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Transaction costs of farmers' participation in forest management: Policy implications of payments for environmental services schemes in Vietnam

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Abstract

Recent research on payments for environmental services (PES) has observed that high transaction costs (TCs) are incurred through the implementation of PES schemes and farmer participation. TCs incurred by households are considered to be an obstacle to the participation in and efficiency of PES policies. This study aims to understand transactions related to previous forest plantation programmes and to estimate the actual TCs incurred by farmers who participated in these programmes in a mountainous area of northwestern Vietnam. In addition, this study examines determinants of households' TCs to test the hypothesis of whether the amount of TCs varies according to household characteristics. Results show that average TCs are not likely to be a constraint for participation since they are about 200,000 VND (USD 10) per household per contract, which is equivalent to one person's average earnings for about two days of labour. However, TCs amount to more than one-third of the programmes' benefits, which is relatively high compared to PES programmes in developed countries. This implies that rather than aiming to reduce TCs, an appropriate agenda for policy improvement is to balance the level of TCs with PES programme benefits to enhance the overall attractiveness of afforestation programmes for smallholder farmers. Regression analysis reveals that education, gender and perception towards PES programmes have significant effects on the magnitude of TCs. The analyses also points out the importance of local conditions on the level of TCs, with some unexpected results.

Keywords: Forest, payments for environmental services, household, mountainous area, transaction costs, Vietnam

1 Introduction

Recent research on payments for environmental services (PES) has observed that high transaction costs (TCs) are incurred through the implementation of PES schemes and farmer participation (e.g., FAO, 2007; Dunn, 2011; To *et al.*, 2012). TCs incurred in setting up and managing PES schemes are central to their sustainability. Many studies have reported that TCs are a significant factor in farmers' decision to participate. Some studies find that for the participation of poor households in PES schemes, higher TCs are likely to be greater obstacles than the household's own capacity and resources (Behera & Engel, 2004; Engel *et al.*, 2008; Locatelli *et al.*, 2008; Wunder, 2008). Several studies find that participation decisions are highly influenced by fixed TCs (Goetz, 1992; Kranton, 1996; Key *et al.*, 2000;

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Ouma *et al.*, 2010). Omano (1998) shows that tension between TCs and participation in specialised farming may contribute to smallholder's disregard for more income through greater specialisation. Studies on agri-environmental schemes (AES)[1] also claim that TCs matter for farmers' decision to participate in such schemes (Falconer, 2000; Van Huylenbroeck *et al.*, 2005; Mettepenningen *et al.*, 2009). The concern over households' TCs is also related to the efficiency of the implementation of agricultural policies (e.g., Buchli & Flury, 2005; Rørstad *et al.*, 2007) and nature conservation practises (e.g., Falconer & Saunders, 2002; Mburu *et al.*, 2003). High TCs, which can be an obstacle to farmers' participation in and the efficiency of PES programmes, is acknowledged by the European Commission who implemented compensation of TCs in calculating agri-environmental payments in 2005. To minimise potential constraints from high TCs through participation in PES schemes and to improve programme efficiency, it is important to calculate actual TCs incurred by farmers. However, few studies have empirically estimated farmers' TCs (Falconer, 2000; Falconer & Saunders, 2002; Vatn *et al.*, 2002; Mburu *et al.*, 2003; Buchli & Flury, 2005; Rørstad *et al.*, 2007; Mettepenningen *et al.*, 2009). Instead, most studies tend to observe patterns of participation without determining which factors cause participation or non-participation (Engel *et al.*, 2008).

This article contributes to the literature on PES by investigating TCs incurred by smallholder farmers who participated in forest management schemes in a mountainous area of northwestern Vietnam. In September 2010, the Government of Vietnam decreed the policy of payment for forest environmental services, which paid service providers for forest protection activity. Previous studies on TCs in past forest management schemes have had policy implications for PES implementation and the design of future PES regulations and guidelines. Our study aims to understand the processes and transactions related to past forest plantation programmes and to estimate TCs incurred by farmers who participated in these programmes. In addition, as recommendations in current studies to reduce TCs have been biased toward the adoption of community-based management as a cost-saving alternative (e.g., Meshack *et al.*, 2006; Jindal & Kerr, 2007), we aim to understand differences in TCs between individual and community-based forest management through a literature review and key stakeholder interviews. Another objective of this study is to examine determinants of household TCs to test whether the amount of TCs vary according to household characteristics. There are only a handful of studies that have empirically investigated factors determining the level of TCs of farmers' participation in forest management programmes (e.g., Adhikari & Lovett, 2006; Arifin, 2006; Meshack *et al.*, 2006).

[1] AES is based on long-term, voluntary contracts between farmers and the government, specifying compensation payments for certain environmental management responsibilities.

