Make or buy: the case of harvesting mechanization in coffee crop in Brazil

RESEARCH ARTICLE

Gustavo Magalhães de Oliveira\textsuperscript{a} and Decio Zylbersztajn\textsuperscript{b,c}

\textsuperscript{a}PhD Student of Economics of Organizations, and \textsuperscript{b}Full Professor of Economics of Organizations, School of Economics, Business and Accounting, University of São Paulo, Avenida Professor Luciano Gualberto, 908, Cidade Universitária, 05508-900 São Paulo, SP, Brazil

\textsuperscript{c}Founder of the Agribusiness Knowledge Center (PENSA), Avenida Professor Luciano Gualberto, 908, room C-18, Cidade Universitária, 05508-900 São Paulo, SP, Brazil

Abstract

This paper investigates the make-or-buy choice on the harvesting mechanization transaction in Brazilian coffee production. It empirically tests this organization choice following the transaction attributes of asset specificity, uncertainty and path dependence. Using a two-stage probit model conditioned by credit availability in a sample of 105 coffee growers in Brazil, our study evidences that the governance decision follows the efficient alignment argument of the Transaction Cost Economics. The research contributes to the understanding of institutional arrangements in place at coffee grower perspective. An additional descriptive field investigation presented the existence of three different types of arrangement as a solution for coffee harvesting mechanization: total vertical integration (make), outsourcing contracts (buy) and tapped vertical integration. Those results demonstrate a shift from a spot transaction pattern to more sophisticated contractual tools. We present managerial implications by illustrating the determinants of each decision, either make or buy, in the harvesting mechanization transaction in coffee production which can provide support to efficient strategies elaboration by farmers or service providers.

Keywords: outsourcing contracts, coordination, harvesting mechanization, coffee crop, Brazil

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\textsuperscript{©}Corresponding author: gustavomoliv@gmail.com

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1. Introduction

The adoption of agricultural contracts has strongly changed since the study of Allen and Lueck (2002). One evidence is the meaningful increasing of contracting services for harvesting mechanization in agriculture instead of the use of own machineries around the world (Houssou et al., 2013; Yang et al., 2013). These several studies explore the farmers’ motivation to contract those services in order to better explain this agricultural modernization once the technology was already available since a couple of years ago. In addition, as a key player in the worldwide agricultural production, this process is also notable on extensive crops such as forestry and soybean in Brazil (Canto et al., 2006; Mascarin, 2014; Morais, 2012; Morais Filho, 2006; Novais and Romero, 2009). Although, other relevant agricultural production in Brazil – the coffee crop – had been able to access these service providers only very recently and, because of that, the make or buy choice in the transaction of harvesting mechanization in coffee production continues still unexplored in the literature. Moreover, the coffee production is a sensible crop and its mechanized harvesting process – either outsourced or through own machineries – is responsible for a large share of value creation in the coffee quality to the farmer (Silva et al., 2001). Therefore, to understand the make or buy choice in the transaction of harvesting mechanization in the Brazilian coffee production can result in impactful implications for practice and theory.

The phenomena of harvesting mechanization in agriculture is widespread adopted, in fact, worldwide (Fisher and Knutson, 2013; Houssou et al., 2013; Igata et al., 2008; Navarro, 2002; Takeshima et al., 2013; Yang et al., 2013) or Brazil (Canto et al., 2006; Laurenti, 2004; Mascarin, 2014; Morais, 2012; Morais Filho, 2006; Novais and Romero, 2009; Zanchet, 2009). The authors study the make or buy choice in different crops, such as soybean, sugarcane, forestry, among others. Although, none of them focus on the coffee production because the firms that provide services of mechanized harvesting in coffee have recently emerged, even in Brazil, where this agricultural product is quite relevant. The country is the world leader in the production and export of the grain. Brazilian production is responsible for about 50 million bags of coffee per year, representing around twice as much the production of Vietnam, the second largest producer. Brazilian production generated about 1.4 billion dollars of exportation in 2016 (Conselho dos Exportadores de Café do Brasil (CECAFE), 2016 – Council of Brazilian Coffee Exporters).

Silva et al. (2001) argue that the harvesting process in this crop is one of the most relevant production stage to create quality in the final product and, consequently, it strongly impacts this income generation in Brazilian production. Additionally, World Bank (2014) presents that contract farming can result in higher performance to farmers. Therefore, given the recent aspect of service providers of harvesting mechanization of coffee in Brazil, the relevance of this crop to the country, the importance of this transaction to the value creation of the coffee sector and, finally, the limitation of the extant literature with this focus, the decision of make or buy in the transaction of harvesting mechanization in coffee production in Brazil is worthy investigating.

Due to the limitation of economies of scale to explain the decision of make or buy in the transaction of harvesting mechanization, this study, in turn, adopts the theoretical framework of Transaction Cost Economics (TCE) to analyze the outsourcing contracts for harvesting mechanization with the efficient alignment hypothesis (Williamson, 1985). The extant literature pinpoints relevant determinants of that decision in different agricultural products that justify this literature, such as the time and location (Houssou et al., 2013; Morais, 2012; Novais and Romero, 2009; Takeshima et al., 2013; Yang et al., 2013), human capital (Canto et al., 2006; Fisher and Knutson, 2013), institutional environment (Laurenti, 2004), among others.

We address the following question: what are the determinants of outsourcing contracts of harvesting mechanization services in the Brazilian coffee agribusiness system? By that, we aim to investigate transaction of harvesting mechanization between coffee growers and specialized service providers in Brazil. We contribute to the growing literature on agricultural contracts (Allen and Lueck, 2002; Almeida et al., 2011; Almeida

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1 We focus our analysis exclusively on the Coffea arabica. We chose this species due to the fact that it presents higher quality aspect than the Coffea canephora, which is also common in Brazilian coffee production. Moreover, the mechanized harvesting differs in both products.
and Spers, 2016; Chaddad, 2015; Rezende and Zylbersztajn, 2012; World Bank, 2014; Zylbersztajn et al., 2015) and, specifically, we contribute helping coffee farmers to make a more efficient decision by illustrating the aspects that surround this transaction. In doing so, we present what kind of coffee growers’ profile favor outsourcing or vertical integration as more efficient coordination mechanisms in terms of management practices. In sum, we focus on coffee farmers with mechanized harvesting – either outsourced or with own machineries.

This paper is organized around six sections. The next section presents our theoretical foundation. Section 3 outlines methodological procedures. Section 4 brings main results. Section 5 presents the discussion. Finally, the last section presents the conclusions.

