Farm	0.639*	0.689*	-0.614	-0.525	-1.253	-1.215
	0.076	*0.051*	*0.160*	*0.257*	*0.024*	*0.032*
County	0.170	0.008	0.859***	0.721***	0.688**	0.713**
	0.412	*0.969*	*0.000*	*0.002*	*0.011*	*0.011*
Seminar	0.224	0.174	0.005	-0.011	-0.219	-0.185
	0.230	*0.341*	*0.980*	*0.960*	*0.407*	*0.484*
Argue	-0.290	-0.334	0.672*	0.642*	0.963*	0.975*
	0.469	*0.391*	*0.075*	*0.080*	*0.068*	*0.059*
Bet		0.206***		0.113		-0.093
		0.004		*0.136*		*0.350*
Reciprocity		0.155		0.305**		0.149
		0.247		*0.046*		*0.431*

OLS with robust standard errors, p-values reported beneath coefficients

* 90%, ** 95%, and *** 99% significant; based on 191 observations

The experimental measure of reciprocity with farmers is weakly associated with *VTrust*. Recall that the reciprocity measure is determined by the play of the receptor (truster) in the trust game between two farmers; it is the share returned to a farmer by a farmer. Our regression results suggest that a farmer's willingness to reciprocate is associated with higher trust in agricultural technicians. Perhaps the farmers who returned more to the senders did so out of respect for social contracts. If they also perceive that professionals, such as agricultural technicians, have more incentive to respect social contracts then we would expect such farmers to pass more money to agricultural technicians; these farmers have the expectation that professionals would reciprocate.

Finally, we found that the variable *Argue* is loosely associated with play in the trust game against agricultural technicians. An argument occurred before one game session; the issue was resolved and a positive trusting tie was formed between the participants, enumerators and managers of the game. We suggest that that these farmers trusted agricultural technicians more because they felt they could trust those running the workshop, individuals whom they perceived in some sense as agricultural technicians.

Difference in Trust (VTrust-HTrust)

Our third regression on *Diff* provides insight into those factors associated with difference in play of the trust games. We noted earlier that women and men did not have different trust behaviors after controlling for risk. However, if we consider individual observations we find that women are more likely to send money to agricultural technicians than to farmers. This suggests that gender is associated with how farmers perceive different trust relationships.

The results for the regression on *Diff* also show that farm size is associated with difference in trust levels; farmers with larger farms trust farmers more than they trust agricultural professionals. One possible explanation is that the trusting behavior of farmers with larger farms is driven by their relationships with their laborers. They have developed personal trust with their horizontal relationships and so feel more comfortable investing money in their community members. Farmers with larger farms may have had more interactions with local and provincial governments. If these farmers had negative interactions with local and provincial governments then this would be reason to have less trust in professionals associated with governments, such as agricultural technicians, than in their community members. Alternatively, these findings may reflect power relations: larger farm owners may feel respected by their neighbors and return this respect with trust; larger farm owners may feel less respect from agricultural technicians and so reciprocate less.

We also note that both *County* and *Argue* are statistically significant explanatory variables; farmers from Triunfo demonstrate more vertical trust than horizontal trust and farmers who experienced an argument with agricultural technicians also demonstrated more vertical trust than horizontal trust. These results corroborate with evidence from the regression on *VTrust* that past positive experiences with agricultural technicians may increase level of trust in agricultural technicians relative to community members[14]. We address the question on causality more fully in the following subsection (C).

[14] It is interesting to note that in the regression on *HTrust* both *County* and *Argue* have coefficients much closer to zero and that there is little correlation between them and *HTrust*. This makes sense: if horizontal relationships function similarly in the two counties then we would not expect *County* to be significant. Likewise, an argument between farmers and agricultural technicians should not affect farmers' levels of horizontal trust.

Table 5. Knowledge Regressions

VARIABLE	Knowledge (1)	(2)	(3)	(4)
Male	2.786	4.508	4.438	4.507
	0.455	*0.259*	*0.269*	*0.250*
Age	-15.523	-14.596	-15.032	-14.556
	0.278	*0.324*	*0.303*	*0.309*
Basic Edu.	4.994	4.784	4.688	6.119
	0.331	*0.344*	*0.348*	*0.226*
Advanced Edu.	6.951	5.836	5.539	7.395
	0.324	*0.424*	*0.446*	*0.310*
Household	-1.017	-0.702	-0.695	-0.529
	0.121	*0.305*	*0.305*	*0.442*
Wealth	-0.346	-0.367	-0.315	-0.310
	0.739	*0.721*	*0.760*	*0.762*
Medium Farm	4.782	5.075	4.839	5.109
	0.163	*0.156*	*0.174*	*0.145*
Large Farm	-12.723	-10.082	-9.905	-9.606
	0.137	*0.204*	*0.213*	*0.215*
County	6.810*	6.625	6.293	7.123
	0.099	*0.116*	*0.136*	*0.090*
Seminar	5.096	5.868*	5.711*	5.196
	0.124	*0.082*	*0.088*	*0.118*
Pesticide	11.010***	12.654***	12.435***	12.448***
	0.002	*0.000*	*0.000*	*0.000*
Bet		-0.976	-1.144	-1.041
		0.397	*0.313*	*0.350*
Reciprocity		-4.846**	-5.050**	-5.257**
		0.027	*0.021*	*0.016*
HTrust		-2.718**		
		0.049		
VTrust		1.484		
		0.197		
Diff			1.960*	
			0.066	
Relative Diff				3.368*
				0.053

OLS with robust standard errors, p-values reported beneath coefficients
* 90%, ** 95%, and *** 99% significant; based on 132 observations

Knowledge

Column (2) of table 5 shows that the variables *Seminar*, *Pesticide*, *HTrust* and *Reciprocity* are statistically significant explanatory variables for *Knowledge* about pesticides. Attending the seminar before taking the knowledge exam is associated with a 5.7% increase in the score. Using pesticides for more than five years is associated with a 12.4% increase on the exam score. One more dollar sent to another farmer (horizontal trust) is associated with a 2.7% decrease on the exam score. A 10% increase in the amount returned to the original farmers is associated with a 2.5% decrease on the exam score.

In column (3) of table 5 we have regression results similar to column (2); however, we replace *HTrust* and *VTrust* with *Diff* to investigate whether farmers who have a preference for vertical trust over horizontal trust exhibit higher levels of pesticide knowledge. We find that *Diff* is positively associated with knowledge scores; each additional dollar sent to an agricultural technician than sent to a farmer is associated with approximately 2% increase on the exam score. One way to interpret this finding is that farmers defer to sources they trust more for knowledge. This result also indicates who farmers trust more and the magnitude in the differential between vertical and horizontal trust are both important. If a farmer only trusts agricultural technicians slightly more than his or her neighbors then paying the extra transaction costs[15] to seek out an agricultural technician may not be worth the extra confidence in the farmer's knowledge source. However, if he or she trusts agricultural technicians much more than his or her neighbors then the extra confidence in the knowledge source may be worth the extra transaction costs.

One might wonder if a difference of one (*Diff*=1) has the same effect on knowledge for a farmer when *HTrust*=4 and *VTrust*=5 (a 25% increase in vertical trust over horizontal trust)

[15] Transaction costs to access an agricultural technician are generally much higher than to access a community farmer.

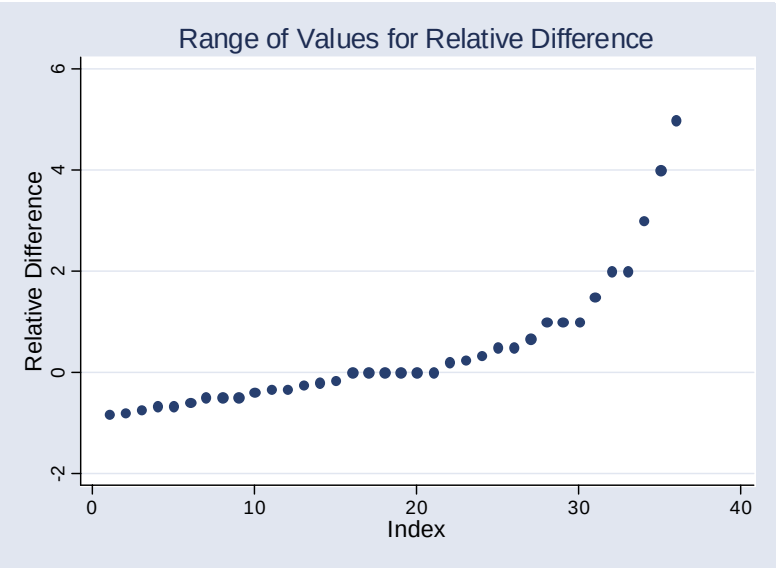
compared to a farmer with *HTrust*=1 and *VTrust*=2 (a 100% increase in vertical trust over horizontal trust). We run a fourth regression on knowledge and replace *Diff* with an alternative measure of change in trust, *Relative Diff*, which is computed according to the following formula:

Relative Diff = (*VTrust-HTrust*)/(*HTrust +1)*

While not a measure of percent increase in vertical trust with respect to horizontal trust, *Relative Diff* has some appealing properties[16]. Most important, this measure weights a 100% increase in vertical trust over horizontal trust more than a 25% increase in vertical trust over horizontal trust. In addition, *Relative Diff* puts less importance on relative decreases in vertical trust under horizontal trust. This is appealing because the transaction costs of seeking out a neighbor for advice is relatively small compared to seeking out an agricultural technician. If a farmer trusts community farmers more than agricultural technicians then the difference in transaction costs would not re-direct a farmer wanting advice to agricultural technicians. However, if a farmer trusts agricultural technicians more than community farmers, the high transaction costs of seeking out an agricultural technician may re-direct a farmer wanting advice toward community members. The range of values for *Relative Diff* is appropriate to test the significance of the relative difference between horizontal and vertical trust, because it permits wide variation when vertical trust is greater than horizontal trust; it permits less variation when horizontal trust is greater than vertical trust. Figure 2 graphs the range of values for *Relative Diff*.

[16] We must add one to *HTrust* in the denominator in order to avoid dividing by zero for some observations.

Figure 2.



In column (4) of table 5 we show the regression results replacing *Diff* with *Relative Diff*. None of the coefficients or p-values change significantly for the other variables, although we find that *Relative Diff* has a similar level of significance to *Diff*, suggesting that preferences for information sources are associated with relative levels of trust between competing sources of information.

These results suggest that horizontal trust may facilitate interactions between farmers that spread bad information about pesticides; alternatively, vertical trust may facilitate interactions between farmers and agricultural professionals and, hence, share 'good' knowledge. Farmers may operationalize their vertical trust to attend formal training workshops provided by agricultural technicians. Also, farmers may operationalize their vertical trust in informal settings by systematically deferring to individuals with more agricultural training. For instance, at the naranjilla trade and distribution center in Ambato, Ecuador, farmers with higher vertical trust than horizontal trust may pay more attention to farmers or technicians with more professional training.

Difference in trust may be an indicator of confidence in agricultural technicians over community farmers. Consider the following scenarios: A community farmer informs Farmer A that Monitor (an insecticide) is used to kill fungus. An agricultural technician at the trade center tells Farmer A that Monitor is used to kill fruit worm. If Farmer A trusts agricultural technicians slightly more than community farmers then Farmer A might be more willing to use Monitor to treat the fungus problem. However, if he or she trusts agricultural technicians much more than community members then he or she might consider using Monitor to treat the problem as a waste of resources.

We expect the returns to vertical trust to be highest when farmers have had more viable options to invest their vertical trust in professionals. For example, vertical trust may facilitate exchange more effectively when opportunities, such as training workshops, are available compared to when opportunities to interact with agricultural technicians are not available. To examine this hypothesis we run two separate knowledge regressions[17]. One regression is run using 70 observations from farmers in Santa Clara, where there have been fewer viable options to interact with agricultural technicians. The other regression is run using 62 observations from farmers in Triunfo, where there have been more viable options to interact with agricultural technicians.

Column (1) of table 6 shows that *Pesticide* is the only statistically significant explanatory variable when we run the knowledge regression on the 70 observations from Santa Clara. *VTrust* is not significant with a p-value of .945; since there have been no previous training workshops or

[17] We also ran four OLS regressions on knowledge using interaction terms with *county*. In one regression on knowledge we included the interaction terms, *county*htrust* and *county*vtrust*; in the second regression we let all of the right hand side variables vary across *county*. The second two regressions were identical to the first two; however, we replaced *htrust* and *vtrust* with the variable *diff*. We find no explanatory power in these regressions and do not present the results.

field days in Santa Clara we expect there to be no correlation between *Knowledge* and *VTrust*. In column (2) of table 6 we present the knowledge regression results on 62 observations from Triunfo we find that both *Pesticide* and *VTrust* are statistically significant.

Table 6. Knowledge Regressions by County

VARIABLE	Sta. Clara (1)	Triunfo (2)	Sta. Clara (3)	Triunfo (4)
Male	3.633 *0.523*	4.150 *0.534*	4.309 *0.454*	4.767 *0.461*
Age	5.304 *0.836*	-19.131 *0.403*	2.003 *0.934*	-20.976 *0.331*
Basic Edu.	8.888 *0.330*	1.117 *0.870*	8.933 *0.322*	1.599 *0.819*
Advanced Edu.	15.268 *0.221*	-5.380 *0.588*	14.815 *0.235*	-4.586 *0.646*
Household	-0.550 *0.532*	-0.800 *0.469*	-0.581 *0.503*	-0.781 *0.483*
Wealth	-1.312 *0.414*	2.022 *0.276*	-1.361 *0.397*	1.678 *0.323*
Medium Farm	0.268 *0.962*	9.252* *0.090*	0.031 *0.996*	9.299* *0.094*
Large Farm	-11.451 *0.299*	-13.321 *0.185*	-10.476 *0.349*	-13.081 *0.209*
Pesticide	12.818* *0.054*	9.384** *0.039*	12.320* *0.057*	9.828** *0.028*
Seminar	4.715 *0.409*	7.609 *0.139*	3.942 *0.483*	7.326 *0.146*
Bet	-2.042 *0.258*	-0.809 *0.664*	-2.217 *0.215*	-0.463 *0.788*
Reciprocity	-1.891 *0.297*	-17.399 *0.376*	-1.931 *0.262*	-1.600 *0.403*
HTrust	-2.056 *0.399*	-1.342 *0.573*		
Vtrust	0.141 *0.945*	2.848* *0.070*		
Diff			0.861 *0.667*	2.311 *0.104*

OLS with robust standard errors, p-values reported beneath coefficients

* 90%, ** 95%, and *** 99% significant; based on 70 obs. from Sta. Clara and 62 obs. from Triunfo

This is consistent with our hypothesis that vertical trust is correlated with knowledge among farmers who have had viable opportunities to interact with agricultural technicians.

In columns (3) and (4) of table 6 we replace *HTrust* and *VTrust* with *Diff* to investigate whether more vertical trust than horizontal trust (preference for vertical trust) is associated with higher knowledge scores. In column (3) we find that *Pesticide* is the only statistically significant explanatory variable when we run the knowledge regression on the 70 observations from Santa Clara. Again, we are not surprised to find that *Diff* is not significant (p-value of .667) since Santa Clara has not had training workshops or field days. However, in the regression on the 62 observations from Triunfo there is a weak positive association between *Knowledge* and *Diff* (p-value .104). These results suggest that vertical trust is more positively associated with farmer knowledge when farmers have opportunities to interact with agricultural technicians.

As we have already mentioned, no instrumental variables can be identified to help understand the direction of causality between trust levels and outcomes such as knowledge. If positive experiences with professionals (for example, when farmers acquire knowledge from an agricultural technician) cause higher levels of vertical trust, then we would expect *Seminar* to be correlated with our trust measures in table 4. Specifically, we would expect those who attended the seminar before playing the trust game to exhibit higher levels of vertical trust in the experiment after the seminar[18]. In addition, if we assume *Seminar* does not affect horizontal trust and positively affects vertical trust then we might also find that attending the seminar is positively correlated with *Diff*. However, in all the regressions in table 4, *Seminar* has little correlation with our trust measures and no statistical significance, indicating that past experiences are not necessarily associated with level of trust.

[18] Of course, this assumes that the seminar was a positive experience.

Table 7. Knowledge Regressions by Seminar

VARIABLE	Seminar 1 (1)	Seminar 2 (2)	Seminar 1 (3)	Seminar 2 (4)
Male	8.831 *0.114*	2.967 *0.636*	7.748 *0.154*	2.196 *0.715*
Age	-22.675 *0.338*	-34.468 *0.132*	-20.198 *0.387*	-32.803 *0.155*
Basic Edu.	11.293 *0.112*	-1.372 *0.868*	10.709 *0.123*	-1.366 *0.869*
Advanced Edu.	11.360 *0.390*	0.183 *0.986*	10.306 *0.441*	0.812 *0.939*
Household	0.191 *0.855*	-0.837 *0.379*	0.116 *0.913*	-0.900 *0.351*
Wealth	0.845 *0.579*	-1.106 *0.488*	1.037 *0.488*	-1.127 *0.474*
Medium Farm	10.950** *0.042*	-1.227 *0.813*	10.329* *0.063*	-0.586 *0.909*
Large Farm	-9.916 *0.475*	-3.626 *0.625*	-7.805 *0.588*	-2.931 *0.693*
Pesticide	15.132*** *0.003*	15.404*** *0.005*	14.596*** *0.005*	15.450*** *0.004*
County	7.267 *0.202*	5.486 *0.520*	7.121 *0.216*	6.488 *0.431*
Bet	0.160 *0.918*	-3.080 *0.137*	-0.043 *0.978*	-2.552 *0.143*
Reciprocity	-4.148 *0.297*	-0.715 *0.856*	-5.594 *0.158*	-1.109 *0.764*
HTrust	-5.303** *0.014*	1.458 *0.610*		
Vtrust	2.591 *0.164*	0.547 *0.726*		
Diff			3.753** *0.029*	-0.008 *0.996*

OLS with robust standard errors, p-values reported beneath coefficients

* 90%, ** 95%, and *** 99% significant; based on 65 obs. for Seminar 1; 67 obs. for Seminar 2.

Our analysis in table 7 provides some more insight into the question of causality. We ran separate regressions on knowledge according to seminar group[19]. If level of trust causes a farmer

[19] We also ran four OLS regressions on knowledge using interaction terms with *seminar*. In one regression on knowledge we included the interaction terms, *seminar*htrust* and *seminar*vtrust*; in the second regression we let all

to access knowledge from a certain individual then we might expect vertical trust to be correlated with knowledge among the farmers who attended the seminar before taking the knowledge exam; we might expect vertical trust to have less correlation with knowledge among farmers who took the knowledge exam before the attending the seminar. These assertions are based on the fact that farmers can invest their vertical trust only when they have opportunities to do so. Farmers with a preference for vertical trust (more vertical trust and less horizontal trust) may be more attentive during the seminar, while those with a preference for horizontal trust (less vertical trust and more horizontal trust) may be less attentive. Therefore, among those who attended the seminar first, we expect participants with stronger preferences for vertical trust to score higher than their seminar-cohort on the knowledge exam. For those who took the knowledge exam before attending the seminar we expect to see less correlation and statistical significance between levels of trust and knowledge scores because farmers would not have had the same opportunity to invest their vertical trust in agricultural technicians during the seminar.

Results in table 7 are consistent with our theory. Among those who attended the seminar and then took the knowledge exam there was a statistically significant correlation between trust levels and knowledge scores. Among these farmers, those with more vertical trust than horizontal trust scored higher on the knowledge exam. These findings support our hypothesis that those farmers with more vertical trust than horizontal trust (a preference for vertical trust) acquired more information from the seminar[20]. If we are controlling for the relevant

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of the right hand side variables vary across *seminar*. The second two regressions were identical to the first two; however, we replaced *htrust* and *vtrust* with the variable *diff*. While we do not present the results, we find that farmers who attended the seminar first and who preferred vertical trust over horizontal trust exhibited higher knowledge scores.

[20] These results may seem at odds with our interpretation of the results in table 5. We assume farmers with higher levels of vertical trust have had opportunities to invest their vertical trust in agricultural technicians during prior periods, such as at a previous workshop or at the trade center in Ambato. If this is the case, then wouldn't we expect to find a correlation between vertical trust and knowledge even if the farmer had not attended the seminar? While

determinants of knowledge then these results suggests that farmers with more vertical trust than horizontal trust paid more attention during the seminar. This provides some evidence that causality can function from trust levels to higher levels of knowledge. In particular, these results provide some support that vertical trust may play a relevant role in knowledge spread among Ecuadorian farmers.

Adoption

In columns (1), (2) and (3) of table 8 we present the results from the regression on *Adoption*. In the first column we only present the tangible assets model and find that *Medium Farm* (20-60 hectares) and *Large Farm* (60 or more hectares) are the only statistically significant variables correlated with adoption. There are two ways to interpret this finding. During informal conversations with Ecuadorian farmers we found that some farmers with larger plots do not apply pesticides to their crops because they hire day laborers to apply the pesticides. Since we were offering products such as masks, goggles, ponchos and rubber gloves, farmers who do not directly apply pesticides would not benefit from adopting the technology; hence, larger farm owners who hire others to apply pesticides would be less likely to purchase the safety equipment. An alternative interpretation of our finding is that larger farm owners may already have the safety equipment and, thus, not need to purchase the safety equipment.

When we add the social norms variables (*Bet*, *Reciprocity*, *HTrust*, *VTrust*) in column (2) of table 8 we see that *Medium Farm* and *Large Farm* remain significant and their coefficients are not much affected. However, *County* becomes significant; farmers from Santa Clara are more likely to adopt. Triunfo is closer than Santa Clara to Puyo, the closest city with a market. Due to

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this is a valid concern, our results in table 8 are based on a much smaller sample; past experiences with agricultural technicians may still influence knowledge levels.

proximity to market, farmers from Triunfo may already have purchased the safety equipment. Alternatively, farmers from Santa Clara may have observed a greater price differential between our products and the distant market in Puyo; transaction costs are greater in Santa Clara than in Triunfo, which increases the price of the safety equipment for the consumers in Santa Clara.

We find *Bet* to be positively correlated with adoption. This finding is consistent with previous results showing that risk-averse individuals are less likely to adopt modern crops (Feder 1980), and are less likely to adopt (or will use less) fertilizer (Hiebert 1974). The result that risk-averse individuals are less likely to adopt provides some validation for our experimental methods as well as corroborating with past evidence.

The results in column (2) of table 8 also show that horizontal trust is negatively associated with technology adoption (p-value 0.031). One possible explanation of this finding is that farmers who are more trusting of their fellow farmers are also reliant on bonding or bounded social capital for sources of new technology/products. Farmers who are very trusting in horizontal relationships may be more likely to adopt a technology from a neighbor or family member rather than at a farmer field workshop put on by agricultural technicians. Vertical trust has almost no correlation with adoption rates. However, in column (3) of table 8 each dollar more invested in vertical trust than in horizontal trust is associated with an increased probability of adoption, although the p-value is only 0.141. We ran a regression replacing *Diff* with *Relative Diff* (not shown). The results show a coefficient on *Relative Diff* that is close to zero and indicate that *Relative Diff* is not associated with adoption behavior. In summary, the results are mixed as to whether our trust measures are related to adoption behavior but suggest that further investigation into the role of vertical and horizontal trust in adoption is warranted.

