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RESEARCH ARTICLE

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Factors influencing the stay-exit intention of small livestock farmers: empirical evidence from southern Chile

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Abstract

This study analyses the factors driving the stay-exit intention of small livestock farmers located in southern Chile. Technical, economic, and social characteristics from 212 farmers were included in this study. Through an empirical probit model we identified the variables that should be considered when developing rural policies aimed at increasing the likelihood to stay in farming. The results showed that 12 out of the 30 parameters were significant (p<0.10), with an extremely good fit of the model (McFadden pseudo-R^2 = 0.25, Count R^2 = 75.9%). Particularly, 'female farmer', 'positive expectation about future farming life', 'capacity of farm income to cover the expenses of the whole family', 'mixed production', 'participation in an association', and 'distance to the nearest city' were positively associated with the stay intention. Moreover, our study also indicates that 'existence of a defined retirement age', 'existence of a defined sale price for the farm', 'a mixed farm focused on livestock production', 'the possibility to make own decisions', 'age squared', and the 'number of people living at the farm' were negatively associated with the stay intention. Our empirical findings suggest that farmer characteristics (gender, family size), the farming system (multi-activity production, efficiency), and social aspects of the rural society (associations, protection of agricultural products) are also important aspects that should be considered by rural development policies aimed at improving the likelihood of staying, in addition to the technical characteristics of the farming which have been traditionally addressed in developing countries.

Additional keywords: exit intention; peasant; family farming; binary choice model; South America.

Abbreviations used: $E(U)_{exit}$ (expected utility of exiting farming); $E(U)_{stay}$ (expected utility of staying in farming); HRB (equivalent irrigated hectares); INDAP (Agricultural Development Institute).

Authors' contributions: Study design, interpretation of data, critical revision of the manuscript for important intellectual content: LMCL, AOL and HS. Obtaining funding, collection and analyses of data, wrote the paper: LMCL. Supervising the work: AOL and HS.

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Introduction

Since the 1970s Chile has been open to global trade (Fleming & Abler, 2013). As a consequence of successful international trade, an ambitious agricultural policy started in 2006 to position the country among the world's top 10 agricultural exporter countries by 2015 (Campos & Polit, 2011). This 'open to global trade' policy implied new challenges to achieve competitiveness of traditional agricultural areas in order to survive, such as gaining participation in international trade and adoption of agricultural innovations (David *et al.*, 2000; Echeverria *et al.*, 2009; Moreira & Bravo-Ureta, 2010).

The exit of smaller and less productive farms from agriculture is beneficial for the agricultural sector regarding its efforts to become competitive in world markets, and also for allocating resources between agriculture and other sectors (Breustedt & Glauben, 2007). However, it has an effect on equity within agriculture, productivity and efficiency of farming, as well as on the welfare of rural communities. This effect can be translated as an increase of large and high tech farms, a decline in farm employment, a decrease of family farms and the out-migration of farm and non-farm residents. The ultimate result is a declining number of farmers and an aging rural population (David *et al.*, 2000; Chang *et al.*, 2011; Raggi *et al.*, 2013). In Chile the rural population has decreased from 40% during the 1980s to 8% in the last decade (Oyarzún & Miranda, 2011). This is mainly rooted in the fact that younger and more educated people have migrated away from agriculture (Fawaz & Vallejos, 2011), as their better education makes non-rural employment opportunities more accessible (Ramírez *et al.*, 2001).