2. Outsourcing contracts in harvesting mechanization through the TCE’s lens

The relevance of agricultural mechanization is usually related to the cost in the production factor of labor. According to Calvin and Martin (2012), labor cost represents 42% of a farm’s cost structure, as the case of the harvest of fruits and vegetables produced in the United States. This is a challenge for the coffee production in Brazil, where the harvesting mechanization services extended the coordination of the use of own machineries to the outsourcing contracts as other institutional arrangement in the harvesting mechanization transaction. The change allowed the use of external contracts as a new form of coordination and, consequently, raised the conflicts in contractual relations such as hold-up problems (Klein et al., 1978; Williamson, 1985). Thus, we assume that economic efficiency is associated with coordination issues – asset specificity and other characteristics of the transaction (uncertainty and path dependence), rising the main questioning of firm theory, the vertical integration dilemma (Coase, 1937).

Verticalization emerges to economize the risks of appropriating quasi-rents from specialized assets (Klein et al., 1978). Asset specificity is associated with specific investments that might lost value when applied in an alternative use (Williamson, 1985), its levels are idiosyncratic, intermediary level of specialization and with no specific application. The transaction of harvesting mechanization in coffee is surrounded by this specificity through different natures, uncertainty and path dependence. Deepening in TCE setting and the outlook of other crops around the world and in Brazil, this paper assumes that resources allocation in that transaction – whether for the purchase or outsourcing contracts – is directly associated with: decisions made in the past (family and farmer’s tradition), farmer’s profile (location and education level), training investments and experience of the machinery driver, structure of the farm (size and investments in specialized assets), and the timing to an efficient harvesting.

Human capital specificity emerges as the knowledge required to operate the coffee harvester. For instance, driving specialization requires investments in training and accumulation of knowledge through the driver’s experience to provide an efficient service. The resources allocation for driver training or experience over time increases specialized knowledge, that is, the human capital specificity of the transaction (Lyons, 1994; Williamson, 1985, 1996). The relevance in analyzing this aspect in the harvesting mechanization transaction in coffee crop relies on the extant literature of other agricultural products. Fisher and Knutson (2013) illustrate that the higher the knowledge requirement for harvesting activity, the higher is the adoption of mechanization services in some crops of the US agriculture. In Brazil, Canto et al. (2006) and Morais Filho (2006) exemplify the driver’s technical knowledge as a determinant in the make or buy choice of the mechanized harvesting in the forestry sector.

Site asset specificity is related to the distance between the farmer and the service provider (Caleman and Zylbersztajn, 2012; Miele and Zylbersztajn, 2005; Williamson, 1985, 1996). Transporting costs are high and, consequently, the higher the distance of the farmer and the service provider, the higher are the investments to transport the harvesters. Yang et al. (2013) illustrate it in China, where machinery transportation along the Chinese territory might result in high costs according to the distance between the agents, and could also damage the equipment. In addition, other illustrations are found in Ghana (Houssou et al., 2013) and...
Nigeria (Takeshima et al., 2013). Similarly, it is notable the relevance of site asset specificity to the case of Brazilian coffee, since the firms of harvesting mechanization services for coffee crop are concentrated in certain regions, highlighting the distance as a relevant factor to this decision.

Time asset specificity also appears in the coffee harvesting activity. The delay in carrying out this operation might cause losses to the farmer due to the quality in agricultural products. Days of delay to harvest coffee may result in a substantial loss in the grain quality. Indeed, time specificity arises in situations when the transaction is sensible to time delays (Masten, 2000; Williamson, 1985, 1996), as the coffee harvesting activity demonstrates. This time asset specificity is also found in other research designs, such as in the Ghana territory and the worry about the rains along the country (Houssou et al., 2013), and the value losses due to delays in harvesting in the Brazilian forestry case (Morais, 2012).

Therefore, distinct types of asset specificities influence the transaction of mechanized harvesting in coffee crop. And, as stated in the literature, in a transaction with high asset specificity, there are higher quasi-rents available to opportunistic capture, which induces to strict hierarchical coordination in order to prevent this from occurring (Klein et al., 1978; Williamson, 1985, 1996). In other words, the use of own machineries in the case of the harvesting mechanization transaction in coffee production. This relationship builds the first hypothesis:

$$H_1:$$ The higher the asset specificity, the lower the adoption of outsourcing contracts as the governance form in the transaction of harvesting mechanization in the Brazilian coffee production.

Another theoretical attribute of the transactions is the uncertainty. This dimension appears as the inability to predict an event, or rather, the lack of knowledge about the probability distribution function of the phenomenon (Williamson, 1985, 1996). This attribute is present in agribusiness systems through the institutional environment (Zylbersztajn, 1996).

Formal institutions are able to decrease or increase the level of uncertainty in transactions (North, 1990; Williamson, 1985), because their agents have limitations due to bounded rationality (Simon, 1955). Then the uncertainty is surrounded by the court’s ability to hold, process, and analyze the information. In addition to this assumption, the difficulty of measurement of contracts also raises as potential factors in the increasing of uncertainty in a given environment (Hermalin et al., 2007).

Mascarin (2014) shows divergences in Brazilian labor law in the use of outsourcing contracts of agricultural equipment services in the sugarcane and soybean cases. The author points out the uncertainty in that institutional environment, because there is not a decision pattern regarding the prohibition or not of outsourcing contracts in harvesting mechanization services. The instability is a consequence of ongoing changes in the law that deals with the outsourcing of activities. Some court decisions are in favor of outsourcing contracts, while others consider illegal and punishable the subcontracting of mechanization services by the farmers. The institutional environment regarding the outsourcing of activities has been changing. Brazilian labor law has been diverging in different court’s decisions on this point. There are conflicts between the norms of the current labor law number 331 of the Superior Labor Court (TST, 2011) and the Bill 4330/2004 (Brazil, 2004). Laurenti (2004) illustrates that the use of outsourcing contracts in agricultural services has been increased as a consequence of the creation of the Brazilian labor bill number 4330/2004 (Presidência da República, 2004). The author claims that Brazilian rural producers have been adopting external contracts in order to reduce the risks of legal conflicts of labor when the transaction is integrated.

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2 We do not explore the market and technological uncertainties (Carlton, 1979; Lajili et al., 2007) and exclusively focus on the institutional uncertainty in our analysis. We make this decision based on the literature that provides basis to argument that the make or buy choice in harvesting mechanization in Brazilian agriculture is much more influenced by the institutional environment than other aspects (Laurenti, 2004, Mascarin, 2014). We follow this path because our analysis also occurs in Brazil and the coffee sector has presented that the technology involved in the harvesting mechanization and the quality of that services are similar in distinct service providers, due to the low competitiveness on the industry of specialized firms of harvesting mechanization services that emerged recently.
Although, Mascarin (2014) also argues that, as a consequence of the lack of pattern in the institutional environment decisions, the farmers avoid the adoption of outsourcing contracts when punished by the “Termo de Ajustamento de Conduta” (TAC). TAC is a document ordering changes and fixing penalties after an investigation that found irregular conditions of labor in Brazilian farms. Usually in agriculture, the main issue of this kind of lawsuit is related with labor conditions and mechanization decisions considered irregular. Thus, the presence of TAC exemplifies an environment of uncertainty to our design.