Table 8. Adoption and Loan Regressions

	Adoption			Loan			
VARIABLE	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Male	-0.025 *0.910*	0.015 *0.949*	0.011 *0.961*	0.317 *0.257*	0.493 *0.113*	0.499 *0.107*	0.508 *0.113*
Age	0.814 *0.316*	0.528 *0.546*	0.453 *0.595*	3.366*** *0.002*	3.402*** *0.002*	3.415*** *0.002*	3.452*** *0.001*
Basic Edu.	0.236 *0.395*	0.281 *0.323*	0.254 *0.366*	0.174 *0.597*	0.153 *0.664*	0.158 *0.652*	0.186 *0.588*
Advanced Edu.	-0.068 *0.855*	0.066 *0.864*	0.065 *0.866*	0.559 *0.256*	0.759 *0.148*	0.770 *0.142*	0.816 *0.114*
Household	-0.008 *0.806*	-0.007 *0.855*	-0.005 *0.890*	-0.020 *0.663*	-0.002 *0.969*	0.001 *0.986*	0.012 *0.786*
Wealth	-0.063 *0.308*	-0.055 *0.387*	-0.047 *0.461*	0.019 *0.811*	0.043 *0.590*	0.040 *0.612*	0.043 *0.585*
Medium Farm	-0.498** *0.021*	-0.401* *0.078*	-0.425* *0.058*	-0.137 *0.628*	-0.078 *0.792*	-0.078 *0.793*	-0.092 *0.762*
Large Farm	-1.161*** *0.003*	-1.102*** *0.004*	-1.118*** *0.004*	-0.992** *0.044*	-0.979* *0.080*	-0.985* *0.078*	-1.041** *0.048*
County	-0.250 *0.253*	-0.424* *0.071*	-0.476** *0.042*	0.814*** *0.004*	0.825*** *0.005*	0.845*** *0.004*	0.906*** *0.002*
Bet		0.171** *0.023*	0.139** *0.048*		-0.123 *0.187*	-0.114 *0.219*	-0.110 *0.226*
Reciprocity		0.110 *0.406*	0.067 *0.605*		0.376** *0.043*	0.391** *0.034*	0.381** *0.038*
HTrust		-0.196** *0.031*			-0.116 *0.272*		
VTrust		0.013 *0.859*			0.172** *0.039*		
Diff			0.093 *0.141*			0.149** *0.041*	
Relative Diff							0.211* *0.053*

Probit with robust standard errors beneath coefficients; * 90%, ** 95%, and *** 99% significant; Adoption based on 191 obs.; Loan based on 160 obs..

Loan

In columns (4)-(6) of table 8 we present our regression results on bank loans. In column (4) we present the tangible assets model. The statistically significant variables are *Age*, *Large Farm*, and *County*. It is not surprising that older farmers were more likely to report having accessed a bank loan. Older individuals may have more wealth and experience, which would make them lower risk candidates for bank loans, and have also had a longer period to access bank loans. It is also not surprising to find that farmers from Triunfo are more likely to have accessed a bank loan. The *Wealth* variable may not be capturing the true levels of wealth so that *County* may be significant due to differences in wealth between Triunfo and Santa Clara. If Triunfo is wealthier than Santa Clara then they may be a more attractive market to banks. It might seem perplexing that farmers who report larger farms are less likely to have accessed a loan from a bank. However, we can interpret this as farmers with very large plots of land have less need or desire for loans.

In column (5) of table 8 we add our social norms variables. A key assumption to this model is that trust in an agricultural technician, *VTrust*, is also an estimation of trust in professionals in general, including bankers. We find two statistically significant experimental variables, *VTrust* and *Reciprocity*; none of the variables included in column (4) of table 8 change sign or significance. Each dollar more sent to an agricultural technician is associated with a greater likelihood of having accessed a bank loan; this is consistent with our story that vertical trust helps farmers access professionals. In addition, *Reciprocity* is statistically significant and positively correlated with *Loan*; if banks successfully identify trustworthy loan candidates then we would expect trustworthiness to be associated with having accessed a bank loan. This is

consistent with Karlan (2005), who found that loan recipients in Peru were less likely to default on their loan if they were more trustworthy in the trust game.

The results in columns (6) and (7) of table 8 duplicate our findings in column (5) of table 8; however, we replace *HTrust* and *VTrust* with *Diff* in column (6) and *Relative Diff* in column (7). Farmers who trust agricultural technicians more than community farmers are more likely to access a bank loan. Likewise, farmers with a larger increase in vertical trust over horizontal trust are more likely to access a bank loan. For example, farmers who have three times as much vertical trust as horizontal trust are more likely to access a bank loan than farmers who only have twice as much vertical trust as horizontal trust. These findings corroborate with our earlier findings that both *Diff* and *Relative Diff* are related to higher knowledge scores. Farmers with a stronger preference for vertical trust (more vertical than horizontal trust) may be more likely to access professionals for consultation.

VI CONCLUSIONS

This paper provides insight in to the role of trust in social exchange. Many studies have focused on how trust can lubricate social exchange and lead to more desirable social and economic outcomes. Our study supports claims that trust may facilitate social exchange; however, desirable social and economic outcomes do not necessarily result. We present evidence that in some cases outcomes are associated with in whom an individual places his or her trust, not just the level of trust. We obtain information about the relationship between experimental measures of trust and outcomes including knowledge of pest control techniques, adoption of pest-control technology and accessing bank loans. We are careful not to overstate

our findings, however, the results are consistent with the hypotheses that farmers with more horizontal trust or stronger preferences for horizontal trust tend toward social interactions with individuals who are less knowledgeable; farmers with more vertical trust or stronger preferences for vertical trust tend toward interactions with individuals who are more knowledgeable.

First, we find trust measures to be correlated with pesticide knowledge. There is a significant negative correlation between knowledge and horizontal trust, but a significant positive correlation between knowledge and farmers who exhibit a preference for vertical trust as measured by *Diff* and *Relative Diff*. The difference in dollars (*Diff*) sent to an agricultural technician compared to a community farmer is positively correlated with knowledge and is statistically significant. Furthermore, farmers who have relatively greater differences (*Relative Diff*) between vertical and horizontal trust exhibit higher knowledge scores. Future studies may better capture the cause and effect between trust levels and outcomes such as knowledge in a variety of ways. Ideally, researchers could collect a panel of data that measures knowledge and trust levels before and after an intervention program with professionals. Such a study could also include detailed questions about the history of interactions with community farmers and agricultural technicians to help understand the direction of causality.

Second, we find trust measures to be correlated with adoption of pesticide safety equipment. Similar to the results in the knowledge regression, horizontal trust is negatively correlated with adoption level. There is no significant correlation between vertical trust and adoption, although there is a weak correlation between adoption and preference for vertical trust as measured by *Diff*. These results corroborate findings from the knowledge regressions that farmers exhibiting more horizontal trust may involve themselves in non-beneficial interactions with community farmers. Likewise, preference for vertical trust may be associated with

beneficial interactions with professionals. However, caution should be taken while considering these results. The nature of the adopted technology, pesticide safety equipment, may have produced misleading results. Larger farm owners may already have invested in pesticide safety equipment. In addition, farmers in Triunfo may already have purchased safety equipment due to their proximity to market.

Third, we find trust measures to be correlated with access to bank loans. While horizontal trust is not significantly correlated with access to banks, vertical trust is positively correlated with whether farmers reported accessing a bank loan. Comparable to the results on knowledge and adoption, farmers with a preference for vertical trust, measured per *Diff* and *Relative Diff* are more likely to access a bank loan. The difference in dollars sent to an agricultural technician compared to a community farmer is positively correlated with access to bank loans and is statistically significant. We find that farmers with a relatively greater difference in vertical trust over horizontal trust were more likely to access a bank loan. These results are further evidence that vertical trust level and preference for vertical over horizontal trust are associated with outcomes that are often facilitated through interactions with professionals.

Some authors have focused almost exclusively on the virtues of social capital and how social capital may help attain socially desirable outcomes (Durlauf 2002a; Putnam 2000). Too often, social capital refers to clubs or groups embedded in horizontal trust relationships. In this study, we distinguish between trust in horizontal and vertical relationships; we find associations between our trust measures and household outcomes that suggest farmers may be better off by entering into more vertical trust relationships and fewer horizontal trust relationships. Our study reminds policy makers that the existence of an effective technology or loan opportunity will not

ensure socially desirable outcomes. Among naranjilla farmers *at the present time*, knowledge spread may be facilitated if farmers are willing to engage in vertical trust relationships; if this is the case, then resources should be implemented in a way that promotes trusting ties between farmers and agricultural technicians. However, if horizontal networks are active then we might expect that the associations we find will change after a sufficient amount of 'good' knowledge has spread from agricultural technicians to farmers. Knowledge spread and technology adoption are dynamic processes so relationships that we find in one period may not hold in a subsequent period.

With respect to the trust measures, the regression on difference in trust suggests that women, compared to men, trust agricultural technicians more than their community farmers, despite that the regressions on horizontal and vertical trust show that women do not trust differently than men. If female preference for vertical trust generalizes to rural households in developing countries then extension-based training programs may be more effective when female participation is encouraged. This lends credence and supplements the importance development literature has placed on the role of women in development (Sen 1999). Increasing the agency of women may be valuable to households, in part, because increased agency expands women's capacity to operationalize their vertical trust by investing in professional ties.

Finally, in Ecuador and other developing countries, plants pests and diseases still damage crops and produce large economic losses for farmers. The improper use of pesticides cause substantial health costs for agricultural workers. Integrated Pest Management technology and pesticide safety equipment can help ameliorate negative outcomes, but technology transfer is often not a rapid process. Diffusion of a technology can be slowed when farmers face asymmetric information and high search costs. This study finds that trust in agricultural

technicians is associated with higher levels of knowledge; therefore, trust in agricultural technicians may facilitate the diffusion of knowledge and technology.

These conclusions should be considered in light of limitations due to using field experiments as part of the research methods. First, our sample of farmers suffers from self-selection bias. The design of the field experiment necessitated that farmers convene in one location to participate in the experiments and seminar. We could not force farmers to attend; farmers who do not trust professionals are likely to stay at home. At the same time, we had high levels of participation in the communities we visited; in some communities over 80% of the households participated. The other main limitation of field experiments is that we do not have a laboratory setting; therefore, it difficult to perform the experiment identically for each group. While we tried to use the same directions and examples for each group, deviations occurred and may have affected the results. In addition other small changes may have changed how farmers responded in each of the games. For example, factors out of our control, such as temperature and if farmers were hungry or not feeling well, may have affected the final outcomes. At the same time, this is not so problematic because real-world decisions are never made in a vacuum; the experimental observations are made in the real-world context. This highlights the fact that field experiments offer a crucial advantage: we can observe behaviors instead of asking hypothetical questions about behavior.

In summary, it is impressive that many of the experimental measures of behavioral norms were associated with outcomes such as knowledge, adoption and access to bank loans, while other common human and physical capital variables showed little or no association with these same outcomes. Future experimental studies may provide more clarity to our results, and how trust can function to overcome information asymmetries, and in doing so promote profitable social exchange.

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APPENDIX A Experiment & Workshop Organization

Detailed Description of the Experiment Session

Proper preparation and prudent execution are essential for a successful field experiment. After careful design and writing of the survey and experimental protocol in the United States I arrived in Ecuador for my field research. I worked closely with a local agricultural technician and two research assistants: a graduate student from Ohio State University and an employee of the Instituto Nacional de Investigadores Agropecuarias (INIAP). Before beginning the experiments we spent three weeks in the Pastaza region visiting naranjilla farms and meeting with local officials. We also attended farmer workshops to observe social interactions in a seminar atmosphere. This helped us plan the format of our workshop days. In addition; we used this time to practice the experiments in local households and then in a close by agricultural university. We also organized a pilot experiment and workshop of 20 farmers in order to prepare the enumerators, research assistants, agricultural technician and myself for the actual workshop days. Collectively, these research experiences three weeks prior to the field experiments helped me identify the physical and social constraints to conducting economic experiments in the field. I was able to utilize this qualitative preliminary research to customize the survey and experiments to the communities in which we conducted the research.

We completed all five workshop days in one week. We did this for two reasons: 1) to minimize costs and 2) to eliminate the possibility of interaction between past and future participants in the experiment. The only likely time the farmers have to meet is at the weekly market. Completing the workshops in five days avoided farmers going to the market and sharing their experiences in our workshop and experiments.

Local agricultural technicians and officials individually notified households of the workshop via flyers approximately one week in advance. The flyers stated that participants would receive a seminar on naranjilla farming, a small lunch and a small farming gear item (mask, gloves, ponchos or goggles). There was no mention of winning money since the local agricultural technicians were worried that advertisements claiming to give money away might appear to be politically motivated. We selected the sites in order to obtain about 15-30 participants; however, the local agricultural technicians were newly employed in the region and could not provide an exact idea of the number of people who would attend. Indeed, there were previously no agricultural technicians in this region of the Upper Amazon Basin and, in fact, we learned that almost all of the farmers had never received any type of extension education prior to our workshops. On each of the five workshop days we had between 40 to 80 participants, many more than we had anticipated.

Shortly after 9 AM we explained to the farmers our purposes and what we wanted to achieve during the day. The main goal was to provide the farmers with some immediate education to combat the many pests that plague the naranjilla plant; the second goal was to collect some farming information for INIAP in order identify the most pressing needs of the farming community. The farmers who were not in the seminar or who were waiting to be interviewed could participate in an activity designed to occupy the farmers while they were waiting. Participants in the activity would also win approximately five to ten dollars in order to compensate the farmers for missing a day of work. The farmers understood that the activities were also part of research project that I was conducting and that they were not obligated to participate in order to attend the seminar. Then we divided the participants into two groups of equal size (I will refer to these as the seminar group and experiment group). The seminar group

went to attend the seminar on Integrated Pest Management (IPM) techniques for naranjilla while the experiment group stayed with the research assistants, enumerators and me to complete the surveys and the experiments. Both the seminar and the surveys along with the four experiments took about three and half hours to complete. After the morning session was completed the participants ate lunch, although the two groups ate separately and were not allowed to interact. After lunch the groups switched; we finished the day between four and five in the afternoon.

The seminar provided was typically given in the community schoolhouse while the survey and experiments were completed in the community pavilion or hall. After the experiment group was seated and comfortable we provided a short introduction and explained that the farmers could earn real money from each of the activities. We told them that they would play these games with fake money but in the end they would turn in the fake money for real money; in addition, we explained they would receive an average of their earnings. We began by presenting the first two activities: the trust game between farmers and the trust game between farmers and agricultural technicians. The moderator, an Ecuadorian research assistant, provided a general explanation of the game and gave two brief verbal examples. Then he moderated a more elaborate example between my U.S. research assistant, an enumerator and myself[21]. For the example, each of us came up one at a time and sat down in front of the moderator and he asked us questions as he would during the real experiment. We each went up individually a second time to play as the receptor in the trust game. We recorded our allocation decisions on a large chart to demonstrate to the farmers how they would distribute the money in the yellow envelope. After recording our distribution decisions the moderator gave us a yellow envelope; we opened the yellow envelopes and distributed the money according to what we had written on

[21] The examples were carefully chosen so farmers would not be influenced to play in a certain way. The enumerator was explicit that there was no "right" or "wrong" way to play.

the chart. After we finished going up the second time all three of us returned to the front of the room and we each received our original yellow envelopes; then the moderator summed up how much each person had received all together.

Following this example we told them that when they came up the first time they would also participate in an identical activity involving an agricultural technician. The only difference in this second activity was that they would be sending the money to an agricultural technician instead of another farmer. We made it clear to the farmers that they would only send an envelope to an agricultural technician and that they would not receive an envelope from an agricultural technician.

When we completed the explanations we asked some of the farmers to begin their interviews while the rest of the farmers formed a semi-circle facing away from the moderator's table. I occupied the farmers while they went up to the moderator's table; there was also food and drink set out for the farmers. I directed the farmers to go up one at a time to the moderator's table and made sure the group did not discuss the experiments.

When the farmers went up to the moderator's table they played as a sender in the trust game with another farmer; then they played as the sender in the trust game with an agricultural technician. Finally, they played as the receptor in the trust game with another farmer. They filled out their form that pre-committed them to returning a certain amount of money to the original owner of the yellow envelope according to the amount sent. Afterwards the moderator explained he would keep this distribution form and that they would not receive a yellow envelope from another farmer until everyone had completed the first cycle.

After everyone had passed the moderator's table a first time we called everyone in the experiment group back together and then explained the next two activities: the public goods

game and the risk game. The moderator first explained the public goods game and then the risk game. These explanations took less time than explaining the trust game.

The moderator provided a general explanation of the public goods game and then he moderated a more elaborate example between himself, my U.S. research assistant, an enumerator and myself. Each of us came up one at a time and sat down in front of the moderator and he asked questions as he would during the real experiment. When each of us came up we distributed money between our white envelope and the big yellow community envelope. When we all had gone the moderator counted the money in the big yellow community envelope, doubled the money and then divided it evenly among the four of us regardless of how much we originally contributed. We completed the four examples and then the moderator re-summarized the game.

At this time we also explained the risk game to the farmers. The moderator provided a general explanation of the risk game using a chart. Next he moderated a more elaborate example between himself, an enumerator and myself. Each of us put part of our money down on the ground as our bets and then the moderator rolled the die and distributed our winnings accordingly. Then he rolled the die a second time considering different bets and distributed the money accordingly. Then without rolling the die he went through how much each of us would win considering some of the remaining options.

After the explanations were complete for the second cycle we asked those farmers who had not completed their interviews to start their interviews while the rest of the farmers formed a semi-circle again facing away from the moderator's table. Just as after the first set of instructions I occupied the farmers while they went up to the moderator's table and directed the

farmers to go up one at a time to the moderator's table. Likewise, I made sure the group did not discuss the experiments.

When the farmers went up to the moderator's table they played the public goods game first and then played the risk game. Next, they received a yellow envelope from an anonymous farmer and distributed the money therein according to their pre-committed distribution forms. After everyone had finished coming up the second time we explained how they would check out. First, we told them how much money had been put into the community pot. We doubled this money and told them how much money they would receive from the community pot. We explained that for check out there would be three tables. At the first table they would receive their original yellow envelope with whatever money had been returned by the farmer who had received it. Also at the first table they would receive their original blue envelope[22] with whatever money had been returned by the agricultural technician who had received it. They were instructed to remove the money inside of the envelopes and place the money in their white envelopes. Then they would proceed to a second table where they would receive the money from the public goods game, which was identical for everyone. The farmers understood that this was the money given to the community pot doubled and then divided evenly among everyone. They were instructed to place the money they received at the second table into their white envelopes.

Following the second table the farmers would move to a third table where their money was counted. Then we quickly re-explained that they would receive the average winnings of the

[22] Since the agricultural technicians were not present, one of the research assistants actually allocated the money between the farmers' blue envelopes and the agricultural technicians. The money was allocated according to the agricultural technicians' pre-committed distribution forms.

four activities, that is, we would divide all of their money by four and this amount would be their winnings. We calculated their winnings and they exchanged their fake money for real money.

Finally, at the end of the day the farmers could use their winnings to purchase protective pesticide gear. They could buy masks, ponchos, gloves or goggles. We sold the items at market price and recorded who purchased which items.

END OF EXPERIMENT & WORSHOP ORGANIZATION

APPENDIX B Experiment Instructions

Introductory Comments

Alright, we are ready to get started. Thank you all for coming today. My name is Robert and I am from INIAP, the National Institute of Agricultural Investigators. My friend, Steven or Esteban, from Virginia Tech in the United States and Catalina, also from the United States, will be helping in the activities. We also have some volunteer students here to complete interviews with those people waiting to participate in the activities (*enumerators are standing at their interviews stations and raise their hands*).

We will begin shortly but I would first like to tell you why we are doing these activities. The main reason for coming today is so that you all have the opportunity to participate in the seminar. However, we only have one naranjilla specialist to give the talk. It is very difficult for the naranjilla specialist to manage a large group of 50 or more people in the seminar. He wouldn't be able to receive questions and you wouldn't have the opportunity to have dialogue with him. We want to provide a more personal seminar so we have split you into two groups. The other group is in the seminar and our part of the workshop will help keep you occupied while you are waiting; our activities also have other benefits. You all will have the opportunity to earn some money. In addition, while you are waiting we would like to interview you. The interviews are important because INIAP and other organizations are interested in continuing work in this area. They have resources that may help you but they want to know your opinions and want to understand the problems you are experiencing. They want to know how they can best assist you all. For instance, they want to know if you all have problems with the fruit worm or fungus? Do you need help with pesticide use? Are there concerns about health practices?

INIAP doesn't know the answers to these questions so it is important that everyone completes the survey.

Now I will explain how the activity works. When I am finished explaining we need some volunteers to start doing the interviews while the others begin the activities. We don't want to waste time explaining multiple times how everything works so it is very important that everybody listens and doesn't talk during the instructions and the examples. If you are confused or have questions don't worry, everyone will have an opportunity to ask questions individually later on.

We will do four activities today in which you all will have the opportunity to win real money depending on the decisions you make and how you all interact with each other. During the activities you will use this fake money (*moderator holds up fake money to everyone*), but at the end you will exchange this money for real money. You should know that your final earnings will be the average of your winnings from the activities. That is to say, in the end we will count up all your fake dollars at the end and then divide by four.

Trust Experiment: Group Instructions

In the first activity everyone will receive a white envelope, yellow envelope and five dollars (*moderator holds up yellow envelope and counts out five fake one dollar bills*). You may do two things with this money. You may keep the money or send the money to another farmer. You may keep or send any part of the money, that is, you can keep 0, 1, 2, 3, 4, or 5 dollars or send 0, 1, 2, 3, 4 or 5 dollars. The money you keep you will put in your white envelope; the

money you want to send to another farmer you put in the yellow envelope (*the moderator indicates the respective envelopes as he speaks*).

Why would anyone want to send money to another farmer in this activity (*pause*)? Because the money you send will be tripled and then sent to another farmer in this room; however, you won't know the exact identity of the farmer. The farmer who receives your tripled money has the opportunity to return a portion of the money to you.

So if you put five dollars in the yellow envelope then the farmer who receives your envelope will receive five times three dollars—15 dollars. If you put in four dollars then the farmer will receive four times three dollars—12 dollars. If you put in three dollars then the tripled amount would be nine dollars. If you put in two dollars then the tripled amount would be six dollars. If you put in one dollar then the tripled amount would be three dollars. If you put in nothing then the farmer who receives your envelope would receive nothing. Basically, the more money you send then the more money the other person has at his or her disposal to return to you; however, the person who receives your envelope is under no obligation to do so.

Now let's imagine I am playing in the activity. I decide to put all five dollars in the yellow envelope and nothing in my white envelope. Then the five dollars in the yellow envelope is tripled to 15 dollars . . . so an anonymous farmer receives my envelope with 15 dollars. He or she may give part, none or all of the money back to me. Their decision is made in secret and is completely theirs. In the end I could end up with zero dollars or fifteen dollars or any dollar amount in between—the amount I get in return all depends on the person who receives my envelope.

I could also decide to not put anything in the yellow envelope and save it all in my white envelope. Then I would end up with five dollars because the person who receives my yellow

envelope would receive zero dollars and so would have nothing to return to me. I would only have the money I saved in my white envelope—five dollars. This may sound confusing so we will do a few examples to make the activity more clear.

Imagine I am over there (*the moderator points to his table*). I will be seated and each of you will come up individually to the table (*Person A walks to the moderator and sits down at chair*).

Moderator: *Hello, how are you?*

Person A: *Good.*

Moderator: *Okay, here is your white envelope, it has your number on the inside . . . see you are number one. Do not share your number with anyone. Here is your yellow envelope that also has your number on the inside (the moderator indicates the number one). Finally, here are five one dollar bills. You may place some, none or all of this money into the yellow envelope. The money that you do not place in the yellow envelope you may save in your white envelope. Do you have any questions?*

Person A: *What happens to the money that I put in the yellow envelope?*

Moderator: *I will triple the money immediately and some anonymous farmer will receive your envelope. That person will have the opportunity to send some, none or all of the money back to you. Okay?*

Person A: *Okay. I will put two dollars in the yellow envelope and keep three dollars (Person A distributes the money accordingly and then gets up).*

(Person B walks up to the moderator and sits down)

Moderator: *Hello, how are you?*

Person B: *Good.*

Moderator: *Okay, here is your white envelope, it has your number on the inside . . . see you are number two. Do not share your number with anyone. Here is your yellow envelope that also has your number on the inside (the moderator indicates the number two). Finally, here are five one dollar bills. You may place some, none or all of this money into the yellow envelope. The money that you do not place in the yellow envelope you may save in your white envelope. Do you understand?*

Person B: *Yes, I will keep all five dollars (Person B distributes the money accordingly and then gets up).*

(Person C walks up to the moderator and sits down)

Moderator: *Hello, how are you?*

Person C: *Good.*

Moderator: *Okay, here is your white envelope, it has your number on the inside . . . see you are number three. Do not share your number with anyone. Here is your yellow envelope that also has your number on the inside (the moderator indicates the number three). Finally, here are five one dollar bills. You may place some or all of this money into the yellow envelope. The money that you do not place in the yellow envelope you may save in your white envelope. Do you understand?*

Person C: *Yes, I will pass all five dollars (Person C distributes the money accordingly and then gets up).*

Okay. Everyone has come up once and I have the all the yellow envelopes. I mix up the envelopes and then everyone comes up a second time. First, Esteban (*the moderator motions to Person A to come forward*).