2 Study area

The study area is the mountainous district of Da Bac, the largest district in Hoa Binh province. The district is located in northwestern Vietnam, with the highest altitude reaching 560 meters above sea level. The study area has diversified economic activities given its proximity to Ha Noi, which is about 100 km away, and its varied geographical conditions since the southern part of the district is adjacent to the Hoa Binh reservoir and the northern part is steep and mountainous. Forest occupies about two-thirds of the district, with natural forest accounting for 39 % and production forest[2] for 28 % of the total area. In Da Bac district, forest land has been allocated to individual households since 1994 according to the 1993 Land Law (Tran *et al.*, 2013). Households receive a land use certificate, also known as a 'Redbook' given its appearance, as proof that its holder has the legal rights to exchange, transfer, lease, inherit and mortgage the land use right to the designated land for the purpose of forestry for 50 years.

2.1 Forest plantation support programmes

In the past, several government programmes have been implemented to provide support for forest plantation, even though the main purposes of these programmes differ. The programme that is the most well-known and had the most participants is a resettlement programme, known as Programme 747, for households that were resettled from the Hoa Binh dam construction site and its reservoir area. Although a main goal of this programme was to stabilise socio-economic development for resettled households, the support of forest plantation was another element. In particular, investment in fast growing trees, such as bamboo, was supported by the provision of bamboo seedlings and cash

[2] According to the *Law on Forest Protection and Development* issued in 2004, forests in Vietnam are classified into three types based on their major use purpose: production, protection and special use. Production forests are mainly used for production and trading of timber and non-timber forest products in combination with environmental protection (FAOLEX, 2005). Production forests do not have restrictions on the volume of timber harvested, whereas protection and special use forests have restrictions on the volume of timber harvested.

to compensate labour costs for three years. The amount of support varied by commune. The programme also provided training on techniques of tree plantation and maintenance.

Another important programme is the *Five-Million-Hectare-Reforestation Programme* (also known as *Programme 661*), which had a main goal of supporting forest plantation at the national level. The programme began in 1998 after the start of *Programme 747*, and initially offered loans to companies for reforestation with the purpose of forest protection. The programme evolved to include direct support to forest plantations established by households since 2006 (Sikor, 2011). The programme was planned and implemented through several hundred local projects designed and carried out by localities after being approved by higher level authorities. The government provided a broad framework and indicated a set of policies. Thus, local authorities were given a high degree of freedom to design activities (MARD, 2000).

Households in the study area have received support from *Programme 661* through projects executed by the district-level Office of Agriculture and Rural Development and State Forest Enterprise (SFE). For individual farmers, there are two types of support according to the purpose of forest plantation, protection and production. Our analysis focuses only on the production component of the programme, which provided tree seedlings and cash as compensation for labour. The forestry department at the provincial level specified the type of trees and technical design of the plantation, such as the number of trees per hectare and the distance between each tree. The programme provided support mainly for *Acacia* and other slow growing trees. The maximum support per hectare was 2 to 3 million VND (approximately, USD 95 to 144), depending on the type of seedling. The allocation of support can be divided into seedling and labour costs which were granted to farmers directly, and administrative costs. The compensation for labour was not fixed, but instead was contingent on the quality and survival rate of the planted trees. In a worst case scenario, farmers would not receive any compensation for labour if the percentage of tree cover was less than 50 % of the designated number of trees per hectare. If farmers maintained the trees well with more than 85 % of coverage, farmers received the full amount of labour compensation one year after the start of the contract. In addition to these two main programmes, there were other forest plantation programmes implemented in the study area; however, because only a few households participated in these programmes, they are not considered in this study.

3 Methodology

3.1 Conceptual framework

Transaction costs are originally defined by Coase (1960) as the costs of carrying out a transaction by means of an exchange on the open market. However, in order to conduct an empirical analysis of private TCs from forest plantation programmes, we adapt this definition and define TCs as costs arising from the organisation of the transfer of goods and services between two agents. We focus on the transfer of support (material, cash, etc.) from the government in exchange for forest cover provided by farmers. Literature on private TCs distinguishes three categories (e.g., Mburu *et al.*, 2003; Van Huylenbroeck *et al.*, 2005; Mettepenningen *et al.*, 2009). The first category of TCs consists of search and information costs, which arise *ex-ante* to the transaction and include the costs of looking for information for forest plantation programmes and costs related to making the decision to join a programme. The second category is *ex-ante* negotiation costs, or in our case, application costs since real negotiation on contract terms between the government and farmers does not exist in the programme. Application costs cover the costs of fulfilling preliminary conditions to be able to participate in the programme, such as contacting government officers or participating in specific training. The third category of TCs occur ex-post to the transaction and comprise of costs that farmers incur as a result of monitoring and enforcement required by the government, such as accompanying control officers to the field when the forest needs to be inspected.