The complexity behind a contractual analysis and the lack of standardization in decision-making in the courts brings uncertainty to the harvesting mechanization transaction in the Brazilian coffee crop. Ceteris paribus, the option with lower transaction costs is the less formal institutional arrangement such as market relationships (Williamson, 1996). Therefore, considering the uncertainty attribute, the vertical integration occurs in environments with high uncertainties, that is, the coffee grower is just limited in the using of outsourcing contracts when he faces an uncertain scenario. The second hypothesis is based on this argument as following:

$$H_2: \text{The higher the uncertainty, the lower the adoption of outsourcing contracts as the governance form in the transaction of harvesting mechanization in the Brazilian coffee production.}$$

Other theoretical attribute of transactions is path dependence. Past experiences also interfere in the choice of the institutional arrangement in the harvesting mechanization transaction. Decision-making over time builds a path dependence that limits future negotiation options due to past choices. The concept emphasizes that previous relationships might influence the future because of losses in the act of breaking that path dependence. The balance between the benefits of continuing to adopt the structure already used in the past and the costs of entering a new path highlights the impossibility of changing (North, 1990).

Path dependence might limit the rational choices of economic agents. This attribute brings the influence between short and long-term decisions. An example may be the knowledge and information accumulation over time that influence the agents’ decision (North, 1990). An agent that accumulates experience through time differ of a new agent in a specific transaction, mainly by the social embeddedness resulted from that past experiences of the former (Granovetter, 1985).

This scenario also emerges in agricultural contexts. Karali et al. (2013) highlight that farmers can assume a profile of traditionalist decisions acting against changes in a prior pattern of routines in farm management. It is a social constraint that difficult the adaptation of new opportunities from market. For instance, this kind of traditionalist farmer can be seen as that farmer that requires to be closer on his farm management doing by himself the activities, such as prepare the land, sow the soil, fertilize, irrigate, operate his machineries, among others. When this kind of path dependence takes place, it is notable that the farmer is more social- and past-oriented than business- and professional-oriented. He usually follows the past decision from his precursors. This is an important aspect to consider in the analysis of the Brazilian coffee production since this activity is one of the oldest crop in that country which can result in a social constraint built through time.

In addition, Navarro (2002) presents this case through the farmer’s family and his tradition influencing the choice of the institutional arrangement in Spain. The traditionalism in agriculture production takes the closeness of the farmer’s transactions interfering in the use of own machineries due to knowledge accumulation about the technology and its functioning. According to the author, Spanish farmers have adopted the vertical integration of the transaction of harvesting mechanization over the years when they already adopted it as their governance mechanisms in past decisions.

In general terms, this is also true in our design. Coffee growers with years of experience or with family tradition in the activity can act quite different in comparison to younger farmers. The need to do the farming activities by himself is more frequently present in the higher farmers’ experience, who assume that to take part of the social aspects (Granovetter, 1985) that surround the farm management as relevant as their performance and
In other words, the closeness of farming activities can take place when individuals’ moral values and beliefs are able to influence the decision-making.

The application of path dependence in this transaction is assumed by the coffee grower’s experience in the activity. The years in the coffee-growing activity and the knowledge transmitted by the family generations might influence the decision to use outsourcing contracts due to previous pattern of decisions and social involvement in the farm management. The literature shows the history of Brazilian coffee production where the transaction of harvesting mechanization has been vertically integrated since its origin (Silva et al., 2001). Consequently, the long-term contact with the activity implies in the tradition of use of own machineries in the transaction of coffee harvesting in order to maintain the past decisions and the farmer’s involvement with the farming activities, specifically the harvesting. So, the successor of a coffee grower who already owns the equipment may be influenced to maintain this practice. Those arguments build the third and last hypothesis:

\[ H_3: \] The higher the path dependence of the coffee grower, the lower the adoption of outsourcing contracts as the governance form in the transaction of harvesting mechanization in the Brazilian coffee production.

3. Methodology

The study has an exploratory, descriptive and quantitative approach. The exploratory aspect is used as a consequence due to the recent emerging of service providers in harvesting mechanization and the recent use of outsourcing contracts to coordinate that transaction by the coffee growers. The descriptive and quantitative parts are embedded in primary data which were collected through a survey based on the TCE literature.

The questionnaire was validated by two specialists in the coffee market during July and September 2015. A pre-test was carried out with a collection of 30 observations during the International Coffee Week in September 2015, a meeting with a diversity of Brazilian coffee growers attended. Afterwards more 39 observations were collected by telephone to investigate the coffee growers behavior during the interviews.

Finally, a final sample of 105 observations of coffee growers with mechanized harvesting (either through his own structure or through outsourcing contracts) with non-probabilistic nature was built. Observations came from personal interviews (55 observations) in two Brazilian conferences (FEMAGRI 2016 and SimCafé 2016) related to the object of study, and from data collection by telephone (50 observations). The data collection was carried out with only coffee farmers with mechanized harvest. Our sample consists of 45 farmers who adopt the outsourcing contracts and 60 farmers who use their own machineries in the transaction of harvesting mechanization. The farmers interviewed are from the states of Minas Gerais and São Paulo because these regions are the two main areas of coffee production in Brazil and they have the variety of production structure found in other states. Thus, the questionnaires were answered by Arabica coffee farmers who bring the different characteristics of high-quality coffee plantations and the mechanized harvesting processes found in the country. In sum, it is possible to say that the sample is representative of the population.

The empirical analysis assumed that economic efficiency is based on Williamson’s concept of efficient alignment (Williamson, 1985, 1996) and on the literature about subcontracting of agricultural mechanization.