(*After Person A sits down the moderator continues*)

Moderator: *Here is a yellow envelope from one of your fellow farmers. Before you may open it you need to tell me how much money you will return depending on how much money is in the yellow envelope. The farmer that sent this yellow envelope received five one dollar bills and so could have sent 0, 1, 2, 3, 4, or 5 dollars. This would be tripled so that in this yellow envelope you would find 0, 3, 6, 9, 12 or 15 dollars inside* (*Person A is shown a big chart that all the participants in the audience can see*).

Money in the yellow envelope.	How much money would you keep?
3	
6	
9	
12	
15	

If there are 3 dollars in the envelope how much would you keep?

Person A: *2 dollars (the moderator writes 2 on the chart).*

Moderator: *If there are 6 dollars in the envelope how much would you keep?*

Person A: *3 dollars (the moderator writes 3 on the chart).*

Moderator: *If there are 9 dollars in the envelope how much would you keep?*

Person A: *4 dollars (the moderator writes 4 on the chart).*

Moderator: *If there are 12 dollars in the envelope how much would you keep?*

Person A: *5 dollars (the moderator writes 5 on the chart).*

Moderator: *If there are 15 dollars in the envelope how much would you keep?*

Person A: *5 dollars (the moderator writes 5 on the chart).*

Moderator: *Okay. Now let's see what is inside the yellow envelope (example person takes out the money and finds that there are 15 dollars inside, the person takes 5 dollars and returns the other 10 dollars to the yellow envelope). Okay you may put the 5 dollars in the white envelope and go.*

Now the next person comes and receives their anonymous yellow envelope from another farmer. This person receives their envelope and before opening up the envelope must fill out the same chart:

Moderator: *If there are 3 dollars in the envelope how much would you keep?*

Person B: *3 dollars (the moderator writes 3 on the chart).*

Moderator: *If there are 6 dollars in the envelope how much would you keep?*

Person B: *6 dollars (the moderator writes 6 on the chart).*

Moderator: *If there are 9 dollars in the envelope how much would you keep?*

Person B: *9 dollars (the moderator writes 9 on the chart).*

Moderator: *If there are 12 dollars in the envelope how much would you keep?*

Person B: *12 dollars (the moderator writes 12 on the chart).*

Moderator: *If there are 15 dollars in the envelope how much would you keep?*

Person B: *15 (the moderator writes 15 on the chart).*

Moderator: *Okay. Now let's see what is inside the yellow envelope (example person takes out the money and finds that there are 6 dollars inside, the person takes all 6 dollars and returns nothing to the yellow envelope). Okay you may put the 6 dollars in the white envelope and go.*

Now the next person comes and receives their anonymous yellow envelope from another farmer. This person receives their envelope and before opening up the envelope must fill out the same chart:

Moderator: *If there are 3 dollars in the envelope how much would you keep?*

Person C: *1 dollar (the moderator writes 1 on the chart).*

Moderator: *If there are 6 dollars in the envelope how much would you keep?*

Person C: *2 dollars (the moderator writes 2 on the chart).*

Moderator: *If there are 9 dollars in the envelope how much would you keep?*

Person C: *5 dollars (the moderator writes 5 on the chart).*

Moderator: *If there are 12 dollars in the envelope how much would you keep?*

Person C: *6 dollars (the moderator writes 6 on the chart).*

Moderator: *If there are 15 dollars in the envelope how much would you keep?*

Person C: *9 dollars (the moderator writes 9 on the chart).*

Moderator: *Okay. Now let's see what is inside the yellow envelope (example person takes out the money and finds that there are 0 dollars inside, the person takes nothing). The farmer that sent you the yellow envelope put nothing in the envelope.*

Now let's return each of the participants their original yellow envelopes (*moderator passes out original yellow envelopes*). See, they each get the yellow envelope they originally received which corresponds to the number on the white envelope that they keep.

(*The moderator points to Person A and Person A opens their envelope; there is no money inside*)

We see there is no money inside—the person who received your original yellow envelope took all of the money.

(The moderator points to Person B and Person B opens their envelope; there is no money inside)

Since she never sent any more in the first place, there was no money to return—again there is no money inside.

(The moderator points to Person C and Person C opens their envelope)

The person finds 10 dollars because she sent 15 dollars originally and the person who received decided to return 10 dollars.

So in the end we have the first person (Person A) who kept 3 dollars originally; then kept 5 dollars from the yellow envelope he received. And he was given 0 dollars in return from his own original yellow envelope. Altogether he ended up with 8 dollars.

The second person (Person B) who kept 5 dollars originally; then kept 6 dollars from the yellow envelope she received. And she was given 0 dollars in return from her own original yellow envelope because she sent nothing. Altogether she ended up with 11 dollars.

The third person (Person C) who kept 0 dollars originally; then kept 0 dollars from the yellow envelope she received because the envelope was empty. And she was given 10 dollars in return from her own original envelope. Altogether she ended up with 10 dollars.

Pay attention. In this example the person who kept everything had the most money in the end, but that isn't always the case. It all depends on how you interact with each other; how much money you send and who receives your envelope. How much you send or keep is up to your personal preference—don't try to pick a right answer because there are no right or wrong answers.

Basically, if you believe that the anonymous person who receives your yellow envelope will distribute the money in a way that benefits you then you would probably be better to send more of the five dollars in your yellow envelope. However, if you believe that the anonymous person who receives your yellow envelope will distribute the money in a way that does not benefit you then you would probably be better off sending less money in your yellow envelope. Remember, there is no right or wrong decision and the decision is completely yours to make. Also, you will make your decisions in secret and none of the other farmers will know your decisions.

Shortly, we will have you all start coming up individually to make your decisions. When you go up you will also participate in a second activity which is identical to this first activity we just explained. However, instead of sending money to another farmer you will send your money

to an agricultural agricultural technician. And you will only send money, you will not have the opportunity to receive a yellow envelope from an anonymous agricultural agricultural technician.

You might be confused about how you will send money to an agricultural agricultural technician since there are not many agricultural technicians present—so let us explain. Last week we went to some agricultural technicians and explained the game to them exactly as we have explained it to you. Then we asked them to fill in a chart just like this one (*the moderator points to the chart from the previous example*). We asked them the same questions that we asked you.

For example we began by asking them: *If the farmer who sent you this envelope put a dollar in the envelope and it is tripled so that you find 3 dollars inside, then how much would return to the farmer?*

We have their answers recorded and will randomly assign their decisions to your envelopes when you play. It is very important that you know this is NOT hypothetical—you will really be playing with an agricultural technician. And yes, we will record how much money the agricultural technicians kept from your envelopes and next week we will give the agricultural technicians their winnings. So the agricultural technicians understood that they would receive real money for the money they kept from your envelopes; they also understood that keeping more money meant that the farmers would be given less money in return.

Thus, if you believe an agricultural technician would distribute the money in a way that benefits you then you would probably be better off to send more of the five dollars. If you believe an agricultural technician would distribute the money in a way that does not benefit you then it would probably be better to send less of the five dollars.

Okay, if you have any questions then please wait until you come up individually to the moderator. You may ask your questions then. Please do not discuss these activities, your decisions or your envelope numbers with anybody else in the activity; otherwise you will not be able to continue with the activity and will receive no money.

Keep in mind that while we will be using fake money now, you will be able to turn in these bills at the end for real money. Since we are doing four activities you will receive the average of the four activities. I repeat that you will receive real money and that you will receive the average of all your money received in the activities as your payment. This means we will divide all the money you have in the end by four and that will be your payment.

Okay, we need six volunteers to start on their interviews. The rest of you can gather in a semi-circle facing away from the moderator's table. You may come up one at a time to make your decisions. Please reserve any questions for me until you come up to my table.

Thank you.

Trust Experiment: Individual Instructions

(*When a person came up to make their allocation decisions they received the same instructions*)

Hello, how are you?

May I have your name?

Thank you.

I am going to give you three things: A white envelope, a yellow envelope and five fake one dollar bills (the moderator has these three items in his hands and indicates them

correspondingly). Here is your white envelope (the moderator opens the envelope to indicate their number). Your number is _____. Please, do not share this number with anyone. You will use this white envelope to save any money you wish to not pass.

Here is your yellow envelope (the moderator opens the envelope to indicate their number). The number matches the number of your white envelope. This allows us to know who to return the envelope to after it is sent to another farmer. You will use this yellow envelope to pass part, none or all of your five dollars to an anonymous farmer. Finally, here are the five one dollar bills.

Before you make a decision let me re-explain how the game works and then if you have any questions you may ask me. These five one dollar bills are yours so you are under no obligation to send any money in the yellow envelope to another farmer. However, any money you do send I will immediately triple. You may pass 0, 1, 2, 3, 4 or 5 dollars. Some examples are if you put one dollar in the yellow envelope then another farmer will receive 3 dollars. If you put 3 dollars in the yellow envelope then another farmer will receive 9 dollars. If you put 5 dollars in the yellow envelope then another farmer will receive 15 dollars. The farmer who receives your yellow envelope will have the opportunity to return part, none or all of the money back to you.

When we are all done with the activity then we will return this yellow envelope with your number to you with any money that was returned, after which you will exchange the fake money for real money. If you have any questions then please ask me—I know the game can be little confusing, many people have questions so don't be embarrassed. Besides, it is important that you ask them now because if you don't understand the activity then you may not receive as much money. Do you have any questions?

Okay. Please place the money you want to save in your white envelope and the money you want to pass in the yellow envelope (*The farmer distributes the money and then hands the yellow envelope to the moderator*).

Now you are going to receive a blue envelope with five more dollars and you will have the opportunity to make the same decision; however, this time the blue envelope will go to an anonymous agricultural technician (the moderator hands the blue envelope and five more dollars to the farmer). Remember, this activity is exactly the same as the previous one, except that an agricultural technician will receive your envelope and then decide how much of the tripled money to return to you. Do you have any questions?

Okay. Please place the money you want to save in your white envelope and the money you want to pass to an anonymous agricultural technician in the blue envelope.

Finally, you will tell me what you will do with money you are going to receive in a yellow envelope from another farmer. Do you remember how we did this in the example? (*The moderator shows the identical form that was used in the example*). These dollar amounts are the possible amounts of money that may be sent to you. Recall that each of you could send 0, 1, 2, 3, 4, or 5 dollars in your yellow envelope and that these dollars are then tripled to 0, 3, 6, 9, 12, or 15 dollars. In the next round, after all of the farmers have decided how much money to send to an anonymous farmer, you will receive a yellow envelope from an anonymous farmer. There will be money inside the envelope that you will distribute between yourself and the farmer who sent the yellow envelope. You must tell me how you would like to distribute the money now. First, do you have any questions?

So if there are 3 dollars inside when you open the yellow envelope then how much would you like to return? (*The moderator records the farmer's response on the distribution form*)

So if there are 6 dollars inside when you open the yellow envelope then how much would you like to return? (*The moderator records the farmer's response on the distribution form*)

So if there are 9 dollars inside when you open the yellow envelope then how much would you like to return? (*The moderator records the farmer's response on the distribution form*)

So if there are 12 dollars inside when you open the yellow envelope then how much would you like to return? (*The moderator records the farmer's response on the distribution form*)

So if there are 15 dollars inside when you open the yellow envelope then how much would you like to return? (*The moderator records the farmer's response on the distribution form*)

Okay, look at your decisions, are you satisfied? Alright, I will keep this form. You will receive a yellow envelope from an anonymous farmer the next time you come up and you will distribute the money according to how you filled out this form.

Thank you. You may return to the group, please ask for another volunteer to come up.

Community and Risk Experiments: Group Instructions

Attention please, everyone has finished the first cycle so we will begin with the second cycle. May we have everyone come to the center again so we may explain the next part?

All of you are going to come up to the moderator's table a second time. When everyone is finished you will be able to exchange the fake money for real money. And remember, you will only receive the average of what you earn in each of the four activities, most people will receive between 5 and 10 dollars.

Okay, the next activity is similar to the first two activities. Everyone will receive $5 just as in the first two activities. However, this time you will have the opportunity to pass the money to the entire community. That is, you may pass part, none or all of the money to a community pot; the rest of the money you may save in your white envelope. When everybody has gone we will double the money in the pot and then distribute the money evenly among everyone regardless of whether or not they contributed to the pot. Lets do a couple of examples to make the activity more clear.

Imagine our community is comprised of four people (four rehearsed enumerators come to the front for the example). The first person comes up and is given $5 (Person A sits down in front of the moderator and receives $5).

(*Example 1)*

Moderator: *Here are your five one dollar bills. You may keep this money or pass it to the community pot. The money in the community pot will be doubled and then re-distributed evenly among everyone. How much money would you like to pass to the community pot?*

Person A: *3 dollars.*

Moderator: *Alright, save your two dollars and don't share its contents with anyone.*

(Person B comes and sits down in front of the moderator)

Here are your five one dollar bills. How much money would you like to pass to the community pot?

Person B: *I'll give you two dollars.*

Moderator: A*lright, save your three dollars and don't share its contents with anyone.*

(Person C comes and sits down in front of the moderator)

Here are your five one dollar bills. How much money would you like to pass to the community pot?

Person C: *I want keep all five dollars.*

Moderator: *Alright, save your five dollars and don't share its contents with anyone.*

(Person D comes and sits down in front of the moderator)

Here are your five one dollar bills. How much money would you like to pass to the community pot?

Person D: *I want to pass all five dollars.*

Moderator: *Alright, don't share your decision with anyone.*

Now let's count all of the money in the community pot. There is $10 in the community pot. We double this amount and have $20 to distribute among everyone so each person gets $5 (*The moderator then passes $5 to each of the four participants*). Let's see how everyone did in the end.

Person A received $5 from the community and initially kept 2 so he has $7 dollars altogether. Person B initially kept $3 plus the five from the community so she has $8. Person C kept everything so ends up with $10. Person D gave everything so only ends up with $5 from the community. Let's do another example.

(*Example 2)*

Moderator: *How much money would you like to pass to the community pot?*

Person A: $5.

Moderator: *Alright, don't share your decision with anyone.*

(Person B comes and sits down in front of the moderator)

Here are your five one dollar bills. How much money would you like to pass to the community pot?

Person B: *I'll pass all $5.*

Moderator: *Alright, don't share your decision with anyone.*

(Person C comes and sits down in front of the moderator)

Here are your five one dollar bills. How much money would you like to pass to the community pot?

Person C: *I'll pass all $5.*

Moderator: *Alright, don't share you decision with anyone.*

(Person D comes and sits down in front of the moderator)

Here are your five one dollar bills. How much money would you like to pass to the community pot?

Person D: *I'll pass all $5.*

Moderator: *Alright, don't share your decision with anyone.*

Now let's count all of the money in the community pot. There is $20 in the community pot. We double this amount and have $40 to distribute among everyone so each person gets $10 (*The moderator then passes $5 to each of the four participants*). Since everyone passed all $5 everybody ended up with just the $10. Let's do another example.

(*Example 3)*

Moderator: *How much money would you like to pass to the community pot?*

Person A: *$5.*

Moderator: *Alright, don't share your decision with anyone.*

(Person B comes and sits down in front of the moderator)

Here are your five one dollar bills. How much money would you like to pass to the community pot?

Person B: *I'll keep all $5.*

Moderator: *Alright, don't share your decision with anyone.*

(Person C comes and sits down in front of the moderator)

Here are your five one dollar bills. How much money would you like to pass to the community pot?

Person C: *I'll pass all $5.*

Moderator: *Alright, don't share you decision with anyone.*

(Person D comes and sits down in front of the moderator)

Here are your five one dollar bills. How much money would you like to pass to the community pot?

Person D: *I'll pass all $5.*

Moderator: *Alright, don't share your decision with anyone.*

Now let's count all of the money in the community pot. There is $15 in the community pot. We double this amount and have $30 to distribute among everyone so each person gets $7.50 from the community (the moderator then passes $7.50 to each of the four participants). Let's see how everyone ended up.

Person A received $7.50 from the community and didn't keep anything so ends up with $7.50. Person B initially kept $5 plus the 7.50 from the community so she has $12.50. Person C passed everything so ends up with 7.50. Person D also gave everything so ends up with $7.50 from the community.

(Example 4)

Now imagine three of them give no money and one person gives all their money. Then there would only be $5 in the community pot, which we double to $10. We would divide this among the four people so that each person would get $2.50 from the community pot. In the end three people would end up with $7.50 because those people passed nothing to the community and so had 5 dollars plus 2.50. The person who gave all their money only ended up $2.50.

We see that there are many different outcomes depending how the community interacts. I must remind you that it is important that you don't discuss the activity or your decisions with

anyone. If you talk to the community you might not receive as much money in the end and you could ruin the activity for everyone.

Alright, now we explain the very last activity which you will also complete when you go up to the moderators table the second time. This is the easiest activity of the four activities. In this activity you will also be given $5 initially. However, you won't interact with anyone else to determine your earnings, instead you will roll dice. It works like this (*A large chart is shown to the audience*):

If you roll a one then you lose everything you bet. If you roll a two you lose half of everything you bet. If you roll a three you neither lose, nor win. If you roll a four then you win one and half times of what you bet. If you roll a five then you win two times what you bet. If you roll a 6 then you win two and half times what you bet. Let's do some examples:

You will each receive $5 dollars (*the moderator hands $5 dollars to each participant*). Then you all have the opportunity to keep part, none or all of the $5 or you may bet part, none or all of the $5.

(*Person A puts down $3, Person B puts down $5 and Person C puts down $1 and then the moderator rolls the dice, then depending on what landed we distributed the winnings accordingly; next, we summed up their winnings plus what they originally kept to see each participants total*)

Now let's roll the dice again (*if the same number faces up then we roll again, then we distribute the winnings accordingly; next, we summed up their winnings plus what they originally kept to see each participants total*).

Let's also consider some of the other possibilities:

If a one was rolled then everybody loses everything that they bet so . . .

➔Person A ends up with the $2 he kept.

➔Person B ends up with nothing, because he kept nothing.

➔Person C ends up with the $4 dollars she kept.

If a three was rolled then everybody ends up with what they bet plus what they kept, which means everyone ends up with $5.

If a six was rolled then everybody wins one and half times what they bet so . . .

➔Person A ends up $3 plus $4.50 plus the $2 he kept; altogether $9.50.

➔Person B ends up $5 plus $7.50; altogether $12.50.

➔Person C ends up $1 plus $1.50 plus the $4 dollars she kept; altogether $6.50.

Now, you should see that there are two opportunities to lose, 1 and 2. There are three opportunities to win, 4, 5 and 6. And there is one opportunity where you neither win nor lose, 3.

Alright, we are finished with the examples. If you have any questions about the two activities then please wait until you come to my table to ask your questions. Do not discuss these activities or your decisions with others. Those who were being interviewed may return to their interviews. Now may I have a first volunteer to come to the table?

Community and Risk Experiments: Individual Instructions

(*When a person came up to make their allocation decisions they received the same instructions*)

Hello, how are you?

May I have your name?

Thank you.

Here are five fake one dollar bills. They are yours; however, you have the opportunity to pass part, none or all of the money to your community. Any money you do not pass to the community you will save in your white envelope. The money that you pass on to the community I will put in this big yellow envelope. When everyone has come up here and made their decisions I will double the money passed on to the community, that is I will double the money that is in this big yellow envelope. Then I will divide the doubled money evenly among all of the participants regardless of whether or not they contributed to the community. Do you have any questions?

How much of the $5 will you save in your white envelope and how much will you pass on to the community? Okay, please put your remaining money in your white envelope and do not discuss it with anyone.

Now we will do the final activity. Here are five more fake one dollar bills. You may do two things with the money. You may save it in your white envelope or you can bet it and roll this die. You can save or bet part, none or all of the money. Your payout for the money you bet will be determined by the roll of the die. Please look at this chart.

If you roll a one then you lose everything you bet; however, you will still keep whatever you put in the white envelope. If you roll a two then you lose half of everything you bet; again you will still keep whatever you put in the white envelope. If you roll a three then you neither lose nor win; everyone will end up five dollars. If you roll a four then you will win half of what

you bet; you will also keep whatever you put in your envelope. If you roll a five then you will win what you bet; you will also keep whatever you put in your envelope. If you roll a six then you will one and half times what you bet; you will also keep whatever you put in your envelope. Do you have any questions?

Would you please lay down on the table the money that you would like to bet? Okay, let's roll the die.

I rolled a ___ so your winnings are ____. Please put this in your envelope and don't share this with anyone.

There is one more thing. Here is a yellow envelope from an anonymous farmer, it is not your yellow envelope. Here is the form you filled out in the last round, do you remember? You may open up the yellow envelope and we will distribute the money sent to you according to your distribution form.

(*The farmer opens the envelope and distributes the money inside accordingly*)

Okay, when we finish this round you will receive your original yellow and blue envelopes with whatever money has been returned to you. In addition, you will receive your share of the money from the community activity. Then you will be able to exchange this fake money for real money. Remember you will only receive the average of your winnings from the four activities. Thank you and may you please ask for the next person to come up.

END OF INSTRUCTIONS

APPENDIX C Field Survey

PART I: Inscription Data

Name: _____ Envelope Number: _____

1. Date: _____ 2. Community: _____

3. Household members: _____ 4. Age: _____ 5. Gender: M F

6. Education: Literate _____ None _____
(Mark the # of years) Primary _____ Secondary _____

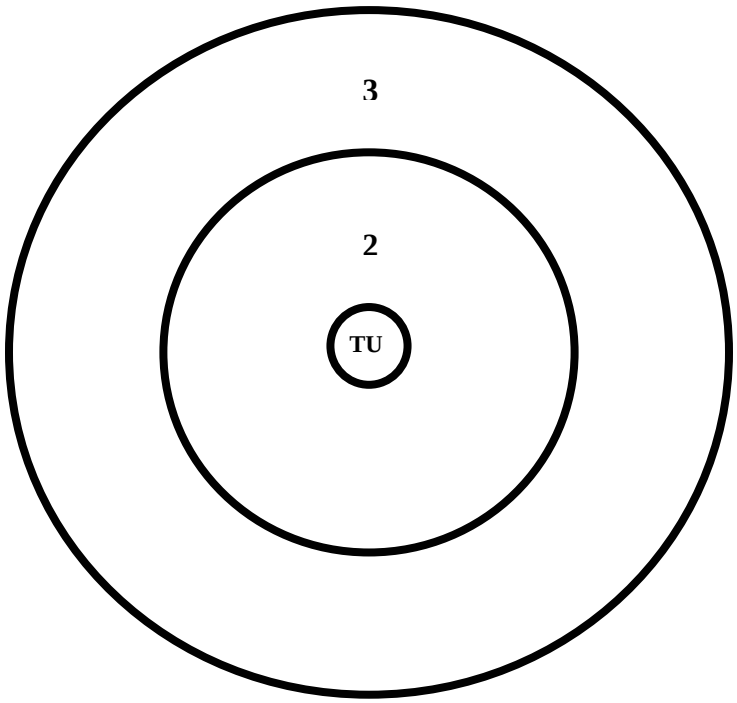
7. Indicate the pests and plant diseases that affect your plants.

What pests and plant diseases affect your plants?	How do you control these pests and plant diseases?	What doses you use?

8. In the second circle write the name of the people closest to you with respect to farming. Those people that help you on your farm or those people you help on their farm. Those people that can help you when you are sick. Those people with whom you discuss farming problems regularly. If there are no such people in your social network then write nothing. Do not include more than five people in the second circle. Finally, do NOT include people that live in your house.