According to Williamson (1996), apart from the behaviour of farmers and the institutional arrangement in which the transaction takes place, the level of TCs also depends on the transaction's attributes. These attributes include asset specificity, uncertainty and transaction frequency. Asset specificity is defined as the degree to which an asset can be redeployed to alternative uses and by alternative users without sacrificing productive value: higher levels of asset specificity imply higher TCs (Williamson, 1996). The level of asset specificity of a forest plantation programme can be evaluated based on its sources of asset specificity, namely site specificity, temporal specificity, specific physical assets, human capital, brand name specificity and dedicated assets (Williamson, 1996). TCs are increased by high uncertainty due to unanticipated changes in the environment and opportunistic behaviour from one of the partners (Van Huylenbroeck *et al.*, 2005). Lastly, TCs are reduced if transactions are repeated over time because of reduced efforts to search for information, as well as

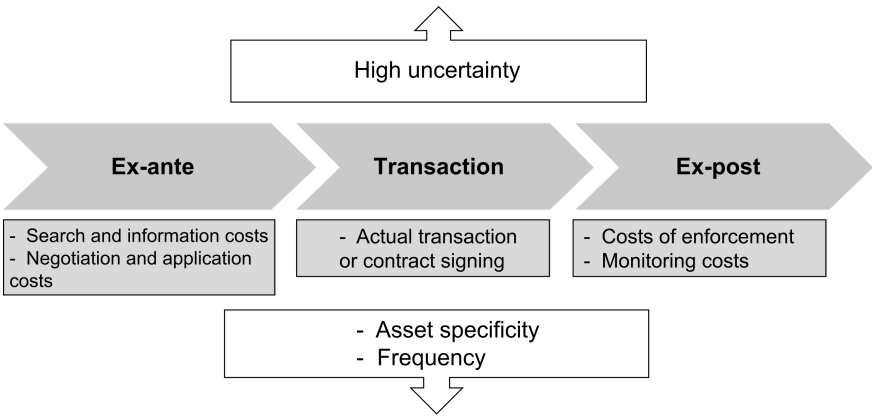

Fig. 1: *Conceptual framework*
Source: Authors

to apply and monitor (Mettepenningen & Van Huylenbroeck, 2009). Figure 1 shows the conceptual framework of the study.

3.2 Sampling and data collection

Two survey rounds were conducted from November to December 2011 and from August to September 2012 in Da Bac district, Hoa Binh province. A two-stage cluster sampling procedure was employed. In the first stage, 20 villages were randomly selected using the Probability Proportionate to Size method (Carletto, 1999). In the second stage, 15 households were randomly selected in each of the previously selected villages using village level household lists. There were two villages that did not have a list, so the random walk method (Henry *et al.*, 2003) was used to select households in these villages. In total, the dataset consists of 300 households and is representative at the district and village levels. Apart from questions about the amount of time and money spent on each transaction, as well as benefits and perceptions towards forest plantation programmes, the questionnaire covered a wide range of topics, such as demographic and socio-economic information, social capital indicators, land use, land tenure, agricultural production and forest plantation activities.

Before analysing TCs, we examined transactions for each household who participated in a forest plantation programme. Household heads were asked about the most recent programmes they participated in, since details on transactions are easier to recall and therefore data are more reliable and complete. Respondents were asked about the activities they had done related to participation in the programme and the amount of time and money spent for each activity. These activities can be clearly distinguished from production activities, such as tree planting and maintaining processes. These questions were about activities specific to forest plantation programmes and were activities that would not have occurred in the absence of forest plantation programmes. A list of activities was generated from focus group discussions in villages that were not included in the sample villages. Participants in the focus group discussions were selected by village heads who were instructed to ensure that the group comprised of varying genders and ages. Activities were then categorised into the three types mentioned above. The first type of activity is the search and information gathering activity, which consists of participation in village meetings by household heads or household representatives to obtain information about the programme, decision making process and any other activities before signing the contract.[3] The second type of activity comprises of application activities, including contract signing, learning about the technical aspects of tree growing, attending trainings and receiving tree seedlings. The last type of activities comprises of monitoring and enforcement activities, which consists of accompanying officers to evaluate the plot during the forest establishment period (weeding, preparing the land and planting trees), maintenance period and the period until payments have been received, as well as transactions that occur when farmers receive payments.

One challenge of estimating private TCs is the monetisation of time inputs reported by farmers. Studies that estimate private TCs have used the opportunity cost of labour, such as the market wage rate (e.g., Mburu *et al.*, 2003; Buchli & Flury, 2005; Mettepenningen &

[3]The term 'signing the contract' in this case indicates the action where participants give their signatures to the officers when they receive the tree seedlings.