3.1 Metrics on the decision of mechanization outsourcing in coffee production

The metrics are based on the literature about outsourcing of agricultural mechanization, using the theory of TCE. The structure of this section is focused on the hypotheses: asset specificity, uncertainty, path dependence and control variables. The metrics are presented in Table 1.
**Table 1. Model’s variables.**

| Variable                          | Hypothesis                                                                                     | Type               | Sign  | Reference                                                                 |
|-----------------------------------|-------------------------------------------------------------------------------------------------|--------------------|-------|---------------------------------------------------------------------------|
| Dependent                         | 1=outsourcing contracts of harvesting mechanization services (buy)                               | Dummy              |       | Canto *et al.* (2006); Fisher and Knutson (2013); Lyons (1994); Morais Filho (2006); Williamson (1985, 1996) |
| Human asset specificity (H₁)      | The higher the need for driver’s experience, the higher is the using of own machineries and services (dri_exp.) | Discrete (years)    | –     | Canto *et al.* (2006); Fisher and Knutson (2013); Lyons (1994); Morais Filho (2006); Williamson (1985, 1996) |
| Site asset specificity (H₁)       | The presence of services provider in the farm’s region minimizes the site asset specificity and enables the outsourcing contracts of harvesting mechanization (pres_serv). | Dummy (1=presence, 0=otherwise) | +     | Caleman and Zylbersztajn (2012); Houssou *et al.* (2013); Miele and Zylbersztajn (2005); Takeshima *et al.* (2013); Williamson (1985, 1996) |
| Time asset specificity (H₁)       | The longer the distance between farmer and service provider, the higher is the site asset specificity and, consequently, the higher is the using of own machineries and service (dist_serv). | Continuous (km)    | -     | Caleman and Zylbersztajn (2012); Houssou *et al.* (2013); Miele and Zylbersztajn (2005); Takeshima *et al.* (2013); Williamson (1985, 1996) |
| Uncertainty (H₂)                  | The lower the perception of value losses due to delay in harvesting, the lower is the time asset specificity and, consequently, the higher is the using of outsourcing contracts (delay_harvest). | Dummy (1=lowest perception of value losses due to delay, 0=otherwise) | +     | Houssou *et al.* (2013); Masten (2000); Morais (2012); Williamson (1985, 1996) |
|                                  | The presence of “Termo de Ajustamento de Conduta” in farmer’s region denotes barriers and institutional uncertainty, implying in the using of own machineries and services (pres_tac). | Dummy (1=presence, 0=otherwise) | –     | Mascarin (2014); North (1990); Williamson (1996).                        |
|                                  | The existence of labor lawsuit in farmer’s farm denotes barriers and institutional uncertainty, that is, implies in the using of own machineries and services (exist_lawsuit). | Dummy (1=existence, 0=otherwise) | –     | Mascarin (2014); North (1990); Williamson (1996).                        |
|                                  | Contract other services denotes greater management ability to solve contractual conflicts, that is, it implies in fewer uncertainty and in higher use of outsourcing contracts in harvesting mechanization transaction (other_contracts). | Dummy (1=other contracts, 0=otherwise) | +     | Hermalin *et al.* (2007).                                               |
Human capital asset specificity had one metric: the need for driver’s experience. It observed the need in years of experience in driving harvesting machineries for coffee crop. The metric bases its reference on Fisher and Knutson (2013), Lyons (1994), Morais Filho (2006) and Williamson (1985, 1996). In harvesting mechanization, it is possible to analyze the driver specialization to maintain the optimum productive level. If the need of knowledge is higher, besides experience over the years or technical training, the higher is the use of vertical integration to keep this accumulation of experiences over time. That is, the farmer is not able to guarantee that the employee will not be fired in a private enterprise, which causes the losses in the accumulated knowledge of the human capital and, consequently, could impact negatively the service quality.

Site asset specificity was associated with the location of the harvesting mechanization service provider. The first metric was a dummy variable that measures the existence or not of the service provider in the farmer’s region. The second variable was the distance in kilometers between the service provider and the farmer. The reference is based on Caleman and Zylbersztajn (2012); Houssou et al. (2013); Miele and Zylbersztajn (2005); Takeshima et al. (2013); Williamson (1985, 1996) and Yang et al. (2013). We expect that the presence of service provider in the farmer’s region reduces the site asset specificity and favor the outsourcing. In contrast, we expect that the higher the distance of a service provider, the higher the site asset specificity, which leads to the use of own machineries.

Time asset specificity was analyzed by the possibility of losses due to delays in the harvesting process. The measurement was a binary metric associated with the perception of few value losses when faces a delay in the harvesting activity. The decision to adopt a binary variable is interconnected with the ability of this type
of metric to capture the interviewee’s perception, because a more reliable variable, such as the number of
days for the value loss is difficult to be measured by the coffee grower himself, and other option, such as
likert scale, has arbitrary issues which should be avoided in a regression. The references are Houssou et al.
(2013), Masten (2000), Morais (2012), and Williamson (1985, 1996), whose studies emphasize the time
relevance on economy activities, mainly in agriculture. We expect that the lower the perception of value
losses due to delay in harvesting, the lower is the time asset specificity and, consequently, the higher is the
using of outsourcing contracts.

Uncertainty was analyzed as the difficulty of the institutional environment in interpreting complex forms of
governance, using the references of Hermalin et al. (2007), Mascarin (2014), North (1990) and Williamson
(1996). This metric observed the uncertainty in labor lawsuits and the coffee grower’s competence to manage
contractual conflicts. In the region where a coffee grower has faced a judicial process related to labor law,
it is expected to observe the vertical integration of the harvesting mechanization transaction, because the
agent tries to avoid other lawsuits through “Termo de Ajustamento de Conduta”. Additionally, the coffee
grower’s competence to manage contractual conflicts is measured through the use of contracts in other
transactions, which can previously increase the farmer’s learning about contractual issues. In sum, the metric
of the existence of other contracts indicates the farmer’s capability to manage contractual problems with
service providers and with the institutional environment (i.e. courts). It was expected that: (1) the indicators
of the existence of Termo de Ajustamento de Conduta and the existence of a labor judicial problem imply
in the use of own machineries; and (2) the use of contracting for other services implies in the outsourcing
of harvesting mechanization services.

Path dependence was measured using the farmer’s family tradition and the time of the farmer experience
in the activity. Tradition was measured by a family’s 3rd generation dummy metric in coffee production.
The experience time was evaluated by the years of experience. The long period of coffee production limits
the decision making due to the individual’s social involvement in the farming activities. Past experiences
build other path that may become more expensive if you make a change in the pattern you have previously
adopted. These aspects highlight the orientation towards vertical integration and show a limitation of change
in the choices made in the past by the agent, which can be marked by the traditionalism in the agricultural
sector. This social involvement results in the closeness between the farmers and their transactions of fixed
assets due to tradition adopted by the farmer and his family. The references are Granovetter (1985), Karali
et al. (2013), Navarro (2002), North (1990), and Silva et al. (2001).

This model also adopted three control variables in order to solve possible undesired interferences: education
level, hectares of coffee crop and percentage of gourmet coffee production. First, the expectation of the
educational level is positively related to outsourcing. The indicator aimed at capturing the farmers’ capabilities
in contractual arrangements. Even though it is not a specific domain, education in general could increase
their specialized capabilities such as the management of contractual conflicts. Therefore, the higher the
educational level, the higher the use of outsourcing of harvesting mechanization services. The metric was a
dummy variable that verified the presence of the education level equal or greater than the undergraduate level.