9. In the third circle write the names of those people with whom you discuss farming practices but are not such good friends. That is, those farming relations that do NOT help you on the farm and don't help you when you are sick. If there are no such people in your social network then write nothing. Do NOT include more than five people in the third circle. Finally, do NOT include people that live in your house.

***If not already include, please write the names of any agricultural technicians that you know. Also, write the names of those people from who you have adopted an agricultural practice.*



10. What organizations or associations do you belong to?

i. _____ ii. _____

iii. _____ iv. _____

11. In the past year did your family participate in an activity that benefited the community?

Yes _____ No_____ How many times? _____

12. Are there people in your community that you can ask to lend small amounts of money (not including family or household members)?

Yes _____ Sometimes _____ Rarely _____ No _____

13. Do you trust your the people in your community?

Yes _____ No _____

14. Are there people in your community that would be willing to help you when you have problems, for example, when you are sick?

Yes _____ Sometimes _____ Rarely _____ No _____

15. Are there people in the community that take advantage of you when you have problems?

Yes _____ Sometimes _____ Rarely _____ No _____

16. If there was a serious problem in your community, are there people that would be willing to help?

Yes _____ Some _____ Few _____ None _____

17. What are your three most common sources of information?

Amigos	_____	Familia	_____
Radio	_____	Television	_____
Magazines	_____	Flyers	_____
Newspapers	_____	Other	_____

18. How long have you lived in this community _____ years

Whole life _____

19. How much longer do you think you will stay in this community? _____ years

(or will you never leave _____ ➔#23)

20. If you were to leave then where would you go?

Other community	_____	Other parish	_____
Other canton	_____	Other province	_____

21. Would you go with your family? Yes _____ No _____

22. Why would you move?

Work _____ Family _____ Health _____ Other Reason _____

23. How far is your house from the common plaza? _____ km

24. How far is the closest health service provider to your house? _____ km

25. How far is your school from your house? _____ km

26. What type of water do you use for auto consumption?:

Filtered	_____	Pond	_____
River	_____	Rain	_____

27. What type of energy do you use?

Electrical _____ Candles _____

Generator _____ Other _____

28. What type of fuel do you use for cooking?

Gas _____ Wood _____

Coal _____ Other _____

29. Do you have a television? Yes_____ No_____

a stereo system? Yes_____ No_____

a refrigerator? Yes_____ No_____

a gas stove? Yes_____ No_____

a chainsaw? Yes_____ No_____

a radio? Yes_____ No_____

PART II: Inscription of agricultural data

30. What is the area of your farm? _____ ha.

31. Your farm is: a property with title ____ rented ____

a property with out a title ____ shared ____

32. Indicate the naranjilla varieties you plant.

Naranjilla Variety	Area cultivated (ha)	Staked plants/total plants	How long does the cultivation last?
H. Puyo			
INIAP Palora			
Common			
Other			

33. Do you consume the naranjilla that you produce?

Yes ___ No ___ Why not? It is more important to sell _____

I don't like it _____

Too many pesticides _____

34. Where do you plant your new naranjilla seeds?

Virgin forest ____ Secondary forest ___ Other _____

35. How far apart do you plant the seeds/grafted plants? _____ m x _____ m

36. Where do your seeds come from: Harvests ____
Harvests ____ Neighbors ____ Market ____ Other ____

37. What do you use to disinfect your grafted plants? Vitavax _____
Pesticides _____
Nothing _____

38. How many plants do you have on your plantation? _____

39. How many fruits does each plant bare during its life cycle? _____

40. How many times a year do weed a year? _____

41. How many months after planting does production start? _____

42. How often do you harvest? _____

43. How many years have you used pesticides?
5 < ___ 10 < ___ 15 <___ 20 < ___ 25 < ___

44. Who taught you to use pesticides?

Father ___ Brother___ Son ___ Brother In-law ___

Friend ___ Neighbor___ Other ___ Technician ___

45. Do you apply pesticides on your farm? Yes__ No ___
(➔53)

46. Do you wear a protective mask when applying pesticides? Yes ___ No ___

47. Do you wear protective goggles when you apply pesticides? Yes ___ No ___

48. Do you wear protective gloves when you apply pesticides? Yes ___ No ___

49. Do you wear protective plastic ponchos when you apply pesticides?

Yes ___ No ___

50. After spraying pesticides do you change your clothes? Yes ___ No ___

51. Have you ever experienced the following symptoms after spraying pesticides?

	Yes	No	How often?
Bad vision	_____	_____	_____
Headaches	_____	_____	_____
Red eyes	_____	_____	_____
Stomachache	_____	_____	_____
Nausea	_____	_____	_____
Vomiting	_____	_____	_____
Diarrhea	_____	_____	_____

52. Do you believe that you have had pesticide poisoning?

Yes _____ No _____

How many times? _____

Did you go to the doctor? _____

How many days of work did you lose? _____

53. Do you let people enter your fields after spraying pesticides?

Yes _____ No _____

54. Is it possible that your pesticides have been in contact with . . .

. . . a source of water? Yes ___ No ___

. . . food or prepared food? Yes ___ No ___

55. Where do you store your pesticides?

A cellar	____	In the forest	____
Room in house	____	In cultivation	____
En el tumbado	____	Other	____

56. What do you do with empty pesticide containers?

Store water	____	Store food	____
Land	____	Burn	____
River	____	Field	____
Other	____	Nothing	____

57. Do you believe that someone from your family has ever been intoxicated by pesticides?

Yes ____ No ____

How many? _____

How often? _____

Did they go to the doctor? _____

How many days of work did they lose? _____

58. Do other people work on your farm?

Yes _____ How many? _____ No _____

Are they Friends? _____

Neighbors? _____

Migrants? _____

Do you pay these people? Yes _____ No _____

59. Do you work on other farms? Yes ____ No ____

Neighbor's ____

Relative's ____

Friend's ____

Other's ____

Are you paid for working there? Yes _____ No _____

60. Have you ever borrowed money from a:

Bank ___ Community Cooperative ____

Friend ___ No one ____

Social Network Component of Survey follows.

PART III: Social Network Data

Name	Who does this person know in your listed social network?	How long have you known this person?	How often do you comunicate with this person?	How often do you visit eachothers' farms?	How far does this person live from your house?	Relation	Occupation	Where is the most common place to meet with this person?	Have you adopted agricultural practices from this person such as the management of . .
1. Circle: ____ Age: ____ M F		____years All my life ___	Daily __ Weekly __ 15 days __ Monthly __	Daily __ Weekly __ 15 days __ Monthly __	_____ (KM)	Father ___ Brother ___ Son ___ In-law ___ Friend ___ Neighbor___ Other ___ Tech. ___	Migrant ___ Domestic ___ Farmer ___ Worker ___ Cattle Farmer___ Other ___ Professional ___	House ___ Farm ___ Road ___ Town ___	Pesticides ___ 2.4D ___ Fertilizer ___ Planting ___
2. Circle: ____ Age: ____ M F		____years All my life ___	Daily __ Weekly __ 15 days __ Monthly __	Daily __ Weekly __ 15 days __ Monthly __	_____ (KM)	Father ___ Brother ___ Son ___ In-law ___ Friend ___ Neighbor___ Other ___ Tech. ___	Migrant ___ Domestic ___ Farmer ___ Worker ___ Cattle Farmer___ Other ___ Professional ___	House ___ Farm ___ Road ___ Town ___	Pesticides ___ 2.4D ___ Fertilizer ___ Planting ___
3. Circle: ____ Age: ____ M F		____years All my life ___	Daily __ Weekly __ 15 days __ Monthly __	Daily __ Weekly __ 15 days __ Monthly __	_____ (KM)	Father ___ Brother ___ Son ___ In-law ___ Friend ___ Neighbor___ Other ___ Tech. ___	Migrant ___ Domestic ___ Farmer ___ Worker ___ Cattle Farmer___ Other ___ Professional ___	House ___ Farm ___ Road ___ Town ___	Pesticides ___ 2.4D ___ Fertilizer ___ Planting ___
4. Circle: ____ Age: ____ M F		____years All my life ___	Daily __ Weekly __ 15 days __ Monthly __	Daily __ Weekly __ 15 days __ Monthly __	_____ (KM)	Father ___ Brother ___ Son ___ In-law ___ Friend ___ Neighbor___ Other ___ Tech. ___	Migrant ___ Domestic ___ Farmer ___ Worker ___ Cattle Farmer___ Other ___ Professional ___	House ___ Farm ___ Road ___ Town ___	Pesticides ___ 2.4D ___ Fertilizer ___ Planting ___
5. Circle: ____ Age: ____ M F		____years All my life ___	Daily __ Weekly __ 15 days __ Monthly __	Daily __ Weekly __ 15 days __ Monthly __	_____ (KM)	Father ___ Brother ___ Son ___ In-law ___ Friend ___ Neighbor___ Other ___ Tech. ___	Migrant ___ Domestic ___ Farmer ___ Worker ___ Cattle Farmer___ Other ___ Professional ___	House ___ Farm ___ Road ___ Town ___	Pesticides ___ 2.4D ___ Fertilizer ___ Planting ___
6. Circle: ____ Age: ____ M F		____years All my life ___	Daily __ Weekly __ 15 days __ Monthly __	Daily __ Weekly __ 15 days __ Monthly __	_____ (KM)	Father ___ Brother ___ Son ___ In-law ___ Friend ___ Neighbor___ Other ___ Tech. ___	Migrant ___ Domestic ___ Farmer ___ Worker ___ Cattle Farmer___ Other ___ Professional ___	House ___ Farm ___ Road ___ Town ___	Pesticides ___ 2.4D ___ Fertilizer ___ Planting ___
7. Circle: ____ Age: ____ M F		____years All my life ___	Daily __ Weekly __ 15 days __ Monthly __	Daily __ Weekly __ 15 days __ Monthly __	_____ (KM)	Father ___ Brother ___ Son ___ In-law ___ Friend ___ Neighbor___ Other ___ Tech. ___	Migrant ___ Domestic ___ Farmer ___ Worker ___ Cattle Farmer___ Other ___ Professional ___	House ___ Farm ___ Road ___ Town ___	Pesticides ___ 2.4D ___ Fertilizer ___ Planting ___
8. Circle: ____ Age: ____ M F		____years All my life ___	Daily __ Weekly __ 15 days __ Monthly __	Daily __ Weekly __ 15 days __ Monthly __	_____ (KM)	Father ___ Brother ___ Son ___ In-law ___ Friend ___ Neighbor___ Other ___ Tech. ___	Migrant ___ Domestic ___ Farmer ___ Worker ___ Cattle Farmer___ Other ___ Professional ___	House ___ Farm ___ Road ___ Town ___	Pesticides ___ 2.4D ___ Fertilizer ___ Planting ___
9. Circle: ____ Age: ____ M F		____years All my life ___	Daily __ Weekly __ 15 days __ Monthly __	Daily __ Weekly __ 15 days __ Monthly __	_____ (KM)	Father ___ Brother ___ Son ___ In-law ___ Friend ___ Neighbor___ Other ___ Tech. ___	Migrant ___ Domestic ___ Farmer ___ Worker ___ Cattle Farmer___ Other ___ Professional ___	House ___ Farm ___ Road ___ Town ___	Pesticides ___ 2.4D ___ Fertilizer ___ Planting ___
10. Circle: ____ Age: ____ M F		____years All my life ___	Daily __ Weekly __ 15 days __ Monthly __	Daily __ Weekly __ 15 days __ Monthly __	_____ (KM)	Father ___ Brother ___ Son ___ In-law ___ Friend ___ Neighbor___ Other ___ Tech. ___	Migrant ___ Domestic ___ Farmer ___ Worker ___ Cattle Farmer___ Other ___ Professional ___	House ___ Farm ___ Road ___ Town ___	Pesticides ___ 2.4D ___ Fertilizer ___ Planting ___

Name	Does this person have a level of welfare that is . .	Does this person know how to read?	Does this person attend community meetings?	Do you trust the agricultural practices of this person?	Is this person boss of their farm?	If this person works on your farm do you pay them?
1. Circle: ____ Age: ____ M F	Higher__ Lower___ Equal ___	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __
2. Circle: ____ Age: ____ M F	Higher__ Lower___ Equal ___	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __
3. Circle: ____ Age: ____ M F	Higher__ Lower___ Equal ___	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __
4. Circle: ____ Age: ____ M F	Higher__ Lower___ Equal ___	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __
5. Circle: ____ Age: ____ M F	Higher__ Lower___ Equal ___	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __
6. Circle: ____ Age: ____ M F	Higher__ Lower___ Equal ___	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __
7. Circle: ____ Age: ____ M F	Higher__ Lower___ Equal ___	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __
8. Circle: ____ Age: ____ M F	Higher__ Lower___ Equal ___	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __
9. Circle: ____ Age: ____ M F	Higher__ Lower___ Equal ___	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __
10. Circle: ____ Age: ____ M F	Higher__ Lower___ Equal ___	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __	Yes__ No __

PART IV: Knowledge of Pesticides

The following pesticides/hormones can . . .	Monitor	Furadan	Daconil	Dacocida	Esterpac
Can penetrate the skin?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __
Can penetrate the eyes?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __
Can be breathed in through the nose?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __
Be present in the air more than two hours after application?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __
Affect children more than adults?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __
Can contaminate food or water in small quantities, such as a spoonful?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __
Can leave a residual in empty containers?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __

The following pesticides/hormones can . . .	Monitor	Furadan	Daconil	Dacocida	Esterpac
Kill the fruit worm?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __
Kill the barrrenador del tallo?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __
Kill fungus?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __
Kill micro-organisms?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __
Desaparecer la lancha?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __
Kill weeds?	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __	Yes__ No__ Don't know __
Should be applied every . . .	Week ___ 2 weeks ___ 3 weeks ___ Month ___ 3 months___	Week ___ 2 weeks ___ 3 weeks ___ Month ___ 3 months___	Week ___ 2 weeks ___ 3 weeks ___ Month ___ 3 months___	Week ___ 2 weeks ___ 3 weeks ___ Month ___ 3 months___	Week ___ 2 weeks ___ 3 weeks ___ Month ___ 3 months___
Should be applied using the following dosis?	1 tapa ___ 3 tapas___ 8 tapas___ 15 tapas ___ Más de 15__	1 tapa ___ 3 tapas___ 8 tapas___ 15 tapas ___ Más de 15__	1 tapa ___ 3 tapas___ 8 tapas___ 15 tapas ___ Más de 15__	1 tapa ___ 3 tapas___ 8 tapas___ 15 tapas ___ Más de 15__	1 tapa ___ 3 tapas___ 8 tapas___ 15 tapas ___ Más de 15__

PART V: Knowledge of Naranjilla Agricultural Practices

1. The majority of pests and plant diseases start in:
    a. ____Those upper parts, such as the leaves; the superior part of the plant.
    b. ____Those lower parts, such as the roots; the inferior part of the plant.

2. Dead plants should be:
    a. ____Left as fertilizer.
    b. ____Removed and burned.
    c. ____Don't know.

3. Contaminated fruits with the fruit worm should be:
    a. ____Left on the branches.
    b. ____Left on the ground for fertilizer.
    c. ____Removed from the plants and taken away.
    d. ____Don't know.

4. The most effective way to control fungus and bacteria is to:
    a. ____Use pesticides.
    b. ____Use healthy seeds.
    c. ____Apply cal to the soil.
    d. ____Don't know.

5. Usually, yellow leaves are a sign of:
    a. ____Too much sun.
    b. ____Not enough fertilizers or nutrients.
    c. ____Fungus.
    d. ____Don't know.

6. In general, plants should be planted:
    a. ____Very close in order to avoid weeds and to provide more shade
    b. ____Farther apart to avoid microclimates.
    c. ____Don't know.

7. It is easier to produce a larger harvest from:
    a. ____100 plants, without much care
    b. ____50 plants, well-maintained
    c. ____Don't know.

8. It is better to plant:
    a. ____100 staked plants.
    b. ____50 staked plants that are disinfected.
    c. ____Don't know.

PART VI: Knowledge of the Community

1. On what day does your community usually meet? _____

2. How many naranjilla farmers live in your community? _____

3. Where is the center of naranjilla trade in Ecuador? _____

4. How long is a trip by bus to Puyo? _____ hours
    to Ambato _____ hours
    to Quito _____ hours

APPENDIX D Marginal Effects of Regressions Reported in Table 8

Table D.1. Marginal Effects

	Adoption			Loan		
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Male	-0.010 *0.909*	0.006 *0.949*	0.004 *0.961*	0.091 *0.226*	0.130 *0.071*	0.131 *0.065*
Age	0.032 *0.317*	0.021 *0.546*	0.018 *0.595*	0.102*** *0.002*	0.098*** *0.002*	0.099*** *0.002*
Basic Edu.	0.094 *0.394*	0.111 *0.322*	0.101 *0.355*	0.052 *0.589*	0.043 *0.657*	0.045 *0.645*
Advanced Edu.	-0.027 *0.855*	0.026 *0.863*	0.026 *0.864*	0.189 *0.292*	0.257 *0.187*	0.261 *0.180*
Household	-0.003 *0.806*	-0.003 *0.855*	-0.002 *0.890*	-0.006 *0.665*	0.000 *0.969*	0.000 *0.986*
Wealth	-0.025 *0.308*	-0.022 *0.387*	-0.019 *0.461*	0.006 *0.811*	0.012 *0.591*	0.012 *0.613*
Medium Farm	-0.195** *0.017*	-0.157* *0.072*	-0.166 *0.063*	-0.042 *0.633*	-0.023 *0.794*	-0.023 *0.795*
Large Farm	-0.408*** *0.000*	-0.397*** *0.000*	-0.401*** *0.001*	-0.208*** *0.001*	-0.194*** *0.004*	-0.195*** *0.004*
County	-0.100 *0.251*	-0.168* *0.068*	-0.188** *0.040*	0.259*** *0.005*	0.251*** *0.006*	0.257*** *0.005*
Bet		0.068** *0.023*	0.055** *0.048*		-0.035 *0.190*	-0.033 *0.223*
Reciprocity		0.044 *0.406*	0.027 *0.605*		0.108** *0.041*	0.113** *0.031*
HTrust		-0.078** *0.031*			-0.033 *0.277*	
VTrust		0.005 *0.859*			0.050** *0.042*	
Diff			0.037 *0.140*			0.043** *0.045*

Marginal Effects of Probit with p-values reported beneath dy/dx coefficient

*-90%, **-95%, and ***99% significant; Adoption based on 191 obs.; Loan based on 160 obs..

APPENDIX E Misspecification Testing and Pseudo R^2s

Tables E.10-13 report relevant statistics for each regression presented in tables 4-7 in the body of the paper. The statistics reported under 'Regression 1' correspond to the regression results in column (1) of the specified table; the statistics reported under 'Regression 2' correspond to the regression results in column (2) of the specified table; likewise for the subsequent columns.

In rows one and two we present the number of observations in the regression and the $R^{2,}$ respectively. In rows three and four we present p-values for two common normality tests. If the p-value>.10 then we can fail to reject normality at the 10% significance level. Please see Appendix F for smoothed histograms of the residuals for each regression. In rows five and six we present p-values for two common omitted variables tests. For the first test we consider powers of the predicted y-values as the omitted variables; for the second test we consider second and third powers of the right-hand side variables as the omitted variables. If the p-value>0.10 then we can fail to reject the null hypotheses at the 10% significance level that the coefficients of the added variables are zero.

We do not present misspecification tests for heteroskedasticity because we correct for potential deviations from homoskedastic errors by running OLS regressions with robust standard errors (Huber-White Standard Errors). In table 14 we present the pseudo-R^2s for Probit Regressions in table 8.

Table E.1. MS Testing for Regressions in Table 4

	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5	Regression 6
Observations	191	191	191	191	191	191
R^2	0.084	0.141	0.130	0.165	0.137	0.146
Skewness Kurtosis Test	0.254	0.323	0.554	0.625	0.378	0.531
Shapiro-Wilk Test	0.001	0.002	0.080	0.183	0.407	0.459
Omitted Variables Test I	0.210	0.954	0.434	0.070	0.941	0.899
Omitted Variables Test II	0.322	0.242	0.097	0.454	0.582	0.715

Table E.2. MS Testing for Regressions in Table 5

	Regression 1	Regression 2	Regression 3	Regression 4
Observations	132	132	132	132
R^2	0.227	0.284	0.281	0.287
Skewness Kurtosis Test	0.464	0.643	0.618	0.528
Shapiro-Wilk Test	0.809	0.339	0.333	0.249
Omitted Variables Test I	0.830	0.412	0.363	0.292
Omitted Variables Test II	0.915	0.907	0.842	0.884

Table E.3. MS Testing for Regressions in Table 6

	Regression 1	Regression 2	Regression 3	Regression 4
Observations	70	62	70	62
R^2	0.259	0.329	0.251	0.325
Skewness Kurtosis Test	0.222	0.809	0.243	0.764
Shapiro-Wilk Test	0.324	0.498	0.297	0.473
Omitted Variables Test I	0.772	0.247	0.207	0.323
Omitted Variables Test II	0.744	0.758	0.844	0.854

Table E.4. MS Testing for Regressions in Table 7

	Regression 1	Regression 2	Regression 3	Regression 4
Observations	65	67	65	67
R^2	0.296	0.400	0.289	0.385
Skewness Kurtosis Test	0.730	0.859	0.605	0.911
Shapiro-Wilk Test	0.651	0.651	0.619	0.697
Omitted Variables Test I	0.754	0.655	0.800	0.531
Omitted Variables Test II	0.375	0.293	0.456	0.118

Table E.5. Pseudo-R^2s for Probit Regressions in Table 8

	pseudo-R^2
Regression 1	0.065
Regression 2	0.106
Regression 3	0.093
Regression 4	0.182
Regression 5	0.234
Regression 6	0.233
Regression 7	0.231

APPENDIX F Smoothed Normality Histograms of Residuals

Below we present smoothed normality histograms of residuals for the regressions presented in tables 4-7. Table 4.1 corresponds to the regression results presented in table 4 in column (1); table 4.2 corresponds to the regressions results presented in table 4 of column (2); likewise, for the subsequent graphs. Each histogram of residuals was smoothed using Gaussian kernel density estimates and the results are plotted against the Normal density curve.