Van Huylenbroeck, 2009) or household farm income (Falconer & Saunders, 2002); however, wage rates for labour in rural areas in many developing countries may not accurately reflect the opportunity cost of labour because the labour market is not perfectly competitive (Gittinger, 1984). Given the data limitation on the opportunity cost of labour and employment opportunities, we use the district's average wage rate multiplied by the reported time and adjusted with the possibilities of working outside of the farm. In the study area, opportunities of working outside the farm are not the same for each farmer since such opportunities depend on the location of the village. For example, it is easier to find a job, such as at a factory, in villages located closer to towns. Another factor is the quality of road access to the village, which is considered to be a barrier for finding a job due to lack of market access, especially for local, small-scale businesses (e.g., toothpick production). Therefore, we adjust the value of TCs based on the assumed varying opportunity costs of labour according to location and road access. This adjustment is indicated by conversion factors shown in Table 1. Here, the opportunity costs of labour for farmers in remote villages with poor quality roads are only a fraction of the local average market wage rate (83,000 VND per day) compared to villages closer to the district centre, where it is assumed that the opportunity costs of labour are equal to the district's average market wage rate. A shortcoming to this approach is that due to data limitations, the conversion factor does not take into account other household characteristics that are relevant to employment opportunities. Although conversion factors can be considered too broad, they can – to some extent – capture differences in the opportunity cost of time of households better than the market wage rate, which was used in previous studies. Furthermore, sensitivity analysis ensures the results are not biased according to conversion factors.

3.3 Estimation strategy

We use regression analysis to investigate whether the level of TCs differs across households due to household and programme characteristics, focusing on differences in incentives created for participants to bear TCs. Our regression analysis is limited to *Programme 747* and *Programme 661* since they are the main programmes that provide support for forest plantation in the study area. In addition, because these two programmes are more recent, households were better able to remember the details of the programmes' activities compared to other programmes. Nevertheless, there are 49 cases of missing data on household TCs due to the fact that some respondents could not recall details of activities undertaken when they had participated in either programme. Using analysis of variance (ANOVA), we investigate whether respondents with missing data on TCs differ systematically from those who could recall data on TCs for a number of key socio-economic characteristics, such as education, duration of residence, and per capita income. We find no significant difference between the two comparison groups for all variables, indicating that there is no systematic bias in missing responses. Therefore, we conclude that respondents with missing information can be dropped from the analysis without generating biased results (Osborne, 2013).

To examine factors determining the level of TCs incurred by households, ordinary least square (OLS) regression is used. The regression model is specified as:

$$y_i = \alpha + X_i' \beta + \varepsilon_i \,,$$

where X_i is a vector of explanatory variables determining the level of TCs and ε_i is the error term. For the dependent variable y_i, we examine total TCs as well as different components of TCs, i.e., search and information costs, application costs and monitoring and enforcement costs. Total TCs are computed as the sum of fixed TCs (i.e., TCs that do not vary with the size of the forest plantation) and variable TCs (i.e., TCs that increase with the size of forest plantation, such as the costs of

Table 1: *Value of time input by location and road quality factors*

Village type	*Conversion factor*	*Value of time input*
Villages near the town (district centre)	1	Labour days of transaction × 83,000 VND
Remote villages with good road access	0.5	Labour days of transaction × 83,000 VND × 0.5
Remote villages with poor road access	0.2	Labour days of transaction × 83,000 VND × 0.2

Source: Authors
Note: The district's average market wage rate is 83,000 VND per day, which is equivalent to approximately USD 4 (2012 average exchange rate: USD 1= VND 20,899).

visiting and inspecting plots which are higher for several larger plots compared to one small plot). Explanatory variables are selected based on previous studies on factors influencing private transactions, taking into account the attributes of the transaction (namely, the conditions of asset specificity, level of uncertainty and frequency), nature of the programmes and local context. Table 2 presents descriptions of the dependent variable and explanatory variables, as well as their descriptive statistics and expected signs. The dependent variable is the reported TCs of participating in a forest plantation programme. We only consider TCs for the most

Table 2: *Variables in the regression analysis and their descriptive statistics*

Variable	*Description*	*Mean*	*s.d.* *	*Expected sign*
Dependent variable				
TC	Total transaction costs of participating in a forest plantation programme (thousand VND/household)	196.8	189.9	NA †
SEARCH	Search and information costs of participating in a forest plantation programme (thousand VND/household)	57.9	66.9	NA
APPLICATION	Application costs of participating in a forest plantation programme (thousand VND/household)	57.7	72.4	NA
MONITOR	Monitoring and enforcement costs of participating in a forest plantation programme (thousand VND/household)	101.5	176.8	NA
Explanatory variable				
RESIDENCE	Duration of household residence in the village (in years)	38.7	13.6	+
MALEHEAD	Gender of the household head (male = 1, female = 0)	0.9	0.2	+
EDUC	If the household head has a high school certificate (yes = 1, no = 0)	0.5	0.5	+
ACTIVES	Number of non-disabled adults living in the household aged 18–60	3.2	1.2	+
INCOMEPC	Annual household income per capita, excluding income from forest (in thousand VND)	6,760.4	7,547.8	+
MEMORG ‡	Number of local organisations in which any household member is a member of	2.3	1.4	+
TRUST §	If the household head in general trusts others in the village (yes = 1, no = 0)	0.4	0.5	+/−
FORESTAREA	Area of forest land per household (square metres)	13,254	13,937	+
FORESTAREASQ	Area of forest land squared per household (million square metres)	369	924	−
DISTANCE	Walking time from the house to the closest forest plot (in minutes)	36.9	36.7	+
REDBOOK	If the household has a land use certificate for forest land at the time of plantation (yes = 1, no = 0)	0.5	0.5	+
BENEFICIAL	If the household head considers the programme to be beneficial for the household (yes = 1, no = 0)	0.9	0.3	+
PROG747	If the household participated in Programme 747 (yes=1, no=0)	0.7	0.5	+/−