Second, the number of hectares of coffee crop was used to analyze economies of scale. Larger farms have
greater capability to invest in fixed assets. Those coffee growers tend to use their own machinery because
they can make huge fixed investments and their size can reduce their costs. Thus, the higher the hectares in
coffee crop, the higher the use of own machineries and service.

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4 We do not consider the opposite perspective related to the higher education, the higher the use of own machineries, because even specific undergraduate degree, such as agricultural engineering and agronomy, do not detail the harvesting process specifically in the coffee production which could increase the farmer capability to manage the harvesting task and equipment, but they focus on a general outlook on this agricultural production stage for different crops. In contrast, we assume that any undergraduate education increases relevant abilities in contractual agreements, such as capability in negotiation, communication, and others.
Third, the percentage of gourmet coffee production analyzed the influence of an upstream transaction in a downstream transaction. The ability to increase coffee quality carries the portrait of a producer with a greater knowledge of coffee production, as well as a competence in the management of the crop technical attributes and more caution in the harvesting activity (e.g. to regulate and to use the machinery to catch matures and high-quality fruits). The metric brought the profile of a high-quality coffee grower implying in the use of own machineries and service.

3.2 Econometric model

In order to evidence robust findings, we follow the widely adoption of probit models on the make-or-buy decisions according to TCE based on the two-stage regression model (Yvrande-Billon and Saussier, 2004; Masten et al., 1991). First, we perform two traditional probit regressions (only control variables and full model) to analyze the make-or-buy choice on the harvesting mechanization transaction in coffee production. These estimates follow the structure of Equation 1 below, but changing the dependent variable to the outsourcing contracts or use of own machineries and excluding the instrument variable only used on the two-stage model.

Second, we estimate a two-stage probit regression considering credit availability corrected for endogenous self-selection. We intend to observe the determinants of make-or-buy choice on the harvesting mechanization of coffee production given a same opportunity to obtain credit from external sources to buy machineries, such as public or private loans. In doing so, we investigate the coffee growers decision-making when they do not have access to those third parties’ resources. Thus, in the two-stage model, the first stage uses covariates to predict if the farmer has or has not access to loans using a probit formulation (Equation 1).

\[ S_i^* = \beta'X_j + u_i \]  
\[ S_i = 1 \text{ if } S_i^* > 0, \text{ and } 0 \text{ otherwise.} \]

Where \( X_j \) are the independent covariates represented on Table 1 added an instrument explained below, \( \beta' \) is a vector of coefficients, \( u_i \) is normally distributed, \( S_i^* \) is a latent measure of credit availability, \( S_i=0 \) corresponds to no access of loans and \( S_i=1 \) when the agent has access to third-parties’ financial resources.

The second stage still analyzes the make-or-buy choice using a probit conditioned on the financial resources availability. So, the second-stage model assumes the following form:

\[ E[\pi_1 | S_i = 0] = \gamma'W'_i + E[e_i | S_i = 0] \]  

Where \( \pi_j \) is the make-or-buy choice for agents without access to loans and credit from external sources, \( W_i \) is the reduced form vector of exogenous covariates, \( \gamma \) is a vector of coefficients. Note that \( W'_i \) and \( X_j \) are identical except for an instrument to identify econometrically Equation 1 which is not included on \( W'_i \). The instrument is the log of investments (in reais\(^6\)) in own machineries for coffee harvesting. The reliability of the instrument relies on the fact that the Brazilian coffee farmers also adopt tapped vertical integration. That is, they also outsource harvesting services even having a reasonable amount of investment in own machineries. Hence, it is expected that these investments do not impact the make-or-buy choice on the coffee harvesting mechanization directly. Therefore, we finally have the corrected model for endogenous self-selection:

\[ E[\pi_1 | S_i = 0] = \gamma'W'_i - \sigma \frac{\phi(\beta'X_j)}{\Phi(\beta'X_j)} \]  

Where \( \phi(\cdot) \) is the density function and \( \Phi(\cdot) \) is the distribution function of the standard normal, and \( \sigma \) is coefficient. While all observations are used to estimate Equation 1, only those observations that do not have

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5 We thank an anonymous reviewer for this suggestion.

6 10 BRL = 2.59 USD, calculated on the basis of the exchange rate on July 17, 2018.
access to loans \((S_i = 0)\) are used for estimating Equation 3. The term \(E[\varepsilon_i | S_i = 0]\) is commonly referred to as the inverse Mill’s ratio and its complement, which correct for endogenous self-selection.

**4. Results**

The results come from a survey with 105 questionnaires with Brazilian coffee growers between December (2015) and April (2016). The article uses some assumptions: (1) the “make or buy” decision in the transaction of harvesting mechanization in coffee crop has influence of asset specificities, uncertainty and path dependence; (2) using the specific investments lens, there is the positive correlation between asset specificity and vertical integration; (3) uncertainty deals with contractual problems and labor lawsuits, which implies in vertical integration; (4) path dependence is observed through the farmer’s tradition in the decision-making process, either by himself or by his family’s tradition in continue using the harvesting mechanization with own machineries and services.

Before initiating the confirmatory approach from the regression estimates, we perform a non-parametric test to compare the sub-samples which make or buy in the transaction of harvesting mechanization. We adopt non-parametric test because the sample size is small (Siegel, 1956, 1957). The technique is the Mann-Whitney test to investigate the hypothesis if the two sub-samples are independent. In other words, to observe whether farmers who outsource or farmers who use own machineries have or do not have the same population distribution. The test assesses this setting through a Wilcoxon rank-sum test (Mann and Whitney, 1947; Wilcoxon, 1945).

About the control variables, the Mann-Whitney test rejects the hypothesis that the presence of high education level (education, \(P<0.01\)) and the number of the farm hectares (hectares, \(P<0.1\)) have the same distribution in the group of the farmers who outsource the harvesting mechanization and in the group of the farmers who use their own machineries. On the other hand, the Mann-Whitney test does not reject this hypothesis in the variable about the percentage of gourmet coffee in the whole production (perc_gourmet).

About the asset specificity variables, the Mann-Whitney test rejects the hypothesis that the need for the driver experience with the harvester in years (dri_exp, \(P>0.001\)) has the same distribution in the group of the farmers who outsource the harvesting mechanization and in the group of the farmers who use their own machineries. However, the Mann-Whitney test does not reject this hypothesis in the variables about the presence of a service provider of harvesting services in farmer’s region (pres_serv), the distance of the nearest service provider (dist_serv) and the perception of low value losses in case of delay in harvesting activity (delay_harvest).