Figure F.1. Residuals from table 4, column 1

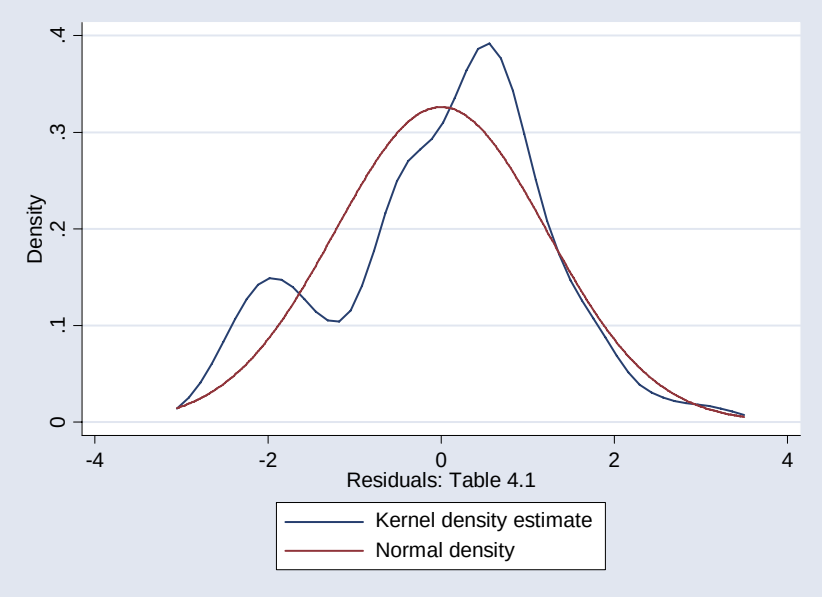


Figure F.2. Residuals from table 4, column 2

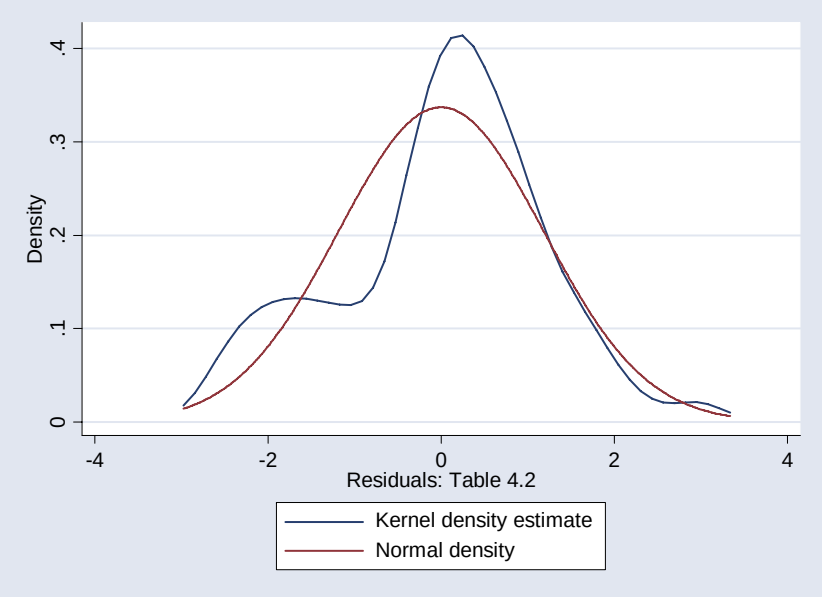


Figure F.3. Residuals from table 4, column 3

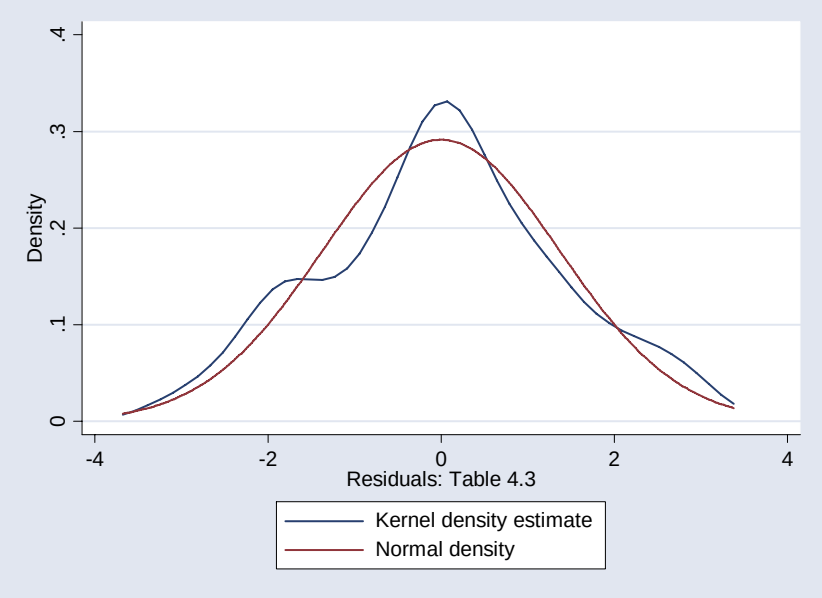


Figure F.4. Residuals from table 4, column 4

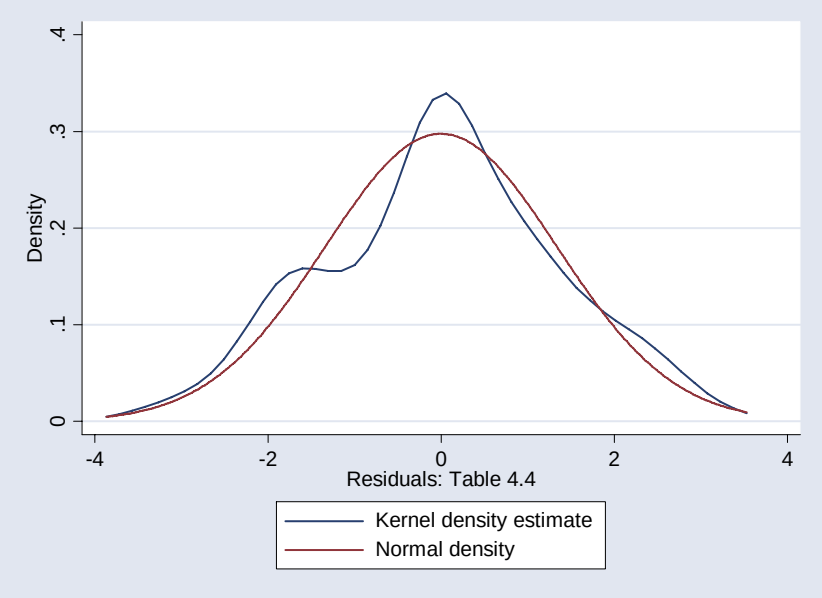


Figure F.5. Residuals from table 4, column 5

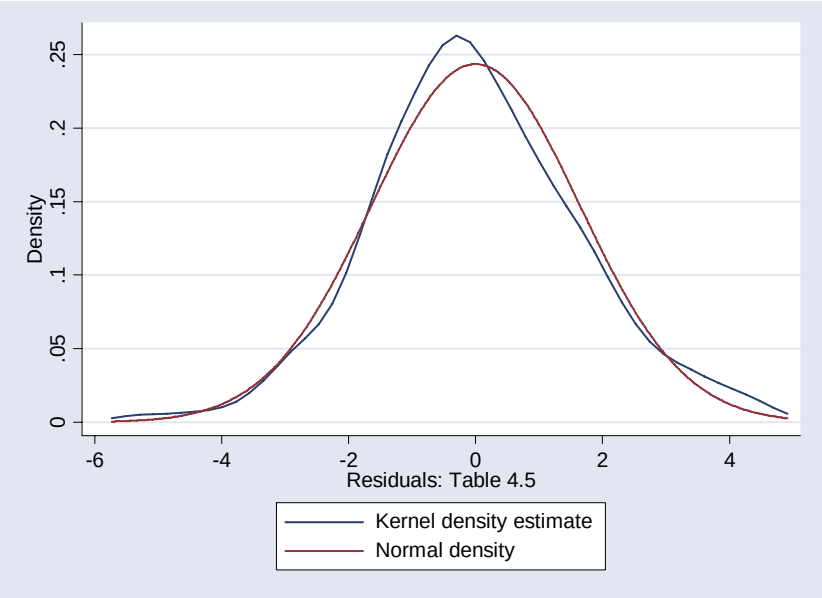


Figure F.6. Residuals from table 4, column 6

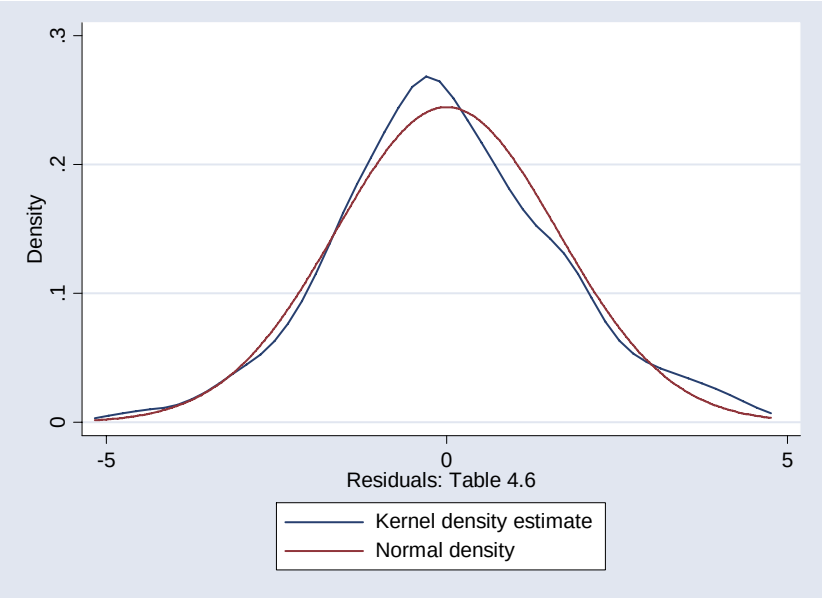


Figure F.7. Residuals from table 5, column 1

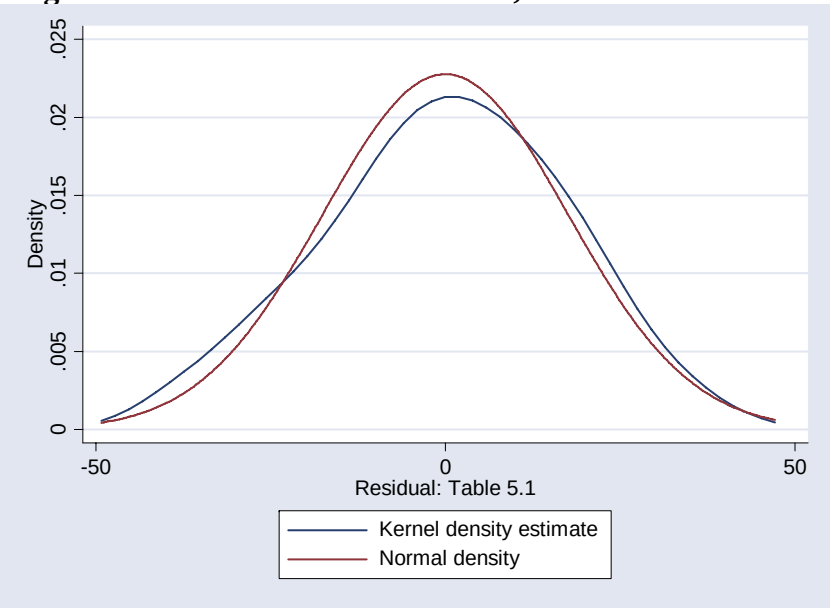


Figure F.8. Residuals from table 5, column 2

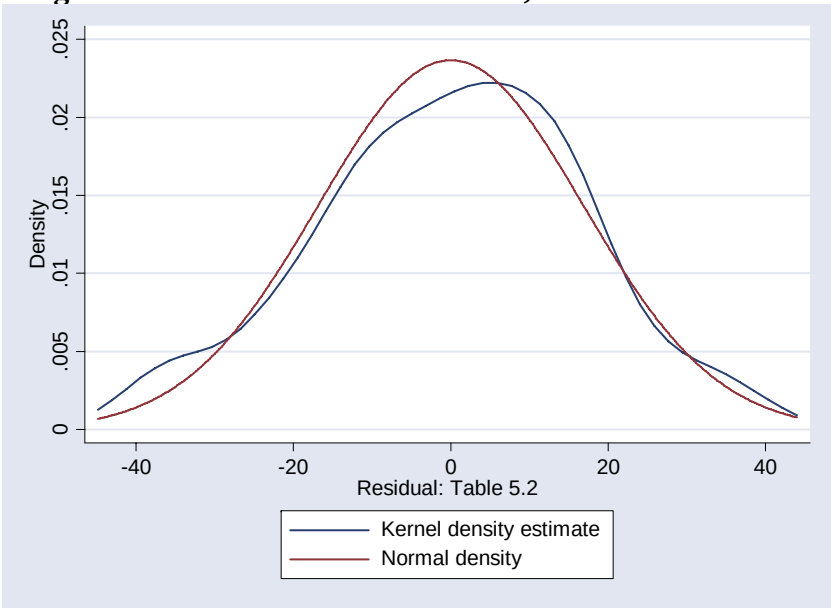


Figure F.9. Residuals from table 5, column 3

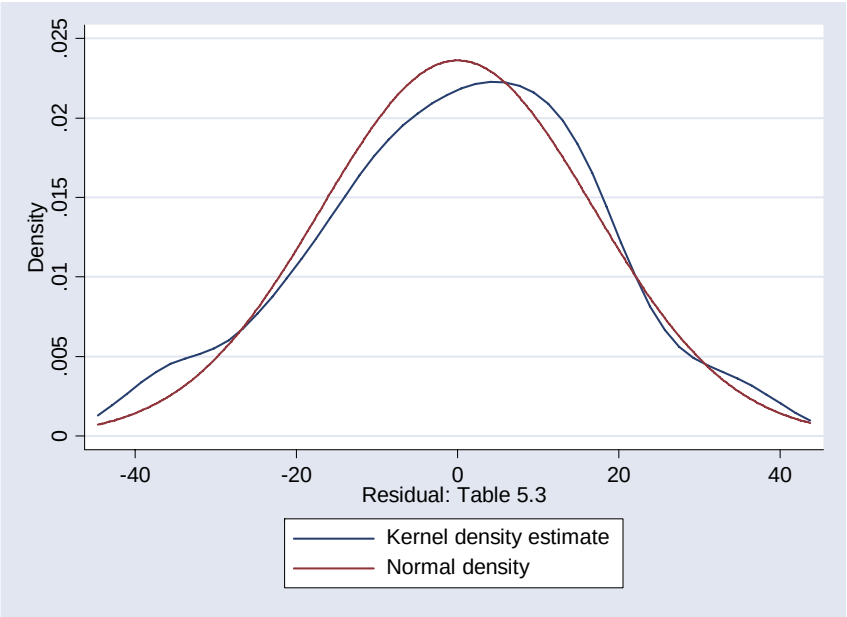


Figure F.10. Residuals from table 5, column 4

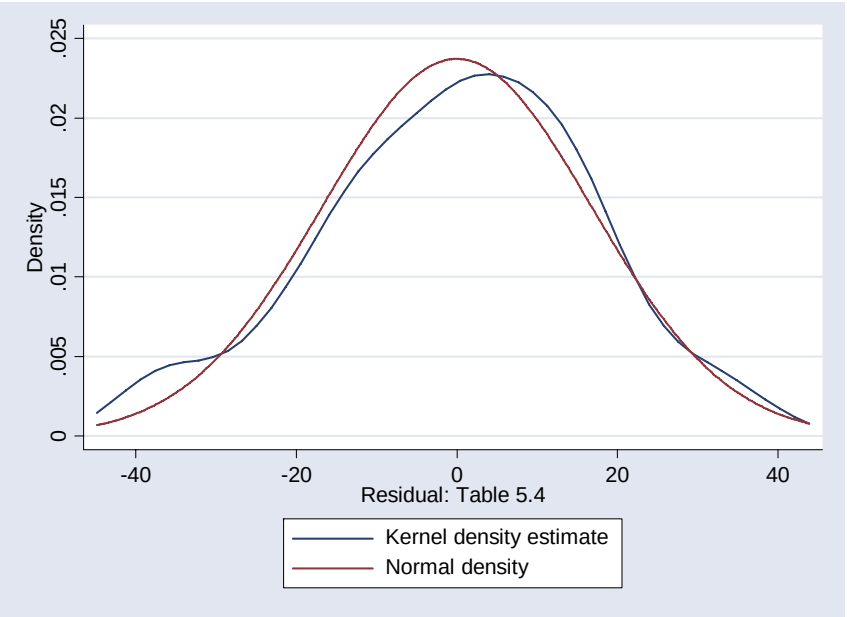


Figure F.11. Residuals from table 6, column 1

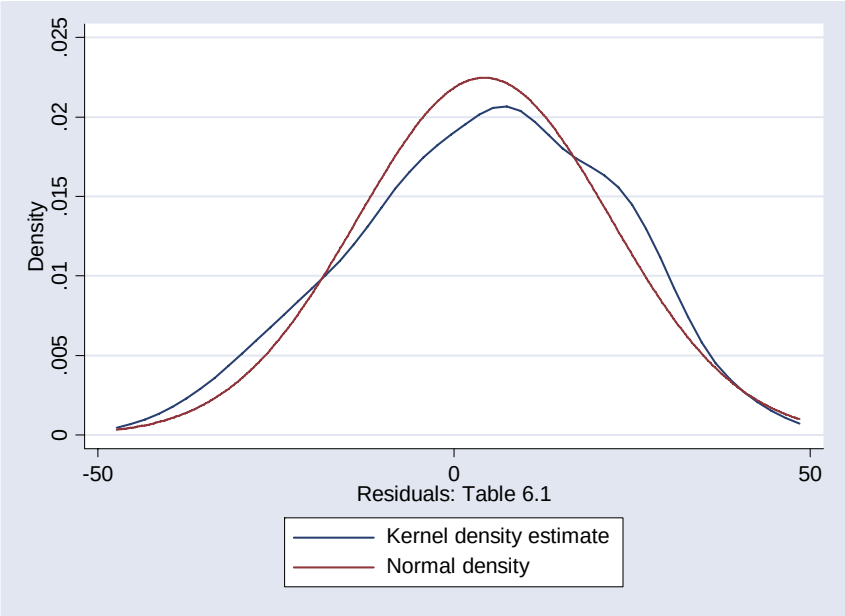


Figure F.12. Residuals from table 6, column 2

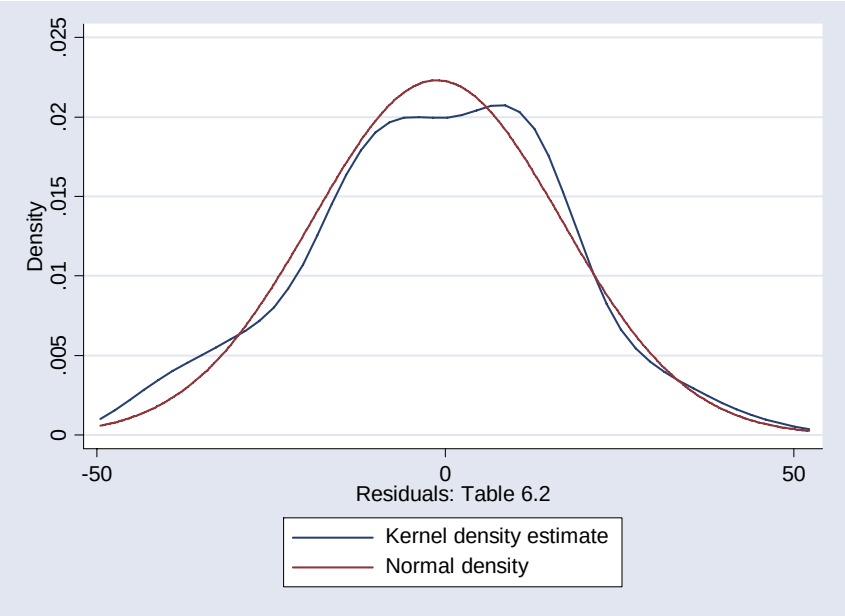


Figure F.13. Residuals for table 6, column 3

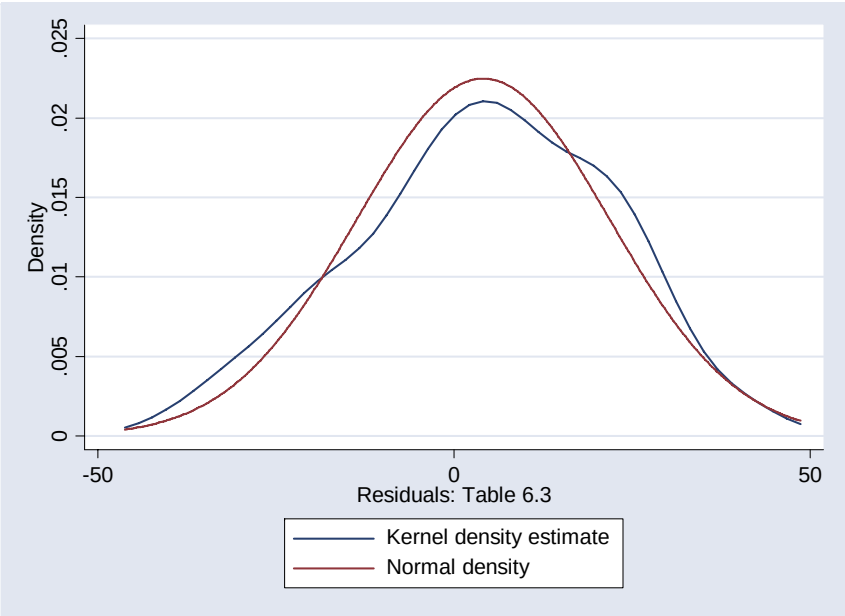


Figure F.14. Residuals for table 6, column 4

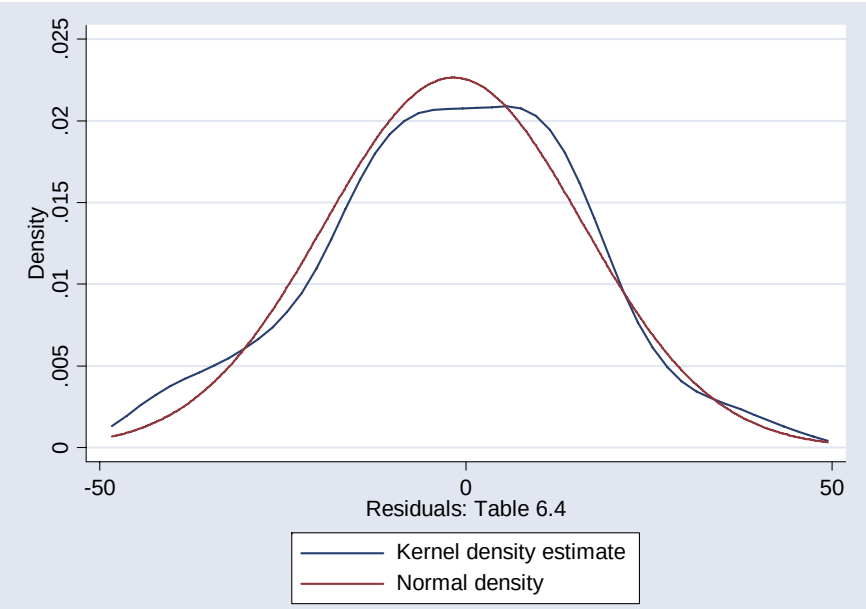


Figure F.15. Residuals for table 7, column 1

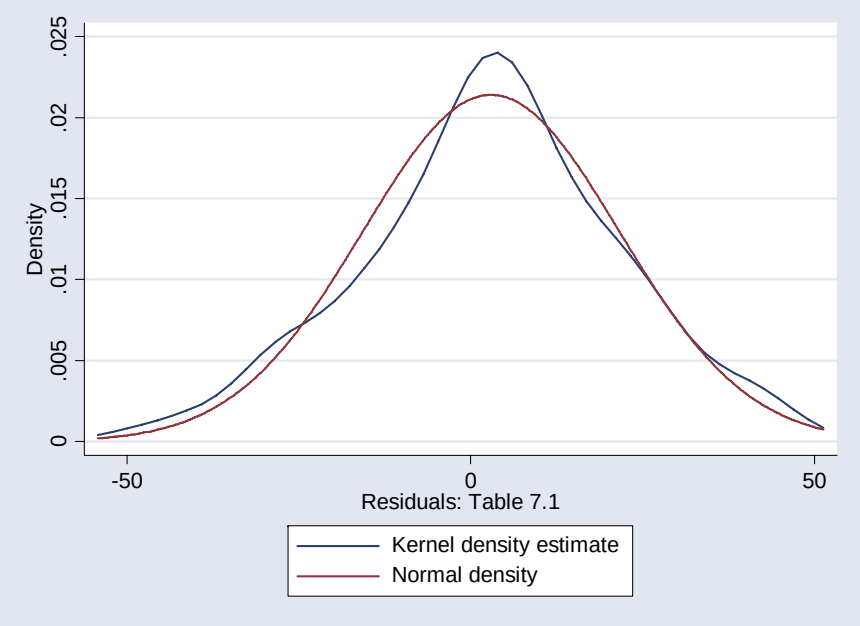


Figure F.16. Residuals for table 7, column 2

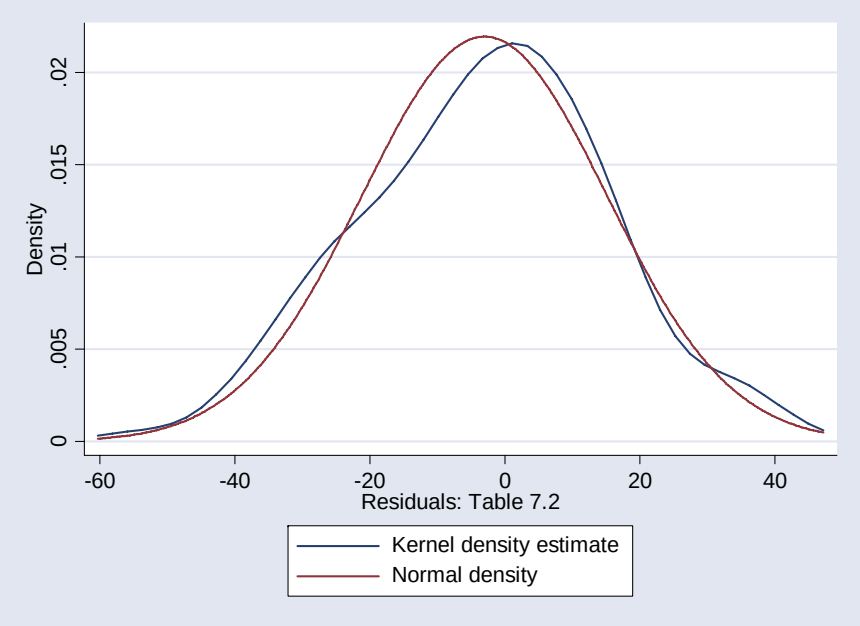


Figure F.17. Residuals for table 7, column 3

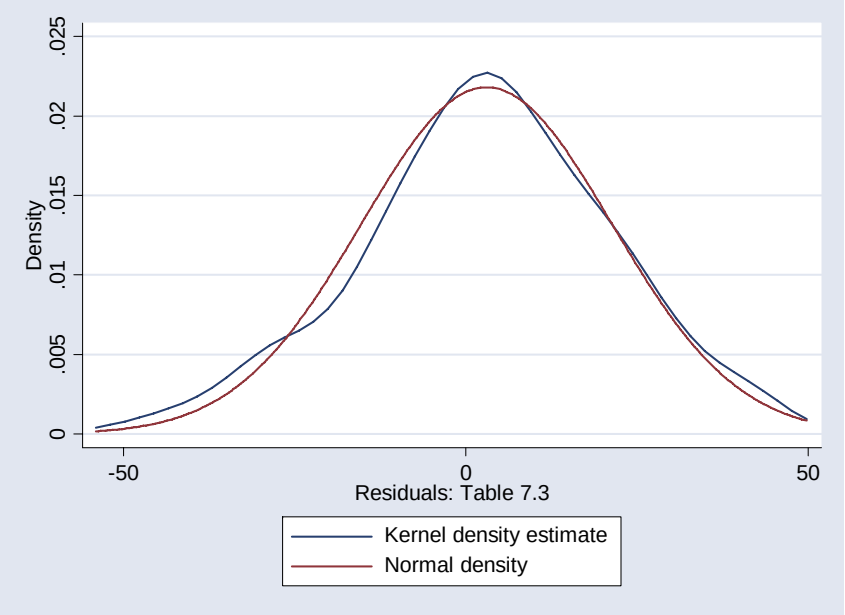
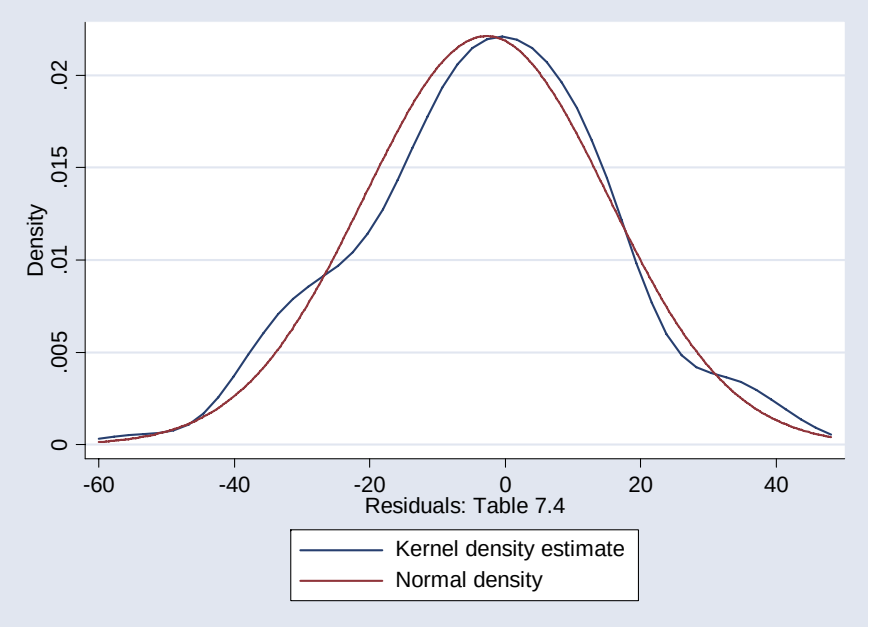


Figure F.18. Residuals for table 7, column 4



APPENDIX G Scatter Plots of the Residuals for Trust Regressions

The field experiments were run across time so there is a natural ordering to the observations, which suggests the possibility of some type of dependence between the observations. One might wonder if farmers who played the trust game with other farmers at the end of the experiment exhibited more trust in the other participants (perhaps because they had been in their presence longer). Likewise, one might wonder if farmers exhibited more trust in agricultural technicians as the game moved along. Below we present scatter plots of the residuals for Trust Regressions 4.2, 4.4 and 4.6 by experiment. The plots suggest that there was little systematic time-dependence in play of the trust games.