Source: Own data.
Note: * s.d. = standard deviation; † NA = not applicable; ‡ The local organisations comprise of: (1) mass organisations (e.g., Farmer's Union or Women's Union); (2) agriculture/trade organisation (e.g., cooperative or trader's association); (3) non-governmental organisation (NGO) providing services (e.g., an NGO providing an extension service or local credit group); (4) political organisation (e.g., communist party or people's committee); and (5) other organisation (e.g., religious group or school committee); § The level of trust is an average based on responses to the following four statements measured on a Likert scale: (1) Most people in this village are basically honest and can be trusted; (2) People are interested only in their own welfare; (3) If my household has a problem, there is always someone to help me; and (4) If you were to lose an animal, someone in the village would help look for it or would return it to you.

recent programme, even though some households participated in several programmes. Since the presence of heteroscedasticity is detected in the linear model, we use the log transformation of the dependent variables.

We aim to test whether household demographic characteristics influence the level of TCs (Mburu *et al.*, 2003; Mettepenningen & Van Huylenbroeck, 2009). The duration of village residence (RESIDENCE) is hypothesised to have a positive relationship with the level of TCs, since households who are more settled in the village tend to participate more in community affairs. Having a male household head (MALEHEAD) is expected to entail higher TCs since it is hypothesised that male household heads tend to have more time to participate than female household heads in programmes. This is because female household heads have more responsibilities in the household after working on the farm and therefore have less time to be involved with programmes. More educated household heads (EDUC) tend to contribute more to village meetings and are thus expected to bear higher TCs. The availability of household labour (ACTIVES) is hypothesised to have a positive impact on TCs since household heads are better able to set aside time for participating in a programme if there is enough labour in the household. The effect of wealth (INCOMEPC) is expected to be the same as the effect of labour availability. Social capital indicators (MEMORG and TRUST) are expected to have a positive influence on the magnitude of participation (Mburu *et al.*, 2003). Higher levels of trust among villagers may reduce TCs from perceiving less of a need to be active in meetings to protect individual rights and/or from spending less time on the decision to participate in the programme because of a lower prospect of failure, such as from a lower incidence of timber stealing among villagers. Falconer (2000), Mettepenningen & Van Huylenbroeck (2009) and Buchli & Flury (2005) indicate that farm size is an important factor influencing TCs because of the fixed cost nature of TCs. Therefore, we hypothesise that farmers with larger areas of forest plantation (FORESTAREA) tend to bear higher variable TCs due to the need to spend more time for monitoring and enforcement activities. To examine the variable cost aspect of TCs, the square of forest land area (FORESTAREASQ) is included in the model to examine whether total TCs increase or decline at the margin. Along the same line, the distance between the forest plot and household (DISTANCE) may increase monitoring costs, especially if the frequency of monitoring is high. Farmers with more land tenure security (REDBOOK), measured by having a forest land use right certificate, are hypothesised to be more motivated to participate in the programme and are therefore hypothesised to incur higher TCs (Mburu *et al.*, 2003). Farmers' perceptions that the programme is beneficial may encourage households to participate more in meetings and may therefore have a positive relationship with TCs. We also examine whether *Programme 7479* (PROG 747) entails higher TCs than *Programme 661* to test the hypothesis that a higher frequency of cash distributions leads to higher TCs incurred by farmers.

4 Results and discussion

4.1 Farmers' transaction costs of participating in forest plantation programmes

We find that household TCs mainly come from the opportunity cost of time spent on activities related to the programmes. This can be partially explained by the decentralised nature of the programmes. The programmes were implemented at the village level and therefore farmers did not need to spend money and time on transportation. The TCs of participating in forest plantation programmes are reported in Table 3. On average, the total TCs for participating in a forest plantation programme is 196,800 VND (USD 9.42)[4] per household per contract. This is relatively low since it is equivalent to about two days of wage labour (the average wage rate is 83,000 VND per day). TCs per hectare are 588,300 VND (USD 28.15). To put this in perspective, this is equivalent to approximately one-tenth of the input costs for maize cultivation (6 million VND per hectare). The high standard deviation of TCs, especially for TCs per hectare, indicates a large variation in TCs across households. Low TCs can be explained by the low level of asset specificity of the programmes. The programmes have small site and temporal specificity since planting forest in our study area can be easily replaced by other agricultural activities, such as growing maize or cassava. The programmes do not require specific human capital since farmers do not need to invest much time learning or attending training sessions on forest plantation techniques. In addition, participants are not obliged to invest in any specific physical assets to join the programme. Even though the programmes have a low frequency of transactions, the level of TCs is not high due to this factor since transactions are not very complicated. Moreover, farmers have already learned how such programmes are implemented given the history of similar programmes in the study area.