About the uncertainty variables, the Mann-Whitney test does not reject the hypothesis that the presence of the “Termo de Ajustamento de Conduta” on the farmer’s region (pres_tac), the existence of labor lawsuit in the farmer’s farm (exist_lawsuit) and the use of contracts as a governance mechanism in other transaction in the farming management (other_contracts) have the same distribution in the group of the farmers who outsource the harvesting mechanization and in the group of the farmers who use their own machineries. About the path dependence variables, the Mann-Whitney test does not reject the hypothesis that the longer farmer’s contact with coffee production (farmer_experience) and the farmer’s family tradition in coffee activity (fam_tradition) have the same distribution in the group of the farmers who outsource the harvesting mechanization and in the group of the farmers who use their own machineries. After this first procedure, we extend to the steps on the confirmatory models. To do so, Table 2 initially shows a summary with descriptive statistics of the model’s variables.

Table 3 displays the estimates. Model 1 is a traditional probit regression which contains only control variables. Model 2 is a traditional probit regression with all covariates. Finally, Model 3 is our corrected model for endogenous self-selection which is a two-stage probit regression conditioned by the credit availability. This last model is performed only on the observations in which there is no access to loans in order to
avoid the influence of financial resources from external sources on the make-or-buy decision of harvesting mechanization of coffee.

Model 1 is statistically significant ($\chi^2=11.70^{***}$) with a Pseudo $R^2$ of 0.0795 and a correct classification of 62.42% of the observations. Only the variable related to the undergraduate degree level of education (education, $P>0.01$) and the farm number of hectares (hectares, $P>0.05$) are statistically significant coefficients. The coefficient for education is positive, which implies that when there is the presence of a high education level the more likely it is to be adopted outsourcing contracts. This finding is consistent with the notion of education and capabilities to deal with contractual agreements. The coefficient for hectares is negative, which indicates that the higher the farm size the less likely is the use of outsourcing contracts. This result is also consistent by the expectation that size could generate economies of scale resulting in the using of own machineries and services of harvesting mechanization.

Model 2 is statistically significant ($\chi^2=29.97^{***}$) with a Pseudo $R^2$ of 0.2789 and a correctly classification of 76.24% of the observations. The significant variables are the undergraduate degree level of education (education, $P>0.05$), the need of driver’s experience in years (dri_exp, $P>0.001$) and the presence of farmer’s family tradition in coffee production (fam_tradition, $P>0.05$). All findings appear as expected. As mentioned above, education has a positive impact in the likelihood of adoption of outsourcing contracts. The coefficient for dri_exp is negative, which exposes that the higher the need for higher driver’s experience in harvesting activity, the less likely is the using of outsourcing contracts. This result follows the expectation that the human capital asset specificity is associated with vertical integration. The coefficient for fam_tradition is also negative, which demonstrates that the higher the presence of farmer’s family tradition the less likely is the adoption of outsourcing contracts. This finding also has theoretical explanations, since this aspect is associated with the higher traditionalism of farmer’s decision and its closeness to his farm’s activities. These results provide support for hypotheses about asset specificity ($H_1$) and path dependence ($H_3$) influencing positively the decision making on the harvesting mechanization in coffee production.

Finally, Model 3 exposes the best goodness-of-fit parameters and justifies our choice for this second stage of switching regression as our main model. This model is statistically significant ($\chi^2=27.50^{**}$) with a Pseudo $R^2$ of 0.4604 and a correct classification of 82.26% of the observations. Excluding the presence of a service provider of the farm’s region (pres_serv), all other variables are statistically significant.

Considering the lowest level of significance, all hypotheses ($H_1$, $H_2$ and $H_3$) were supported with a $P<0.05$, $P<0.05$ and $P<0.01$, respectively. The variables at $P<0.01$ are the presence of high level of education

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**Table 2. Descriptive statistics of model’s variable.**

| Variable         | Obs | Mean   | Standard deviation | Min | Max |
|------------------|-----|--------|--------------------|-----|-----|
| cont_mec         | 105 | 0.4285714 | 0.4972452             | 0   | 1   |
| education        | 105 | 0.447619  | 0.4996336             | 0   | 1   |
| hectares         | 105 | 87.38095  | 185.1324              | 2   | 1,160 |
| perc_gourmet     | 104 | 0.1480769 | 0.2445447             | 0   | 0.8 |
| dri_exp          | 105 | 2.695238  | 1.754795              | 0   | 10  |
| pres_serv        | 105 | 0.7333333 | 0.4443376             | 0   | 1   |
| dist_serv        | 104 | 50.24038  | 110.1837              | 0   | 600 |
| delay_harvest    | 105 | 0.0857143 | 0.2812843             | 0   | 1   |
| pres_tac         | 104 | 0.2211538 | 0.4170337             | 0   | 1   |
| exist_lawsuit    | 103 | 0.1747573 | 0.3816164             | 0   | 1   |
| other_contracts  | 104 | 0.2692308 | 0.4457081             | 0   | 1   |
| fam_tradition    | 105 | 0.3714286 | 0.4855042             | 0   | 1   |
| farmer_experience| 105 | 23.75238  | 12.77225              | 2   | 60  |
(education), the percentage of the whole coffee production that is classified as gourmet (perc_gourmet) and the high presence of farmer’s family tradition in coffee production (fam_tradition). The variables at P<0.05 are the number of hectares of the farm (hectares), the distance of the nearest service provider of harvesting mechanization services in kilometers (dist_serv), the perception of low value losses due to delay in harvesting (delay_harvest), the presence of “Termo de Ajustamento de Conduta” in farmer’s region (pres_tac), the existence of labor lawsuit in farmer’s farm (exist_lawsuit), the adoption of contracts as coordination