Figure G.1. Horizontal Trust Residuals, experiment 1

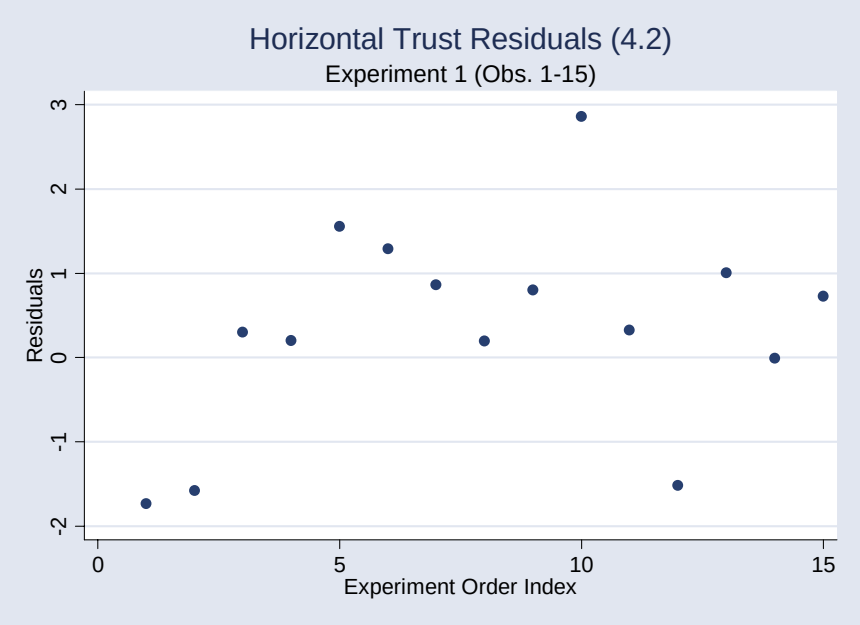


Figure G.2. Horizontal Trust Residuals, experiment 2

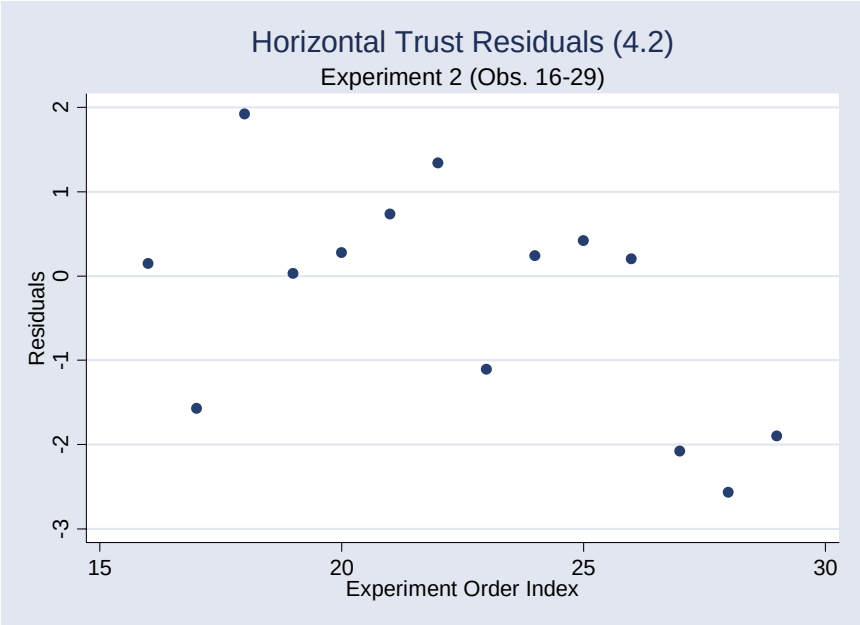


Figure G.3. Horizontal Trust Residuals, experiment 3

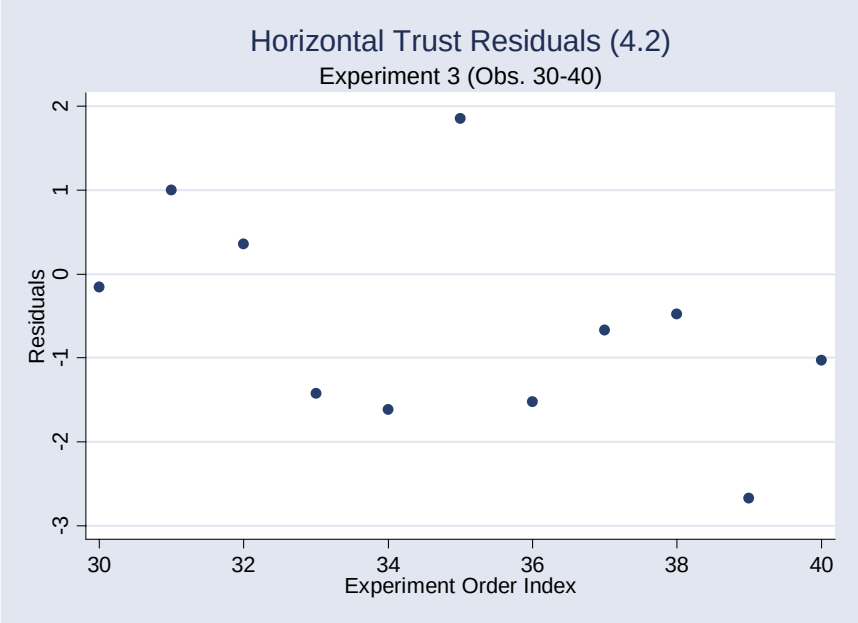


Figure G.4. Horizontal Trust Residuals, experiment 4

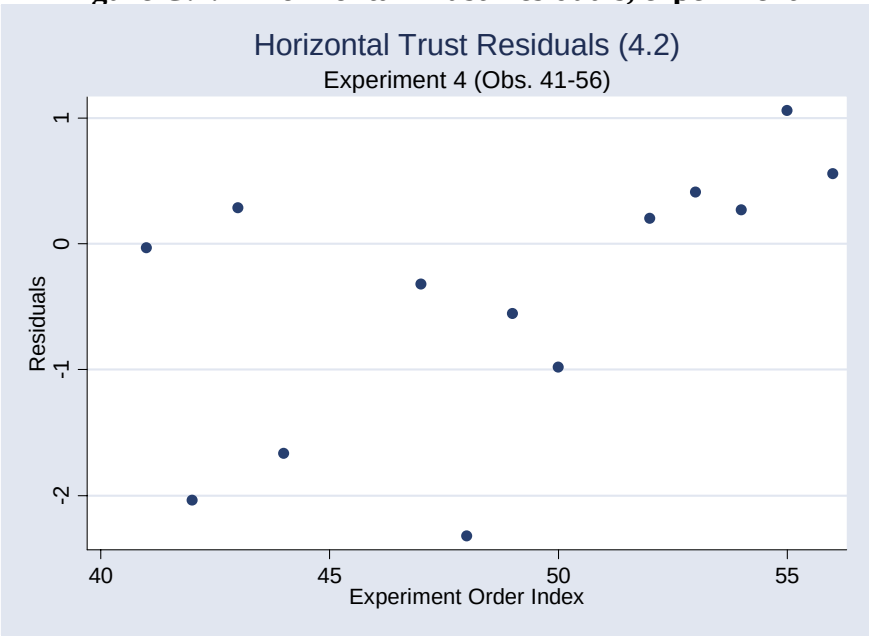


Figure G.5. Horizontal Trust Residuals, experiment 5

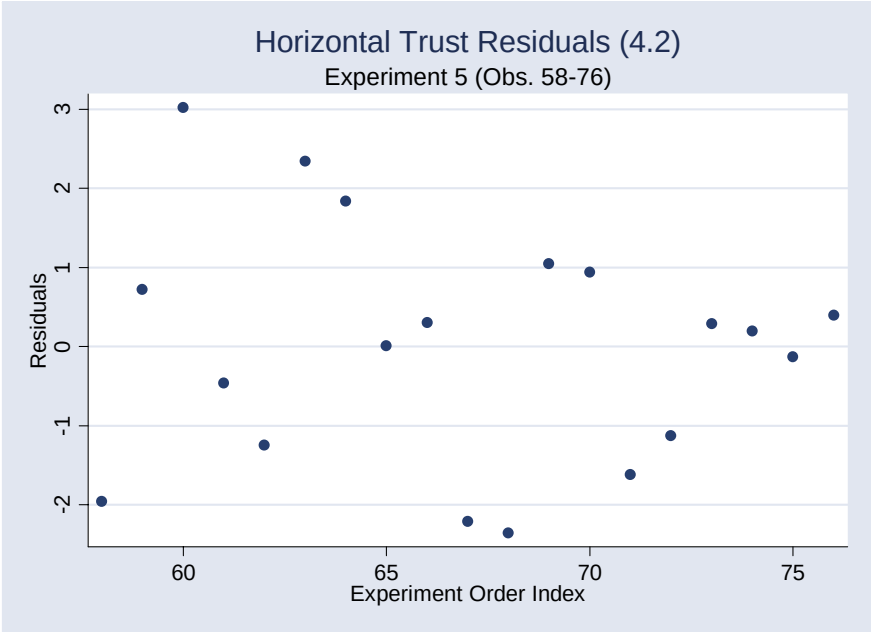


Figure G.6. Horizontal Trust Residuals, experiment 6

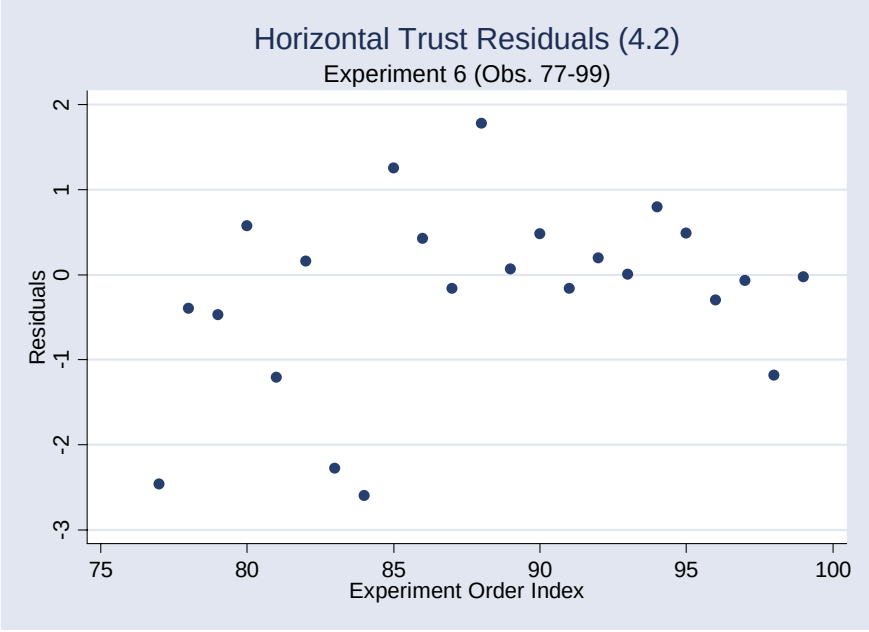


Figure G.7. Horizontal Trust Residuals, experiment 7

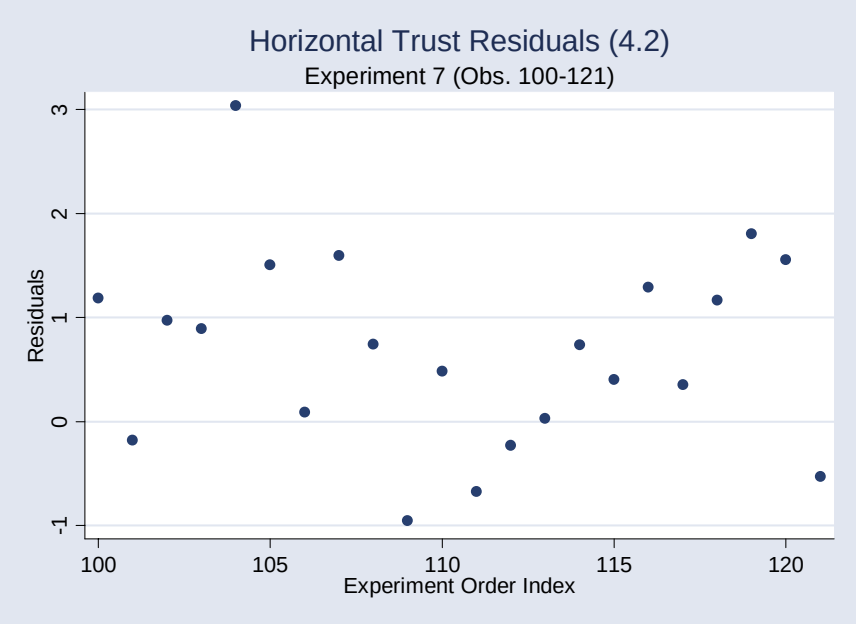


Figure G.8. Horizontal Trust Residuals, experiment 8

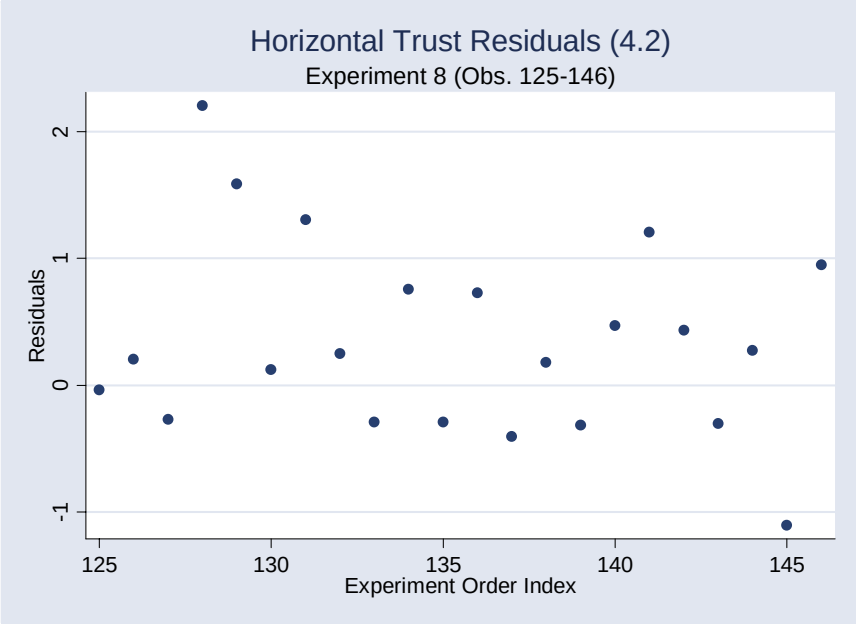


Figure G.9. Horizontal Trust Residuals, experiment 9

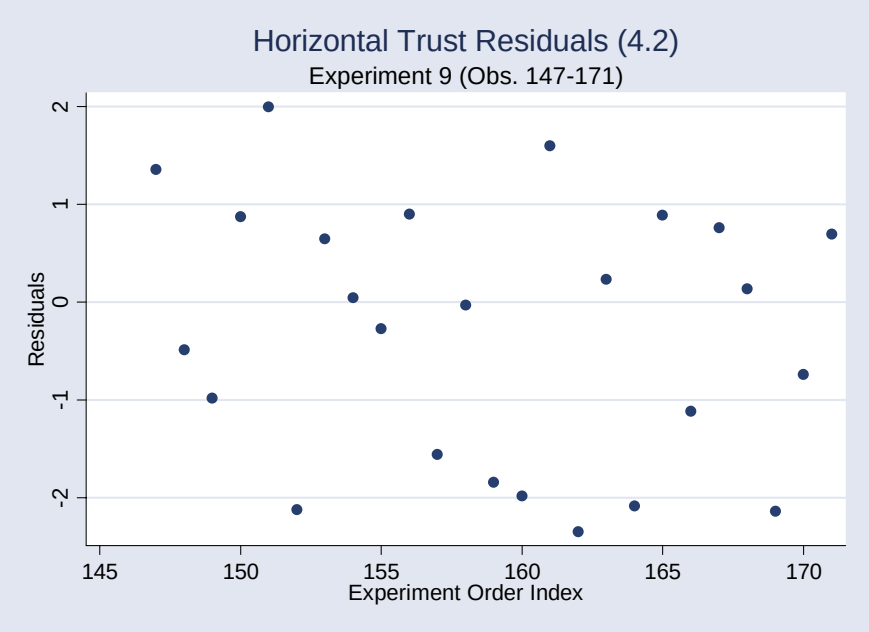


Figure G.10. Horizontal Trust Residuals, experiment 10

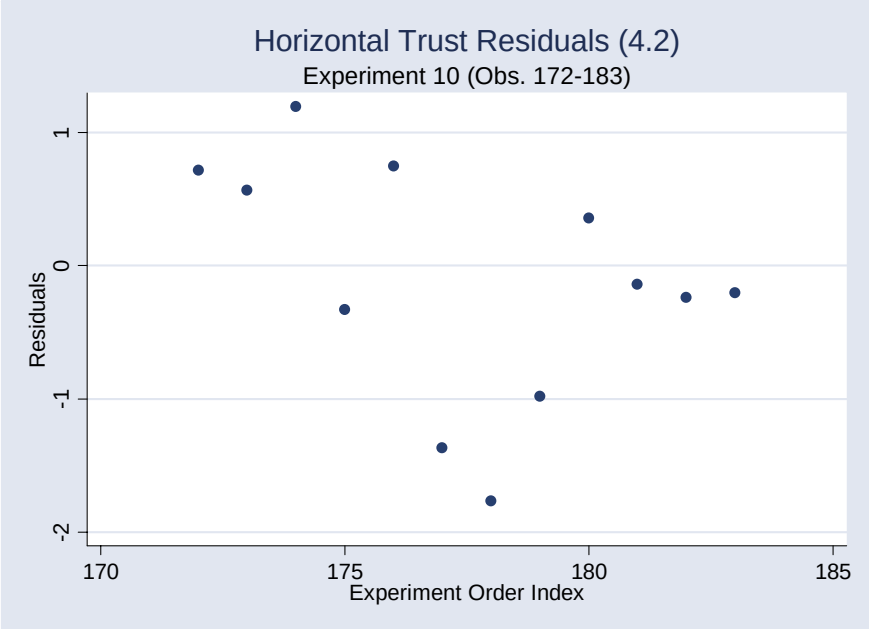


Figure G.11. Horizontal Trust Residuals, experiment 11

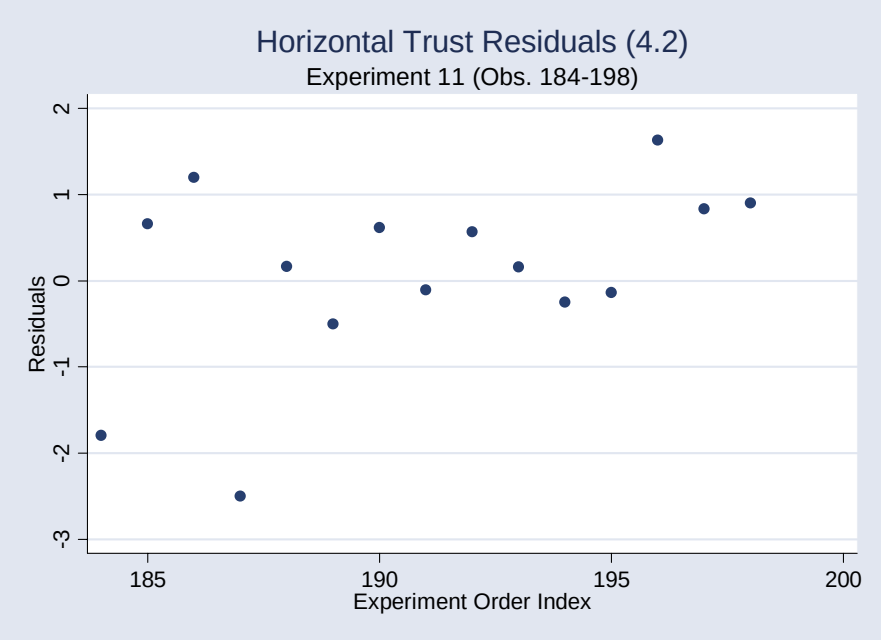


Figure G.12. Horizontal Trust Residuals, all experiments

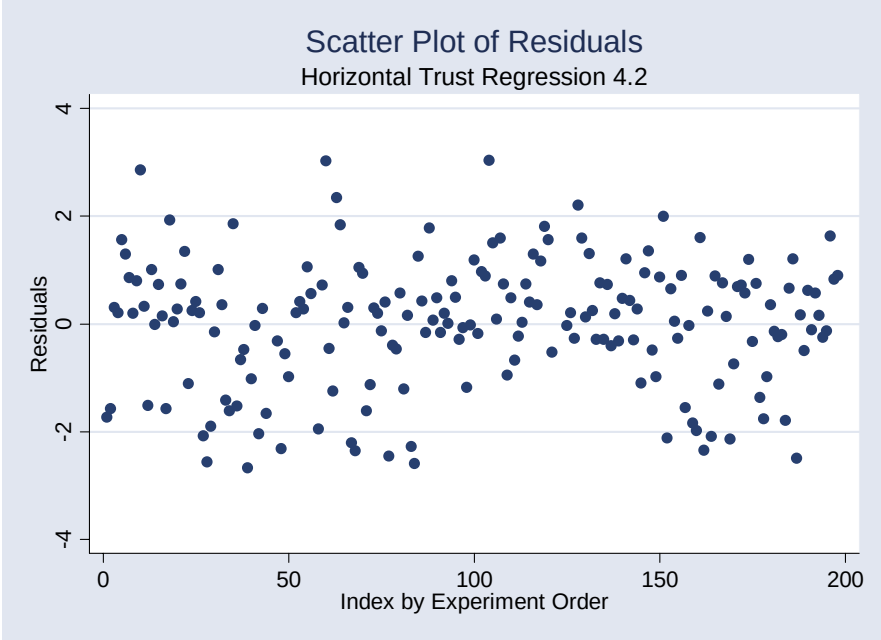


Figure G.13. Vertical Trust Residuals, experiment 1

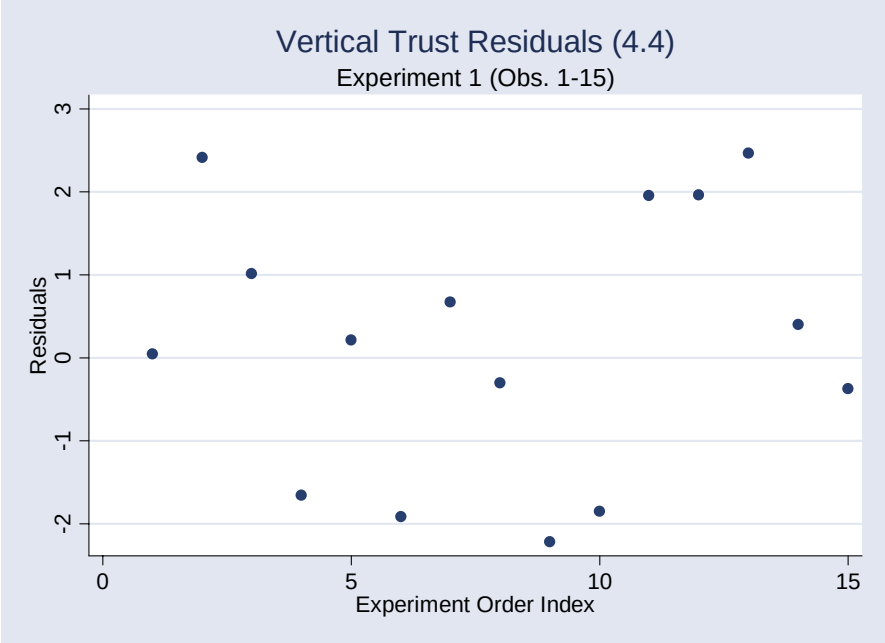


Figure G.14. Vertical Trust Residuals, experiment 2

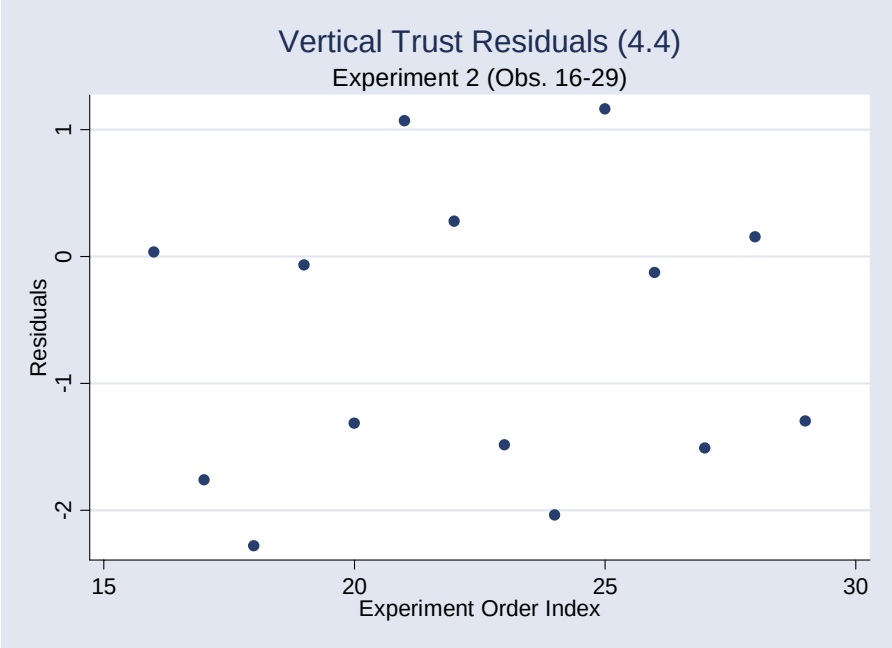


Figure G.15. Vertical Trust Residuals, experiment 3

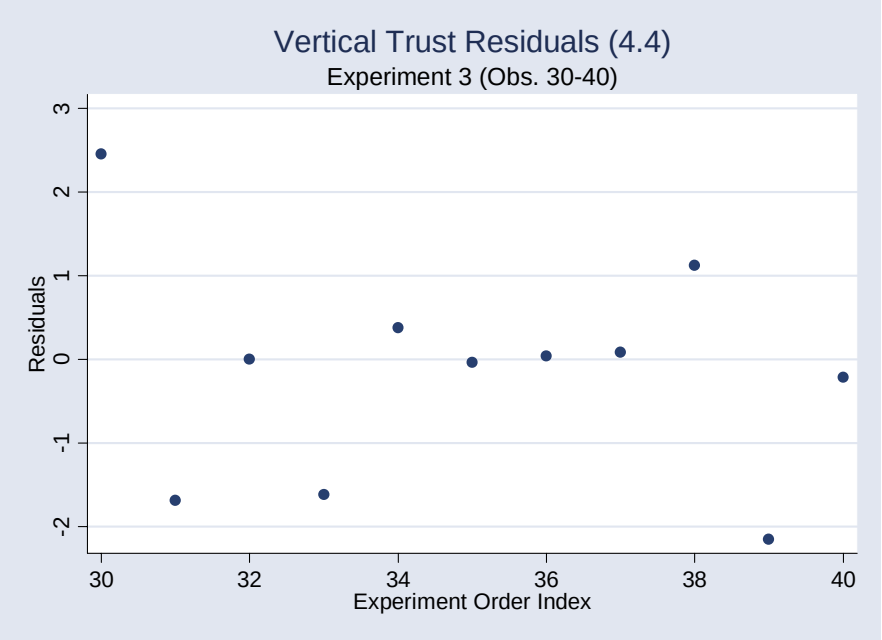


Figure G.16. Vertical Trust Residuals, experiment 4

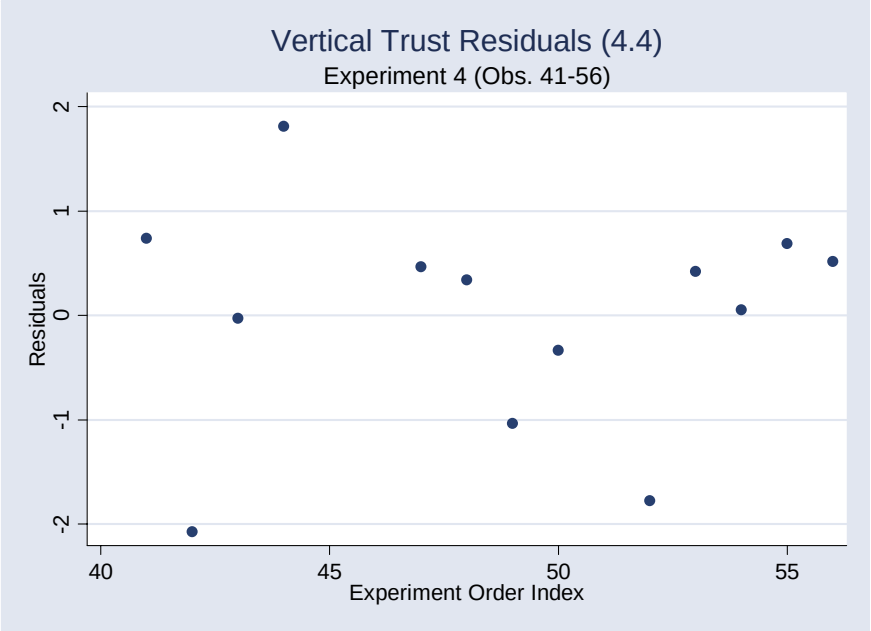