[4]The average exchange rate in 2012 is USD 1= VND 20,899 (Vietcom Bank).

Table 3: *Farmers' transaction costs and benefits from forest plantation programmes (in thousand VND/household/contract)*

Category	*Programme 747* (n=114)		*Programme 661* (n=48)		*Both programmes* (n=162)	
	Mean	% fixed cost	Mean	% fixed cost	Mean	% fixed cost
Search and information costs	54.4 (66.1)	100 (0)	55.7 (59.1)	100 (0)	54.8 (63.9)	100 (0)
Application costs	55.7 (77.8)	100 (0)	54.8 (53.4)	100 (0)	55.4 (71.3)	100 (0)
Monitor and enforcement costs	83.3 (99.6)	26.4 (24.1)	83.7 (98.5)	24.5 (26.7)	83.4 (99.0)	25.8 (24.8)
Total transaction costs	195.9 (197.4)	67.9 (15.7)	198.9 (172.8)	69.0 (17.7)	196.8 (189.9)	68.3 (16.3)
Transaction costs per hectare	593.8 (1,226.4)	–	575.4 (1,056.6)	–	588.3 (1,175.4)	–
Benefits of the programme	2,403.7 (5,750.0)	–	1,961.5 (2,234.7)	–	2,272.7 (4,970.3)	–
Transaction costs as % of benefit	34.7 (59.9)	–	40.5 (63.3)	–	36.4 (60.8)	–

Source: own calculation.
Note: Standard deviations are shown in parenthesis and n is the number of observations.

Even though the focus of the study is on individual household TCs, we also discuss the differences in TCs between individual- and community-based participation based on a literature review and interviews with key stakeholders. Our results reveal that search and information costs account for less than one-third of total TCs. Compared to the case of community forest management, search and information costs are usually incurred in community meetings at an early stage of the process and are largely fixed. These costs include costs associated with identification, negotiation with potential members, formation of groups, gathering information about the physical attributes of resources, demarcation of resources and capacity building (Adhikari & Lovett, 2006). TCs from seeking information regarding potential members may be high (McDowell & Voelker, 2008). For example, group establishment in a PES-like scheme in Indonesia ranks high in TC components as observed by Arifin (2006). Similar findings are reported by some leaders of community-based forest management in Hoa Binh province. Locating willing and trustworthy members is time consuming. On the other hand, individual participants have the advantage of not having to go through such processes. In addition, Meshack *et al.* (2006) report that spending a lot of time in meetings is typical of community-based forest management. While individual participants in Hoa Binh spend some time in meetings with implementing officers, community-based participants require more time in meetings with group members. TCs from monitoring and enforcement are the greatest TC for both programmes, accounting for almost half of all TCs. Thus, the extent of farmer involvement is less important in the process of information receiving and decision making compared to monitoring activities. Compared to the case of community-based forest management, community-based management schemes have the option of delegating and rotating labour for planned activities. The larger the group, the more participants are able to divide labour and time. Individual participants do not have this option, which increases their TCs. However, conflicts and rule violations among members are inherent in group- or community-based systems. In Hoa Binh province, these activities consume a considerable amount of time and resources for households participating in community-based programmes. Low level of trust among villagers in our study area may also contribute to higher level of TCs in the case of community-based management, especially for controlling conflicts and rule violations among members. Community-based forest management may lower

TCs incurred by the buyer or government, but a large portion of these costs is transferred to and taken up by members of the community or groups. Such a transfer is cost-efficient (i.e., it reduces the sum of transaction costs incurred by principal and agents) if the local group has information advantages over the principal, i.e., the buyer of the environmental service. This has been argued by Zeller (1998) and Sharma & Zeller (1997) for the case of microfinance institutions that transfer the functions of screening and monitoring borrowers to local solidarity credit groups who take out loans under joint liability for repayment of the group loan.