| Table 3. Models of probit regression with robust errors.1 |
|----------------------------------------|-----------------|-----------------|-----------------|
| Dependent variable                  | 1=outsourcing of harvesting mechanization services (buy) | 0=using own machineries and services (make) |
|                                       | Probit models with robust errors                        |
|                                       | Traditional model (1)                                    | Traditional model (2)                                    | Corrected model for endogenous self-selection (3) |
| education                             | 0.9064*** (0.2865)                                     | 0.9169** (0.391)                                         | 6.063*** (2.145)                                     |
| hectares                              | -0.0015** (0.0007)                                     | -0.0011 NS (0.0007)                                      | -0.0104** (0.0043)                                  |
| perc_gourmet                          | -0.4657 NS (0.5574)                                    | -0.3624 NS (0.5913)                                      | -8.5129*** (3.1514)                                 |
| dri_exp                               | -0.4147**** (0.1057)                                   | 1.169* (0.685)                                           |
| pres_serv                             | 0.4058 NS (0.3345)                                     | 0.0910 NS (0.6436)                                      |
| dist_serv                             | -0.0017 NS (0.0014)                                    | -0.0221** (0.009)                                       |
| delay_harvest                         | 0.6232 NS (0.5232)                                     | -4.408** (2.15)                                         |
| pres_tac                              | -0.0767 NS (0.3433)                                    | -12.448** (5.11)                                        |
| exist_lawsuit                         | 0.2347 NS (0.3544)                                     | 13.006** (5.06)                                          |
| other_contracts                       | 0.0029 NS (0.3770)                                     | 3.5** (1.35)                                             |
| fam_tradition                         | -0.7188** (0.3247)                                     | -3.29*** (1.08)                                         |
| farmer_experience                     | -0.0043 NS (0.0119)                                    | -0.2162** (0.087)                                       |
| Mills ratio                           | -0.4010** (0.18)                                       | 0.6655 NS (0.4803)                                      | -19.09** (7.85)                                     |
| Constant                              | 0.6437                                                   | 0.8385                                                   | 0.9153                                                   |
| Observations                          | 104                                                     | 101                                                      | 62                                                   |
| Log-likelihood                        | -65.48                                                  | -50.04                                                   | -22.91                                              |
| Wald χ2                               | 11.70***                                                 | 29.97***                                                 | 27.50**                                             |
| Pseudo R2                             | 0.0795                                                  | 0.2789                                                   | 0.4604                                              |
| Hosmer-Lemeshow test (prob significance) | 0.3074                                                 | 0.4122                                                   | 0.9851                                              |
| Correctly classified (0.5 cut-off)    | 64.42%                                                  | 76.24%                                                   | 82.26%                                              |
| Area under Roc Curve                  | 0.6437                                                   | 0.8385                                                   | 0.9153                                              |

1 NS = not significant, *P<0.1, **P<0.05, ***P<0.01, ****P<0.001; standard error in parentheses.
mechanism to other farming activities (other_contracts), the experience of the farmer in coffee production in years (farmer_experience) and the Mills ratio parameter. The variables at P<0.1 are the need for driver’s experience to operate the coffee harvesters in years (dri_exp).

All control variables appear as expected. education increases the likelihood of adoption of outsourcing contracts. hectares and perc_gourmet decrease the likelihood of using of outsourcing contracts. To better assess the impact of these variables we calculate the marginal probability for all variables. The expected difference in probability of outsourcing contracts is associated with a 26.5 percentage point increasing in presence of high education level, 0.21 percentage point decreasing when hectares increases a unit and 77.64 percentage point decreasing when perc_gourmet increases a unit.

About Hypothesis 1, it is possible to observe that the variable about the need of driver’s experience “dri_exp” (P<0.1) affects positively the likelihood of adoption of outsourcing contracts. Differently of the expected, this result can be associated to the fact that the service providers also preserve the valuable human capital when needed. In other words, the companies maintain their specialized employees since their training could be expensive when dismissal occurs. The variables about the distance of the nearest service provider of harvesting services “dist_serv” (P<0.05) and the perception of low value losses due to delay in harvesting “delay_harvest” (P<0.05) impact negatively in the likelihood of using the outsourcing contracts. The first appears as expected since the lower the distance, the lower the site asset specificity and, consequently, the higher the likelihood to adopt outsourcing contracts. However, the second appears differently than the expected, because this result presents that the presence of a perception of low value losses due to harvesting delay guides to a lower likelihood of the choice of outsourcing contracts. We believe that this finding is a consequence of lack of trust in the quality of the services in some situations, because even with a perception of low losses, the farmer decides to use his own machineries. In sum, the expected difference in probability of outsourcing contracts is associated with a 24.39 percentage point increasing when dri_exp increases a unit, but it is associated with a 0.46 and 91.9 percentage point decreasing when dist_serv increases a unit and in the presence of a perception of low possibility of value losses due to delay in harvesting by the farmer (delay_harvest), respectively.

The variable about the presence of service provider of harvesting mechanization (pres_serv) appears as expected, but it is not significant. Different from the dist_serv variable that impacts directly on the costs of contract, this finding suggests that presence of the service provider might not interfere in the make or buy decision of transaction of mechanized harvesting, because there is a strategy of amplification of service area of the service providers throughout the Brazilian territory. Specialized firms began to move in the coffee producing regions during the harvest period, as well as in the case of soy and sugar cane. In this way, the transportation investments of the machines are now compensated by the operation volume, as the operators move towards regions with a reasonable number of farms that demand the service.

About Hypothesis 2, it is noted that the presence of the Termo de Ajustamento de Conduta “pres_tac” (P<0.05) negatively affects the likelihood of the choice of outsourcing contracts. While the existence of labor lawsuit in farmer’s farm (exist_lawsuit, P<0.05) and the use of contracts as a coordination form in other transactions of the farming (other_contracts, P<0.05) impact positively in the likelihood of decision of outsourcing contracts. All findings appear as expected, except for exist_lawsuit. The result from pres_tac denotes that there is a higher uncertainty in the regions where the Public Prosecutor’s Office already banned, at least once, the outsourcing of mechanization through the TAC, which implies the vertical integration (make) of the harvesting mechanization transaction. And the finding from other_contracts shows that the lower uncertainty from the capability to deal with contractual management (e.g. conflict resolution, negotiability) implies in outsourcing contracts (buy). In sum, the expected difference in probability of outsourcing contracts is associated with a 59.76 percentage point decreasing in the presence of the TAC in farmer’s region (PRES_TAC), but it is associated with a 73.05 percentage point increasing in the presence of adoption of contracts to other transactions of the farming management (other_contracts).
In contrast, the possible explanation behind the unexpected result from exist_lawsuit is given by the fact that the existence of labor problems in the coffee culture has been frequent for many years. Coffee producers are aware of the institutional environment’s action on this topic. Therefore, even having issues with the courts on that topic which highlight the uncertainty, the farmers decide to outsource the harvesting mechanization activity due to other reasons, such as lower production costs, access to technology, among others. Therefore, frequent contact with labor rights issues of employees makes this kind of uncertainty less relevant to the transaction.

About Hypothesis 3, the findings from the farmer’s family tradition in coffee production “fam_tradition” \( (P<0.01) \) and the farmer’s contact with coffee production “farmer_experience” \( (P<0.05) \) confirms the tradition and the path dependence aspect as relevant to the harvesting mechanization transaction. These results indicate that both variables affect negatively the likelihood of adoption of outsourcing contracts. In doing so, they demonstrate that the higher the path dependence and the traditionalism in the farmer’s decision-making, the higher the use of vertical integration (make) as a coordination mechanism. The expected difference in probability of outsourcing contracts is associated with a 68.68 and 4.51 percentage points decreasing in the high presence of farmer’s family tradition in coffee production and in the increasing in a unit of farmer_experience, respectively. Table 4 summarizes these main findings.