Figure G.17. Vertical Trust Residuals, experiment 5

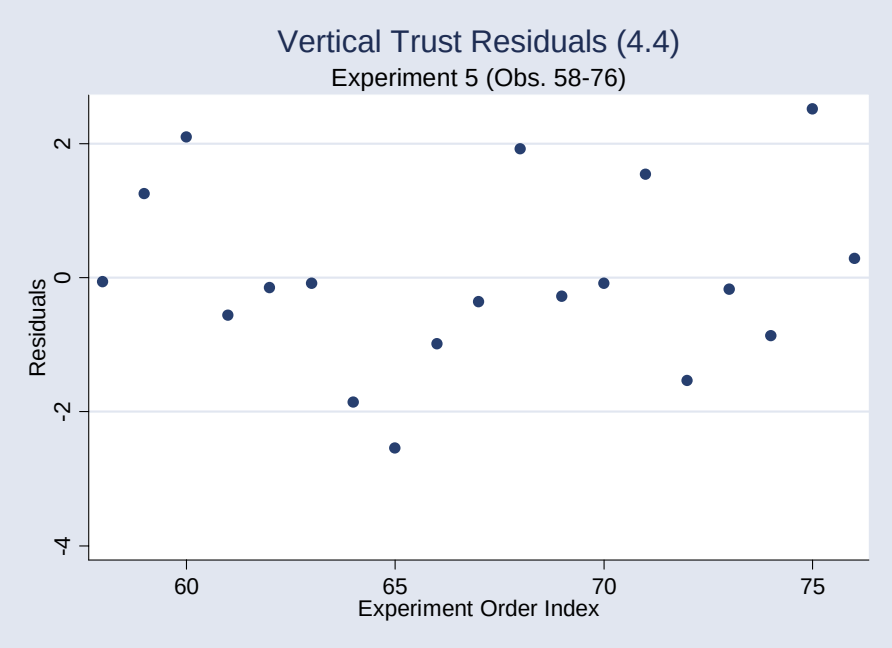


Figure G.18. Vertical Trust Residuals, experiment 6

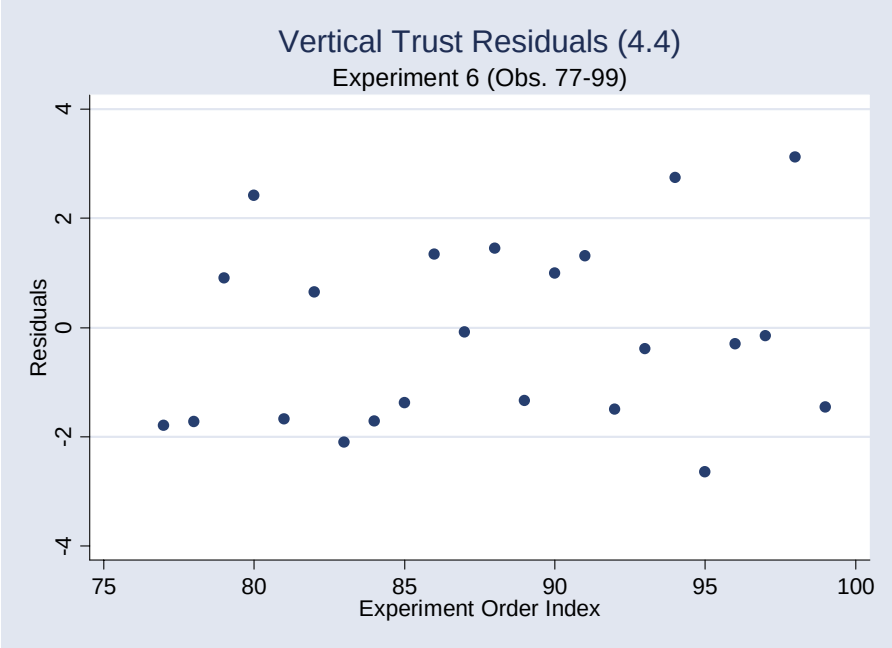


Figure G.19. Vertical Trust Residuals, experiment 7

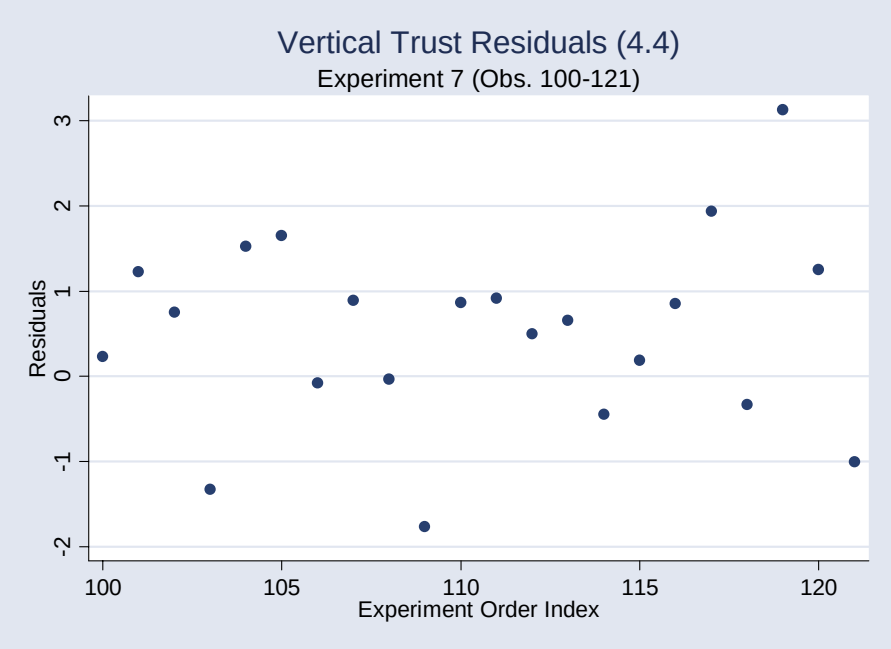


Figure G.20. Vertical Trust Residuals, experiment 8

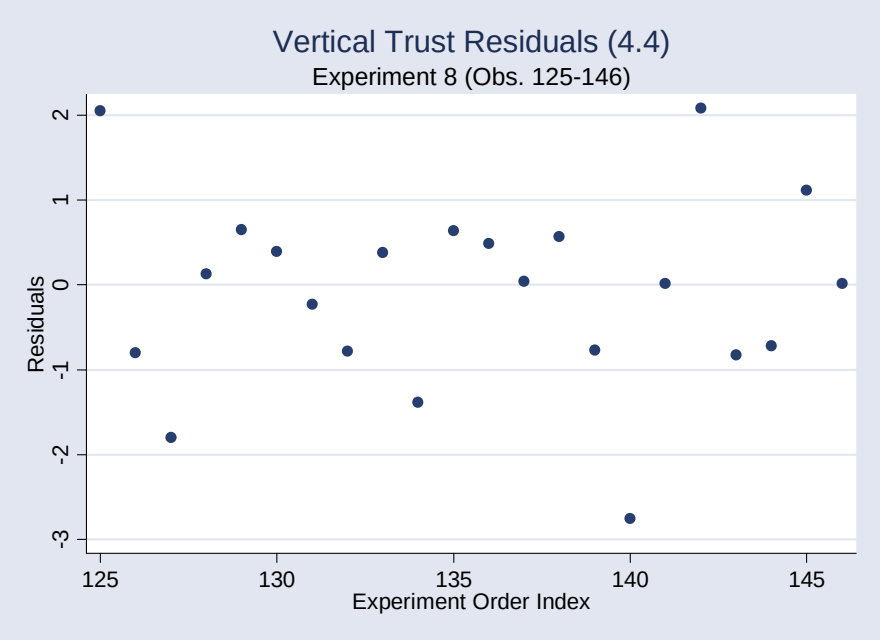


Figure G.21. Vertical Trust Residuals, experiment 9

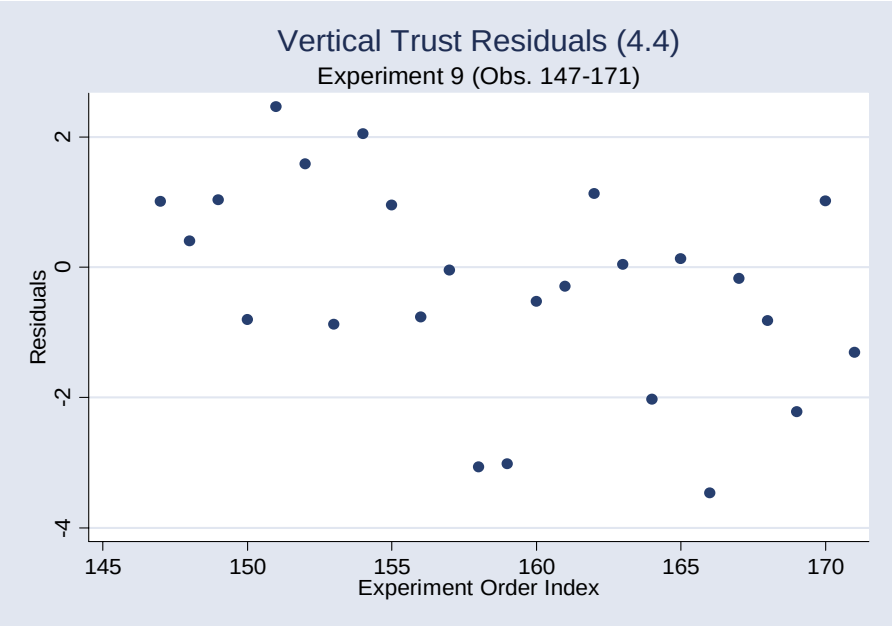


Figure G.22. Vertical Trust Residuals, experiment 10

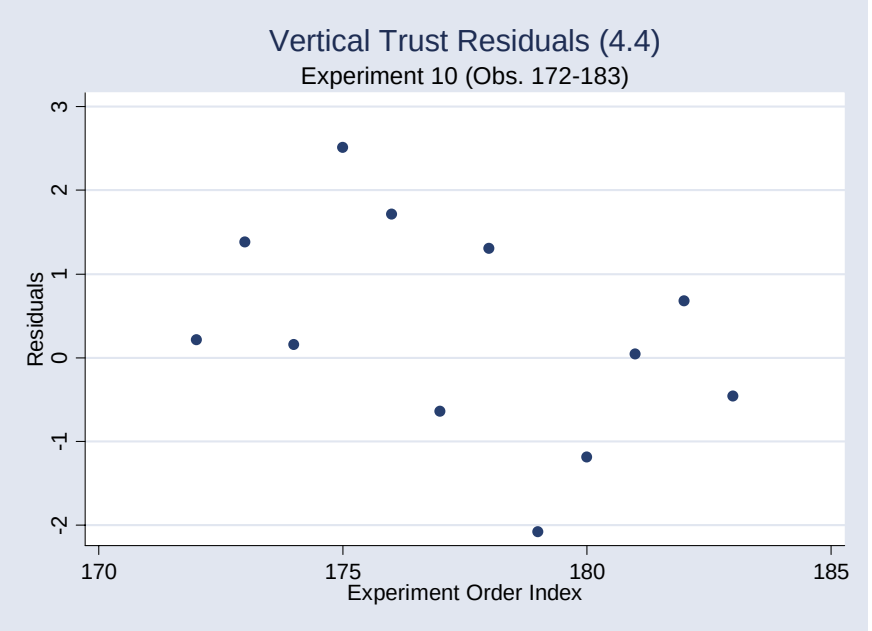


Figure G.23. Vertical Trust Residuals, experiment 11

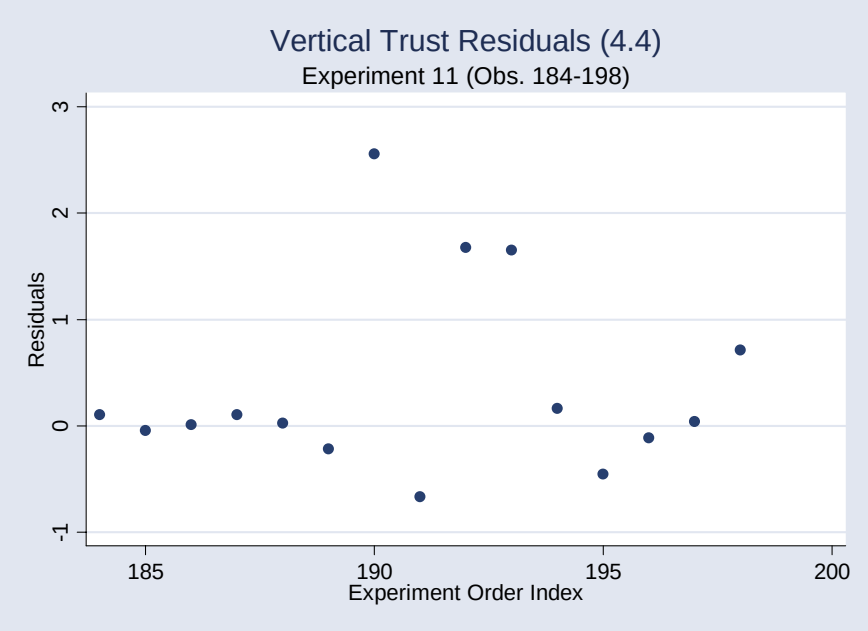


Figure G.24. Vertical Trust Residuals, all experiments

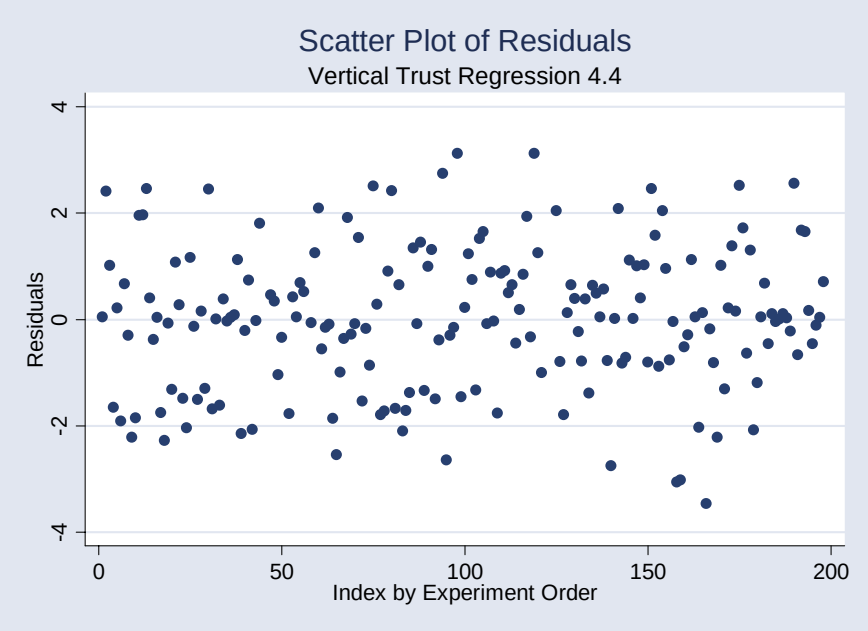


Figure G.25. Diff Trust Residuals, experiment 1

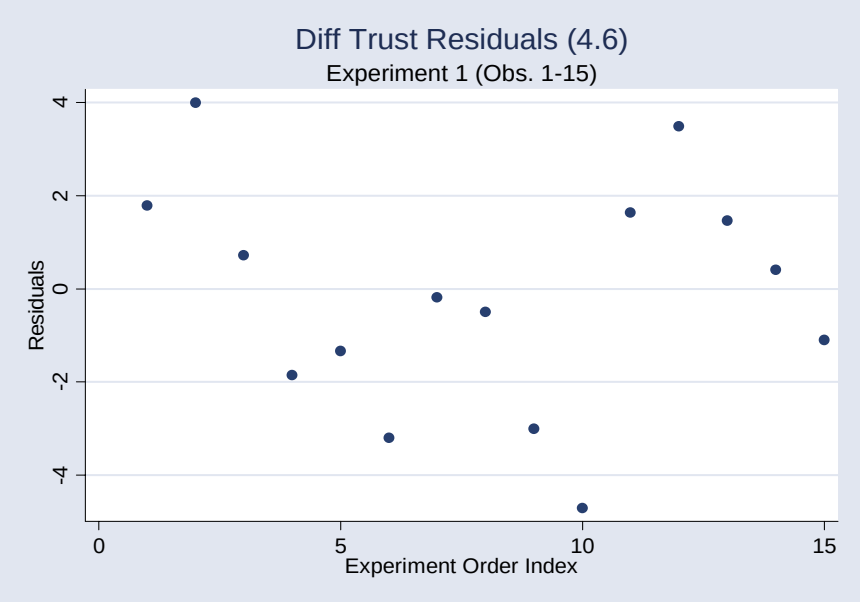


Figure G.26. Diff Trust Residuals, experiment 2

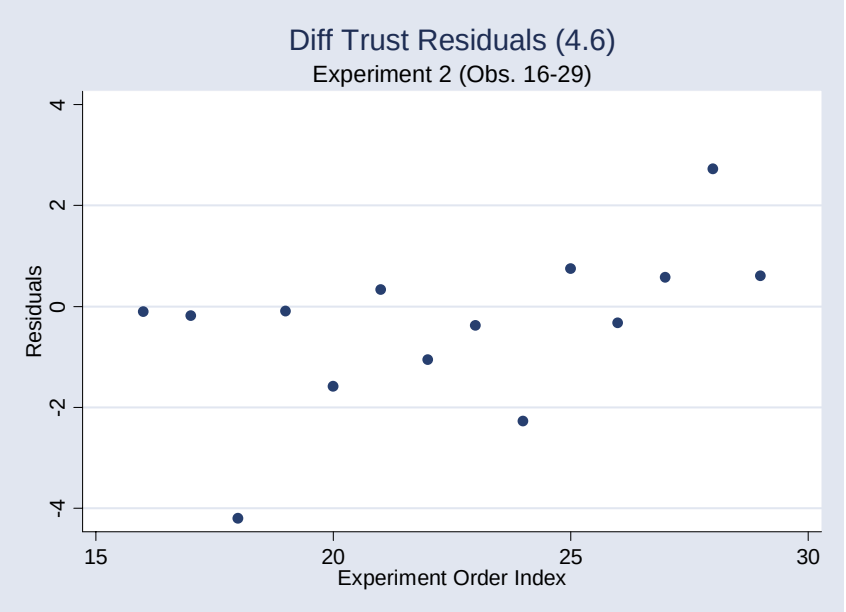


Figure G.27. Diff Trust Residuals, experiment 3

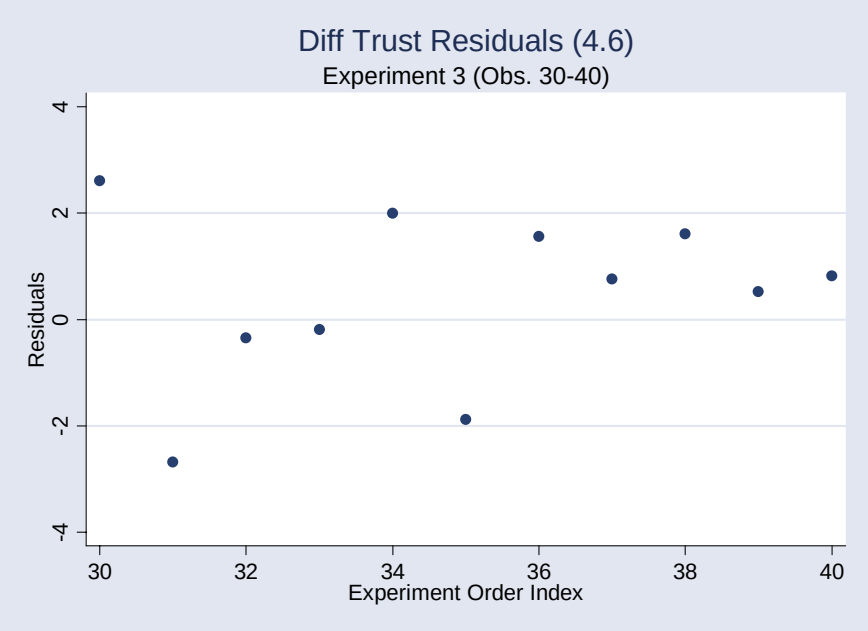


Figure G.28. Diff Trust Residuals, experiment 4

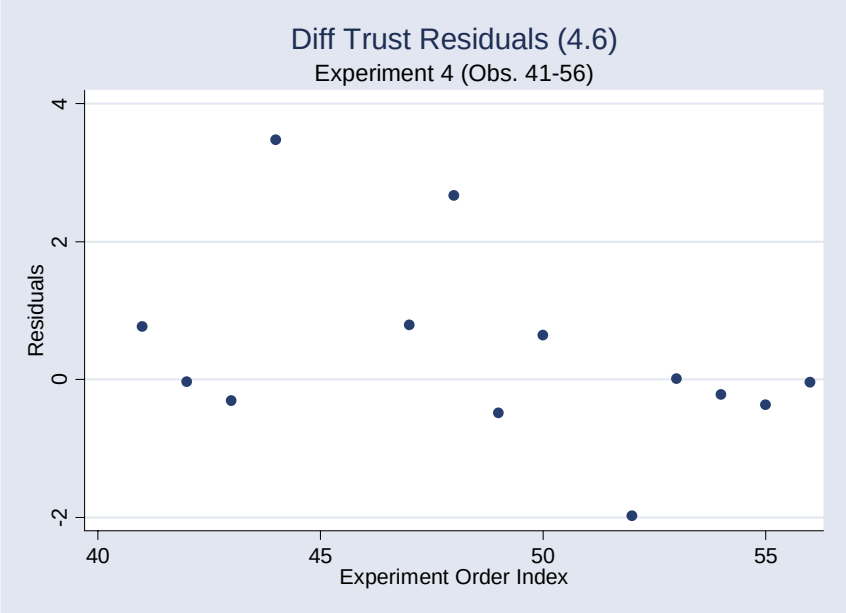


Figure G.29. Diff Trust Residuals, experiment 5

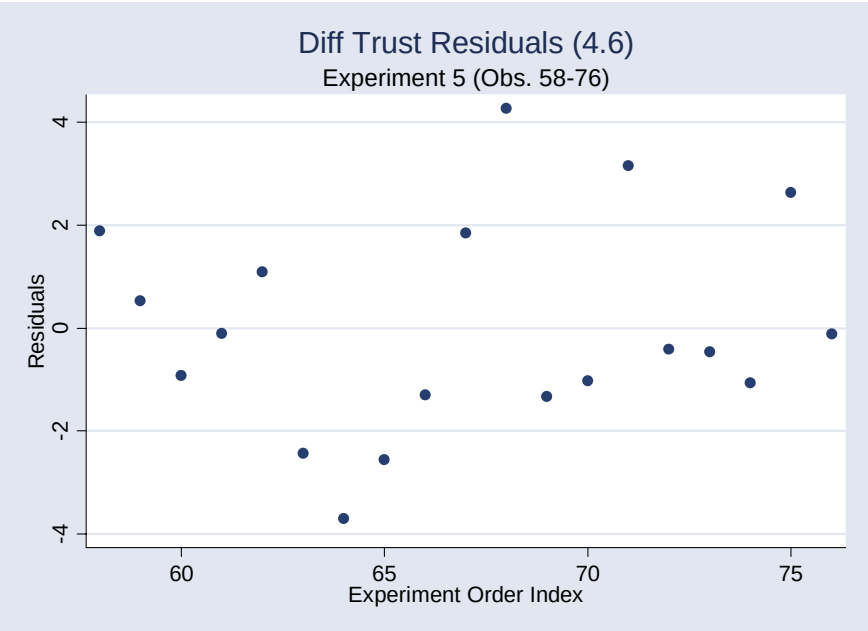


Figure G.30. Diff Trust Residuals, experiment 6

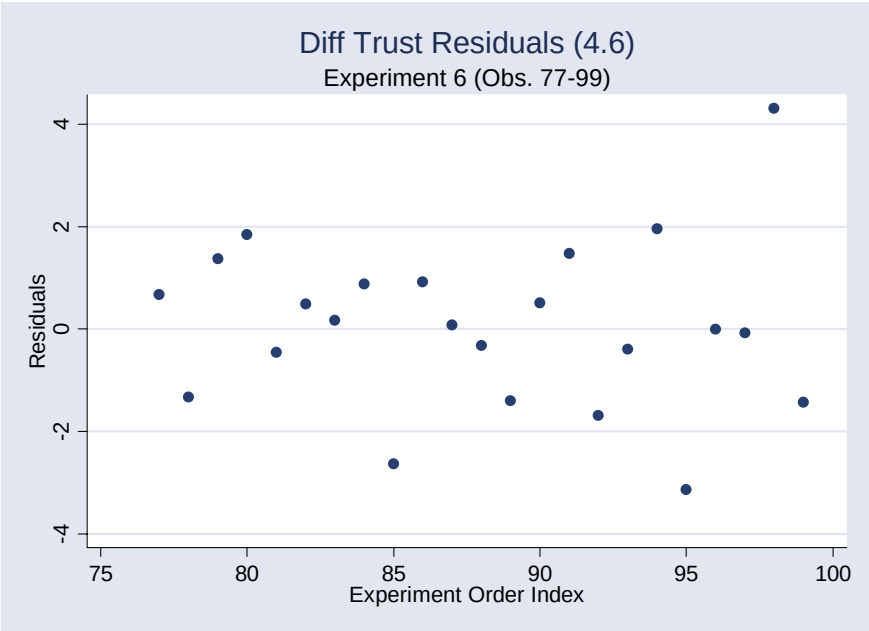


Figure G.31. Diff Trust Residuals, experiment 7

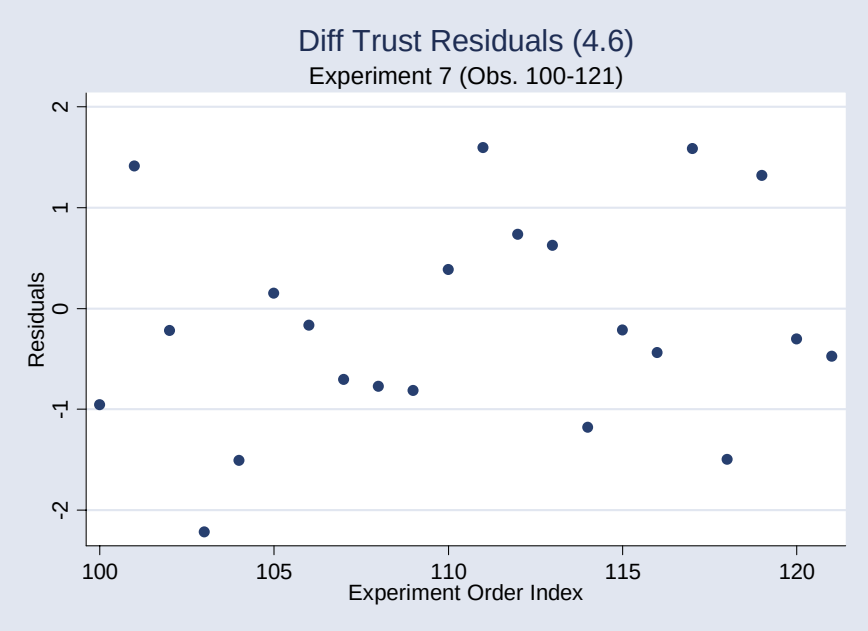


Figure G.32. Diff Trust Residuals, experiment 8

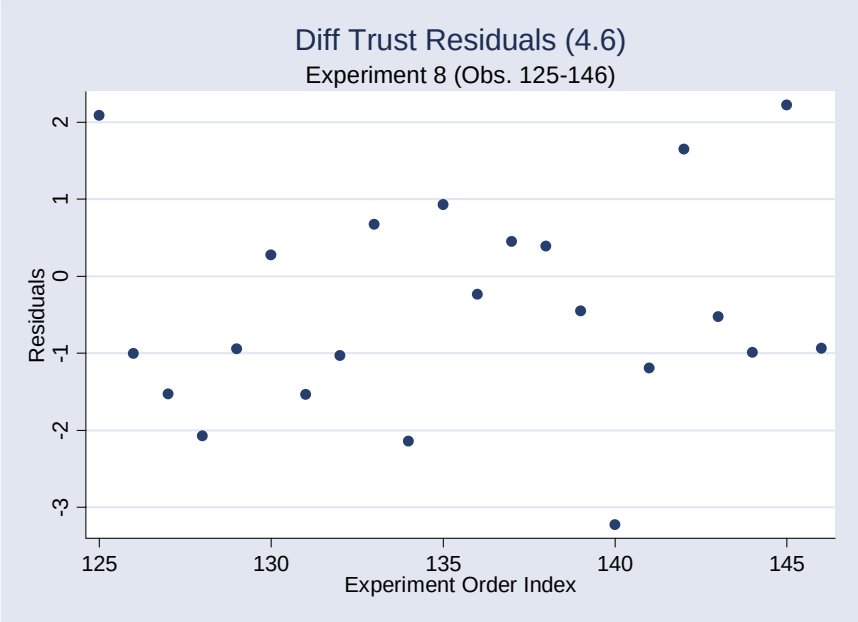


Figure G.33. Diff Trust Residuals, experiment 9