In individual participation, nearly 70 % of total TCs arise from fixed costs. Variable costs consist of monitoring and enforcement. Monitoring costs amount to about three-quarters of these variable costs. Comparing the two programmes, there is no significant difference in total or per hectare TCs. However, the monitoring costs of *Programme 747* are higher than that of *Programme 661*. All other costs are not significantly different from one another between the two programmes, indicating that transactions prior to contract signing are more or less the same for both programmes. The higher monitoring and enforcement costs of *Programme 747* reflect its higher frequency of cash transfers to participants. The average benefit from the programmes, which is the sum of cash given as compensation and the value of tree seedlings, is about 2.27 million VND (USD 108.7) per household per contract. At the individual household level, TCs account for, on average, about one-third of the benefits received from the programmes.[5] This is rather high compared to similar programmes. For example, the share of private TCs per compensation is just 4.5 to 5 % in a direct payment scheme to farmers for ecological compensation in Switzerland (Buchli & Flury, 2005). For other agri-environment programmes in Europe, this share ranges from 12 % to 25.4 % (cf. Kumm & Drake, 1998 cited in Falconer, 2000; Rørstad *et al.*, 2007; Falconer & Saunders, 2002; Mettepenningen *et al.*, 2009). This can be explained by the fact that the monetary benefits from the two programmes examined in our study are relatively low compared to the agro-environmental programmes in developed countries.

4.2 Determinants of household transaction costs

Table 4 presents the coefficient estimates of the regression analysis. Diagnostics of multicollinearity among explanatory variables indicate that there is no collinearity problem since the largest variance inflation factor (VIF) of all variables is less than 10 (Kutner *et al.*, 2005) and the condition number is 23.7, which is less than the cut-off value of 30 (Belsley *et al.*, 2005). The sensitivity analysis of varying conversion factors is conducted for all the models and the results are consistent, implying that the results from the regression analysis are robust.[6] For total TCs, the duration of residence is negative and significant, indicating that households that have had a longer residence in the village are less active in participating in the administrative process. This does not support our hypothesis and is contrary to a previous study (Mburu *et al.*, 2003) since we had expected that household heads of such households would be more involved in meetings used to disseminate information about the programmes. However, further examination into different TC components reveals a higher magnitude of the coefficient on application costs. This means that longer established households spend less time in the application procedure. This result may be driven by improved access to information that households with longer residence have. The significant and negative coefficient on search costs indicates that such households spend less time in meetings to gather the same amount of information compared to newer households who are less embedded in the political gossip of the village and have less information from key informants. Longer established households also spend less time for monitoring and enforcement activities.

Other than the length of the household's presence in the village, there are some other interesting results from the regression analysis. Education is positive and significant for search and application costs, which supports our hypothesis that more educated households are more active in taking up the role of disseminating information and helping clarify regulations or technical explanations to others. Gender is negative and significant, rejecting our hypothesis that female household heads have less time to participate. This can be explained by the fact that most female headed households in our study area are single parent households where the husbands are absent or working somewhere outside the village. Therefore the female household heads need to spend more time in transactions due to the lack of experience in participating in such programmes or other types of social wel-

[5]This value is calculated by taking mean TCs per benefit at the household level. This emphasises the importance of the differences between households. In addition, this value may not be equivalent to taking the ratio between mean total TCs and mean programme benefits from Table 3, which considered mean TCs per benefits for the entire sample.

[6]The conversion factor for villages close to the district center is equal to one, whereas differences in conversion factors for remote villages with good and poor road range from 0.1 to 0.8. In other words, a series of all the conversion factors would be (1, 0.9, 0.8), (1, 0.8, 0.7), . . ., and (1, 0.9, 0.1). In total there are 36 cases of different conversion factors in the sensitivity analysis.

Table 4: *Estimated coefficients from ordinary least square regression analysis*

Variable	*Coefficient estimate*							
	Total TCs		*Search and infomation TCs*		*Application TCs*		*Monitoring TCs*	
	Coeff.	*P-value*	*Coeff.*	*P-value*	*Coeff.*	*P-value*	*Coeff.*	*P-value*
RESIDENCE	–0.0171 ***	0.001	–0.0098 *	0.056	–0.0182 ***	0.003	–0.0089 *	0.094
EDUC	0.4899 ***	0.001	0.4022 ***	0.005	0.4974 ***	0.003	0.2094	0.156
MALEHEAD	–0.8070 ***	0.007	–0.3912	0.183	–0.5342	0.134	–0.4266	0.156
ACTIVES	0.0235	0.678	0.0003	0.996	0.0623	0.337	–0.0009	0.987
INCOMEPC	–4.82e-06	0.614	–8.97e-06	0.412	–0.00001	0.304	4.35e-06	0.655
MEMORG	–0.0445	0.342	–0.0280	0.599	–0.0136	0.801	–0.0437	0.363
TRUST	0.0214	0.873	–0.2392	0.122	0.2129	0.169	0.0720	0.597
FORESTAREA	0.00002 **	0.050	1.29e-06	0.915	0.00001	0.240	0.00002 **	0.048
FORESTAREASQ	–1.95e-10	0.226	–8.75e-11	0.635	–4.02e-11	0.826	–1.82e-10	0.263
DISTANCE	–0.0016	0.396	–0.0032	0.139	–0.0012	0.566	0.0014	0.484
REDBOOK	–0.1394	0.305	–0.1000	0.521	–0.0162	0.917	–0.1391	0.322
BENEFICIAL	0.4936 **	0.050	0.3373	0.238	0.2099	0.460	0.9803 ***	0.001
PROG747	0.1571	0.300	–0.0704	0.687	0.1262	0.466	0.3482 **	0.027
constant	5.5134 ***	0.000	4.9570 ***	0.000	3.8846 ***	0.000	3.8455 ***	0.000
Observations	166		164		164		163	
F-statistic	2.83 ***		1.77 *		2.02 **		2.25 ***	
R-squared	0.1946		0.1330		0.1489		0.1639	