5. Discussion

Our findings corroborate with the theoretical expectation of human asset specificity from Lyons (1994) and Williamson (1985, 1996). In addition, these results are similar to the human capital influencing the harvesting activity in the US agriculture (Fisher and Knutson, 2013) and in Brazilian forestry sector (Canto et al., 2006; Morais Filho, 2006). Furthermore, the time feature emerges as conceptual predicted by Masten (2000) and Williamson (1985, 1996). In sum, the harvesting delay concerns are the same as found in Ghana (Houssou et al., 2013) and in Brazilian forestry production (Novais and Romero, 2009; Morais, 2012). In addition, the economic organization of the industry of service providers of harvesting mechanization services in Brazil illustrates that the service availability is not influenced by the coffee crop location, but by the transportation costs involved in the contracting. Thus, we evidence some complement arguments to the Chinese (Yang et al., 2013) and African case (Houssou et al., 2013; Takeshima et al., 2013).

We also illustrate the impact of the uncertainty in the make-or-buy choice in the harvesting mechanization in coffee crop in Brazil. Our findings follow the logic behind the theory from Hermalin et al. (2007) and, especially, North (1990). Moreover, they are correlated with the empirical arguments about labor law in Brazil from Laurenti (2004) and Mascarin (2014). We present that the TAC as a specific punishment from the

| Table 4. Summary of the results. |
|----------------------------------|
| Hypotheses | Variables | Expected | Observed | Significance level |
| H1     | dri_exp | – | + | \( P<0.1 \) |
|        | pres_serv | + | + | Not significant |
|        | dist_serv | – | – | \( P<0.05 \) |
|        | delay_harvest | + | – | \( P<0.05 \) |
| H2     | pres_tac | – | – | \( P<0.05 \) |
|        | exist_lawsuit | – | + | \( P<0.05 \) |
|        | other_contracts | + | + | \( P<0.05 \) |
| H3     | fam_tradition | – | – | \( P<0.01 \) |
|        | farmer_experience | – | – | \( P<0.05 \) |
| Control variables | education | + | + | \( P<0.01 \) |
|        | hectares | – | – | \( P<0.05 \) |
|        | perc_gourmet | – | – | \( P<0.01 \) |
courts reduces the likelihood of doing further contracts related to the harvesting mechanization outsourcing. Simultaneously, we show that the make-or-buy decision in harvesting mechanization in coffee production is not affected by the presence of other kinds of labor lawsuits, because the sector is historically known by these conflicts due to existence as one of the oldest rentable activity in Brazilian agriculture together with sugar cane. We also expose that the learning from the use of contracts in other transactions also impact the make-or-buy decision in the harvesting processing specifically. By adopting contracts as coordination mechanism, the agent accumulates knowledge related to contractual management and its specialized skills, such as bargaining, communication and so on.

Our study also reports the path dependence impact on the make-or-buy choice on the harvesting mechanization transaction in coffee production. We find that involvement in crop production across generations carries the traditionalism aspect of path dependence in decision making. This factor suggests that the intrinsic conservatism in the activity can only be constructed in the long or short term, because the time of an individual or his family are both sufficient to influence the make or buy decision in the harvesting mechanization transaction. These findings corroborate with the expectations about the path dependence concept from North (1990) and Brazilian coffee sector features (Silva et al., 2001). In addition, they are similar to the rural tradition in Spain (Navarro, 2002).

We evidence that the education level of a farmer is relevant in his/her decision-making. We find that the contractual management is stronger and the capacity of the producer to deal with the arrangement is boosted when he/she has a high education level. We demonstrate that the larger the coffee crop, the higher the possibility of dilution of capital fixed costs due to the scale of the operation. Larger coffee growers tend to use their own machinery for the cost-benefit ratio. The need to provide a service in a coffee crop in larger areas raises the costs as well as there will be a need to contract more service hours. We also evidence that the Brazilian coffee grower is meticulous in the harvesting process by aiming at obtaining better quality in his/her fruits and, consequently, he/she usually has to do the activity with caution on his/her own (e.g. exact regulation in the machinery), which sometimes discourages the use of a third-party as an outsourcer in doing the harvesting activity due to the obligatory caution when harvesting and when high-quality is involved.

6. Conclusions

The objective of analyzing the make-or-buy choice in harvesting mechanization in coffee crop was reached in conjunction with the exposure of its determinants. Theoretically, it was obtained the empirical validation of the hypotheses of asset specificity and uncertainty of the efficient alignment of the TCE theory as well as the validation of path dependence.

About business and management applications some strategic points were obtained for the coffee grower and for the firms providing the service. It was observed that the characteristics that negatively impact the likelihood to adopt outsourcing contracts in harvesting mechanization transaction in coffee production are: farm size (number of hectares of coffee), percentage of high quality coffee production, the distance of the service provider, the perception of low value losses in delay in harvesting, presence of TAC in farmer’s region and farmer’s family tradition in coffee production. While the determinants of outsourcing contracts are: high education level, the presence of labor lawsuits, the adoption of contracts as a coordination mechanism for other transactions.

An additional descriptive field investigation illustrated that the Brazilian coffee grower is able to use the harvesting mechanization through three scenarios: exclusive use by own machineries (make), exclusive use of outsourcing contracts (buy) or use of both (tapped vertical integration) – own machineries and outsourcing contracts. The decision in the three scenarios depends on the characteristics of each farm. It is possible to affirm that the transaction of harvesting mechanization of the coffee farmer has changed and probably continues to change constantly. The traditional view of the conservative farmer might be taken as extinct,
because several agents are able to use outsourcing contracts and other coordination mechanisms offered by the market.

The main managerial and public policy contribution is that the outsourcing of agricultural mechanization should be seen as a legal institutional arrangement, not a coordination form that aims to precarious work. Specifically, attention is drawn to political interference in outsourcing decisions, which may limit the production agent choice and affect his economic performance. Thus, the efforts of political decision-makers should be directed to the standardization of monitoring mechanisms and the work employment control as a whole, whether outsourced or not, because the worker will continue to work, however with a different boss. That is, they have to improve the law enforcement instead of prohibit the outsourcing contracts without technical basement.

In terms of generalization, the results can be careful extended to other countries and other crops. They might help institutional agents in the creation of regulations aiming at the reduction of potential conflicts. Indeed, the study highlights similar points able to generalize the results in the transaction of harvesting mechanization. For example, the influence of specialization of human capital in rural decisions as mentioned by Fisher and Knutson (2013) in the U.S. agriculture, the amount of investments in specialized assets in rural farms in China (Yang et al., 2013), the Netherlands and Japan (Igata et al. (2008), the concerning with wheather in agricultural production in Ghana (Houssou et al., 2013) and the tradition interference on past decisions in Spain (Navarro, 2002).

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