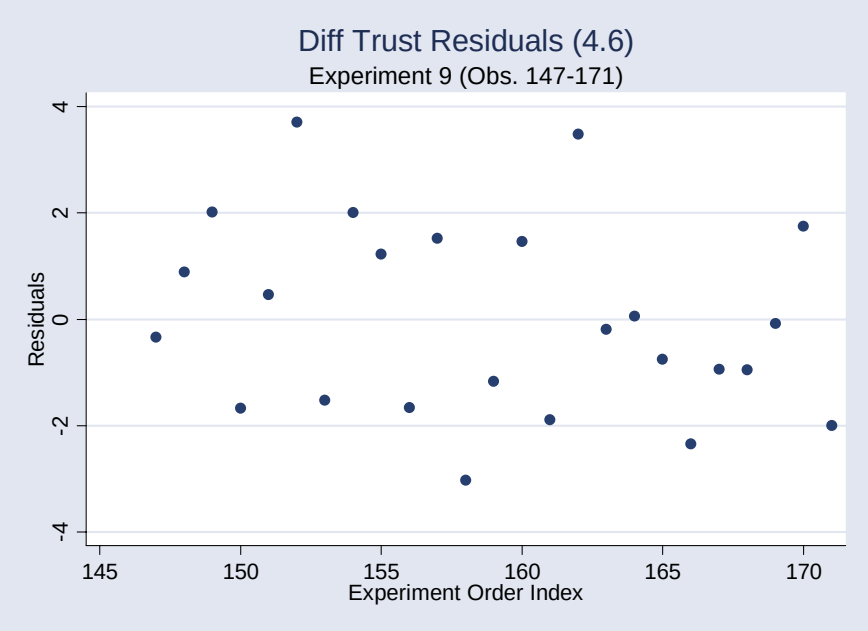


Figure G.34. Diff Trust Residuals, experiment 10

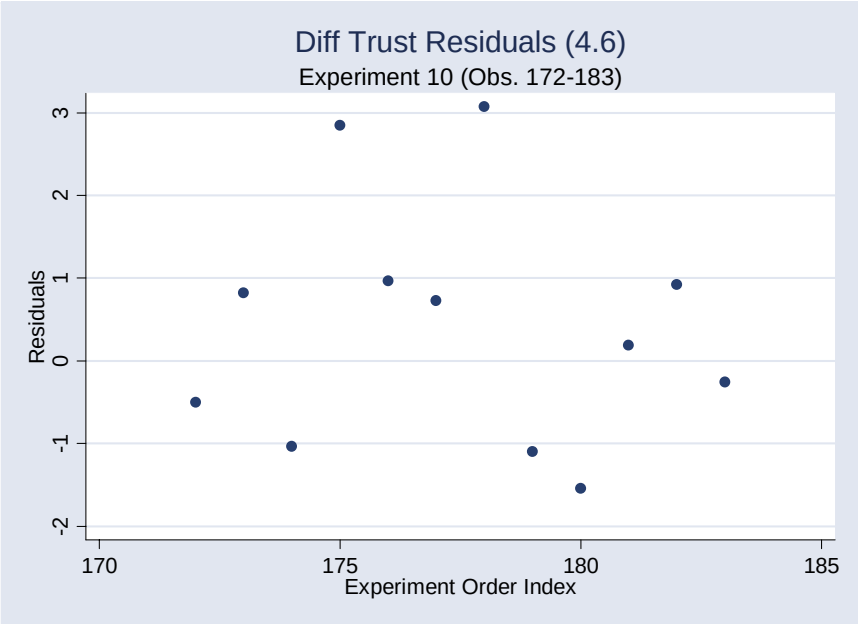


Figure G.35. Diff Trust Residuals, experiment 11

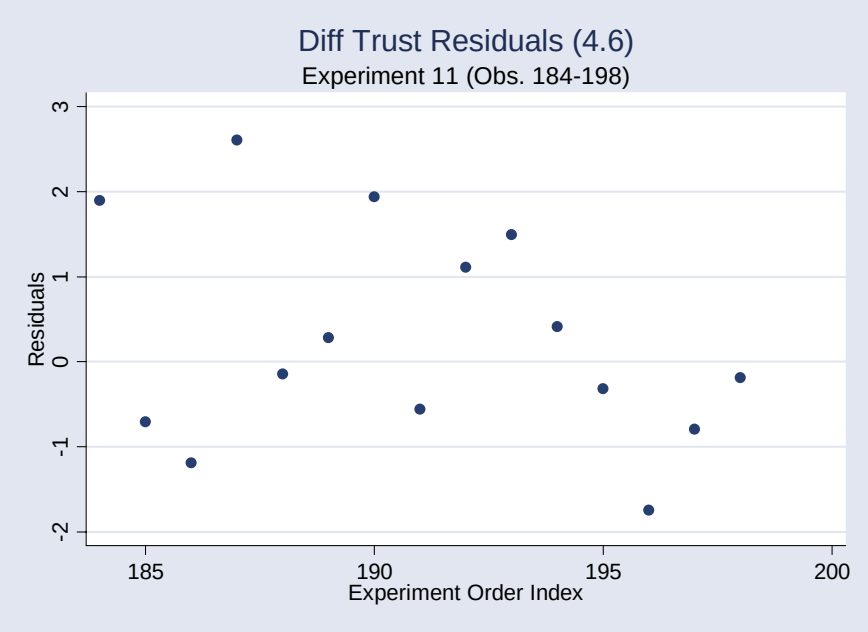
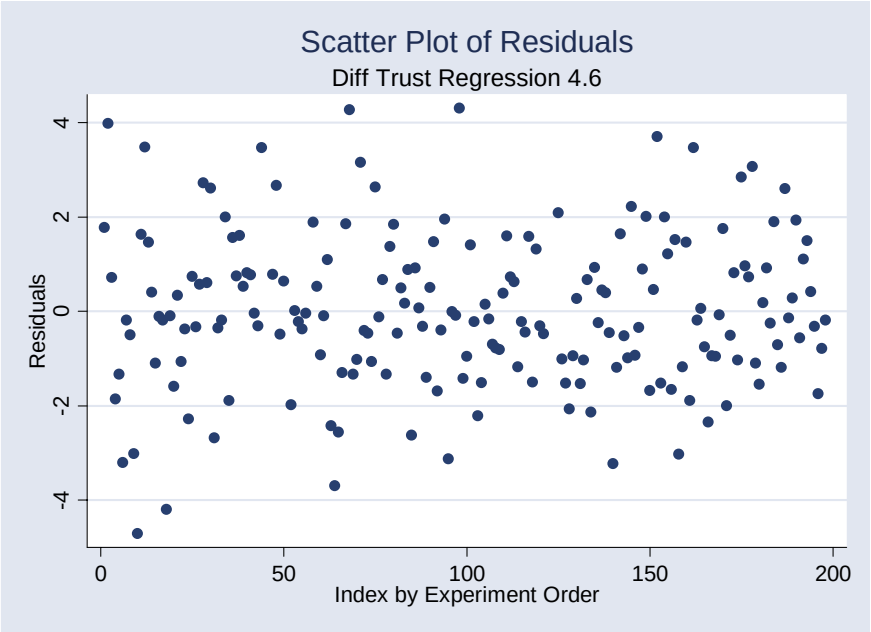


Figure G.36. Diff Trust Residuals, all experiments



VITA

Steven Charles Buck was born July 29th, 1980. As an undergraduate student at the University of Dayton he was awarded grants to study international development topics in India, Guatemala and Chile; in his senior year he developed and directed a two-month summer immersion trip to Guatemala for undergraduate students. He graduated from the University of Dayton in 2003 with a Bachelor of Science in Mathematics and a Bachelor of Arts in International Studies. He then went on to study at Virginia Tech where he earned a Master of Science Mathematics in May of 2005 and Master of Science in Agricultural and Applied Economics in May of 2006. While at Virginia Tech he served as a calculus instructor in the Mathematics Department; a research assistant in the Discrete Mathematics Group at the Virginia Bioinformatics Institute and a research assistant in the Agricultural and Applied Economics Department on a project funded through the United States Agency for International Development. Currently he is employed as a short-term consultant to the World Bank. In the Fall of 2006 he will continue his graduate studies at the University of California, Berkeley in the Agricultural and Resources Economics Department.