Source: Own calculations.
Note: ***, ** and * indicates significance at the 1 %, 5 % and 10 % of error probability, respectively; different number of observations among models results from zero values being dropped under the process of log transformation; coeff.= coefficient.

fare supports. The area of planted forest is positive and significant for total TCs and monitoring costs, implying that time spent on monitoring outcomes or enforcing regulations does depend on the size of the planted area. The square of forest area is not significant. Therefore, the nature of the fixed cost effect could not be measured. Farmers' perception that the programme is beneficial is positive and significant, suggesting that greater expectations of benefiting from the programme encourage farmers to participate more, especially for monitoring and enforcement activities. This implies that farmers with greater expectation on the benefits of the program tend to spend more time on monitoring activities which influence the compensation they would receive. Participating in *Programme 747* is found to incur higher monitoring costs compared to participating in *Programme 661* due to its longer period of implementation and more rounds of compensation payments.

However, we cannot find significant results from other relevant variables. Labour availability and income per capita are not significant, implying that farmers' time spent participating in the programme may not be large enough to largely affect their work schedule and income. Both social capital indicators are not statistically significant, which may be explained by the nature of the programmes which require a low level of co-management from farmers. In addition, since there is a low incidence of conflict among participants in the programmes, the role of social capital in resolving conflicts is presumably of lower importance. The distance variable is also not significant, indicating that differences in the distance from the household to the forest plots are not high enough to generate differences in TCs. Land tenure security is not significant. The insignificant result might be caused by the fact that some households who do not have a Redbook for their land may join the

programme with the hope and expectation that they may receive the Redbook by participating in the programme.

5 Conclusions

This study has aimed to measure the level and importance of TCs incurred by households who participated in two major forest plantation programmes in northwestern Vietnam. Measuring actual TCs is helpful to understand whether TCs could potentially act as a constraint to programme participation. Our study has contributed to the knowledge on TCs borne by households in developing countries, since there are only a handful of studies that have empirically analysed actual TCs. The results found that monitoring and enforcement costs are higher than information searching and application activity costs. Average TCs are about 200,000 VND (USD 10) per household per contract, which is equivalent to about two days of wage labour. Thus, TCs are not likely to be a constraint for participation in forest management programmes such as PES, given the same level of farmer involvement and monitoring mechanisms in past programmes. The relatively low TCs are also reflected by the programme's low level of asset specificity. It is expected that farmers will bear higher TCs from PES schemes due to greater programme complexity and longer periods of implementation.

We found a large variation in TCs among households, but there is no evidence that poorer farmers bear the burden of TCs more than wealthier farmers. Even though the absolute value of TCs is low, the share of TCs to programme benefits is 35.7 %, which is relatively high compared to similar yet more complex programmes in developed countries. This implies that the payout ratio of the programmes is quite low and could be increased for the programmes to be more widely adopted and to have better efficiency. Hence, rather than aiming to reduce TCs, balancing the level of TCs with benefits to enhance the overall attractiveness of afforestation programmes for smallholder farmers is considered to be a more appropriate agenda for policy improvement.

Our regression analysis on the determinants of total TCs and their components reveals interesting results, even though there are several insignificant and unexpected findings. The results support the argument from a previous study (Mburu *et al.*, 2003) that factors influencing the level of private TCs depend on local conditions. The case study of forest plantation programmes underscores the importance of analysing how programmes are actually implemented when identifying determinants of private TCs. The findings on separate components of TCs provide insight into how TCs are linked to different activities within the programmes. The household head's education, gender and perception towards the programmes have large effects on the magnitude of TCs. Strengthening social capital may not be effective in influencing the level of TCs if the programme is based on a top-down approach with less collaboration from participants regarding programme implementation and where there is no significant conflict among participants and authorities. Land tenure security does not impact the level of TCs. This may be due to the local context as well as historical events within the villages and area, which may influence perceptions relevant to programme participation and land ownership. The policy design process should give particular attention to trade-offs between strict monitoring and enforcement mechanisms and the level of TCs incurred by farmers.

Although it was not possible to empirically measure TCs of farmers engaged in community-based forest management, our study identifies possible lower transaction cost and cost effectiveness in group activities. Implications from this study could be further developed by expanding the survey and gathering data from participants in community-based forest management programmes. Further research on the comparison of TCs associated with community- and individual-based management systems will have significant implications for managing PES programmes and providing more insight on the growing bias towards community-based systems.

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