Researchers and policy makers have developed long-term strategies to mitigate the negative consequences of the exit from agriculture and to sustain or rejuvenate the rural population. These strategies have considered long-term financial assistance for farmers to increase production efficiency, such as commodity subsidies, price controls, diverse forms of market protection, government-funded R&D and education (Chang *et al.*, 2011). In Chile, the Agricultural Development Institute – INDAP[1] is the government organisation mandated to assist small farmers[2] , in order to reduce the economic gap between rural and urban areas to make them competitive at global trade (MINAGRI, 1990; INDAP, 2013a). To counteract the exit from agriculture, INDAP provides technical and financial support to fostering entrepreneurship among peasant families (as a first step) and then promotes them as successful firms able to compete in the global trade (as a second stage). The INDAP investment in consolidating and expanding existing farm businesses, *i.e.* farmers in the second stage (15% of INDAP users), has increased 65% in the last 5 years. However, the number of INDAP users has been increased by only 3% (INDAP, 2013b), which indicates that current INDAP programs have not been successful in achieving their goals.

To increase the likelihood to stay in farming, a good understanding of the factors underlying the exit process and economic development in rural areas ought to be achieved (Henning *et al.*, 2013). Therefore, a more accurate understanding of the stay-exit mechanism is essential for the design of well targeted and efficient policies that enhance the future structure of farming, land management, population and employment dynamics in rural areas (Raggi *et al.*, 2013).

A number of studies on Chilean agriculture have been either focused on the economic and technical efficiency of farms (Smith *et al.*, 2002; Lerdon *et al.*, 2010; Moreira & Bravo-Ureta, 2010) or the characteristics of the farmer and labour force (Vera & Moreira, 2009; Carmona *et al.*, 2010). However, there are no studies that examined the factors driving the exit intention of farmers in Chile, nor in Latin America.

This paper aims to fill this knowledge gap by investigating the main factors driving the stay-exit intention of small livestock farmers in three regions of southern Chile. This study provides information for decision-makers that is useful to design well-targeted and efficient rural policies.

Material and methods

Theoretical foundation for the study

Stay-exit decisions of farmers have been studied in the past (Boehlje, 1992; Rosenbaum & Lamort, 1992; Gale, 1994; Karakaya, 2000). There are various theories that partially explain these intentions. Particularly, three theories have been developed: *efficiency* theory, *exit barriers* theory and the *life-cycle* theory (Boehlje, 1992; Pushkarskaya & Vedenov, 2009). We started the study by merging these three theories into a holistic theoretical framework, aimed at obtaining a sound scientific foundation for questionnaire development and subsequent analysis. This theoretical framework is presented in Fig 1.

Efficiency theory is the main theoretical framework for explaining the exit decision (Boehlje, 1992; Pushkarskaya & Vedenov, 2009). It compares the expected utility of staying in farming, $E(U)_{stay,}$ with the expected utility of exiting farming, $E(U)_{exit}$. The $E(U)_{stay}$ is a function of financial factors, such as farm income and non-farm income, as well as of non-financial ones, such the social and network status. The $E(U)_{exit}$ is mainly determined by labour income (which depends on job availability and skills), and by factors such as living expenses and availability of services. This theory assumes a rational decision maker that has access to all the required information to make a decision; if that is the case then the alternative with the highest expected utility $E(U)$ is preferred. However, assumptions are never fulfilled. Therefore, two complementary theories are used: *exit barriers* theory and *life-cycle* theory (Karakaya, 2000; Pushkarskaya & Vedenov, 2009). *Exit barriers* theory focuses on direct or indirect obstacles, which limit the rational behaviour assumed by the efficiency theory. Direct barriers are obstacles on their own, such as the sunk cost of previous investments, while indirect barriers affect the $E(U)$ by reducing the capability of acquiring new skills. This theory explains why enterprises continue operating even while releasing a very low profit or a loss (Chang *et al.*, 2011).

[1]INDAP: Instituto de Desarrollo Agropecuario, established in 1962. In 2013, 62% of the 270,000 Chilean small farmers were beneficiaries of the INDAP.
[2]To receive this assistance, the farm's size must not exceed 12 equivalent irrigated hectares (HRB) and the farmer's main income must be provided by farming (MINAGRI, 1990). A HRB is a measurement unit that uses soil and climate variables to establish a production potential equivalent throughout the country.

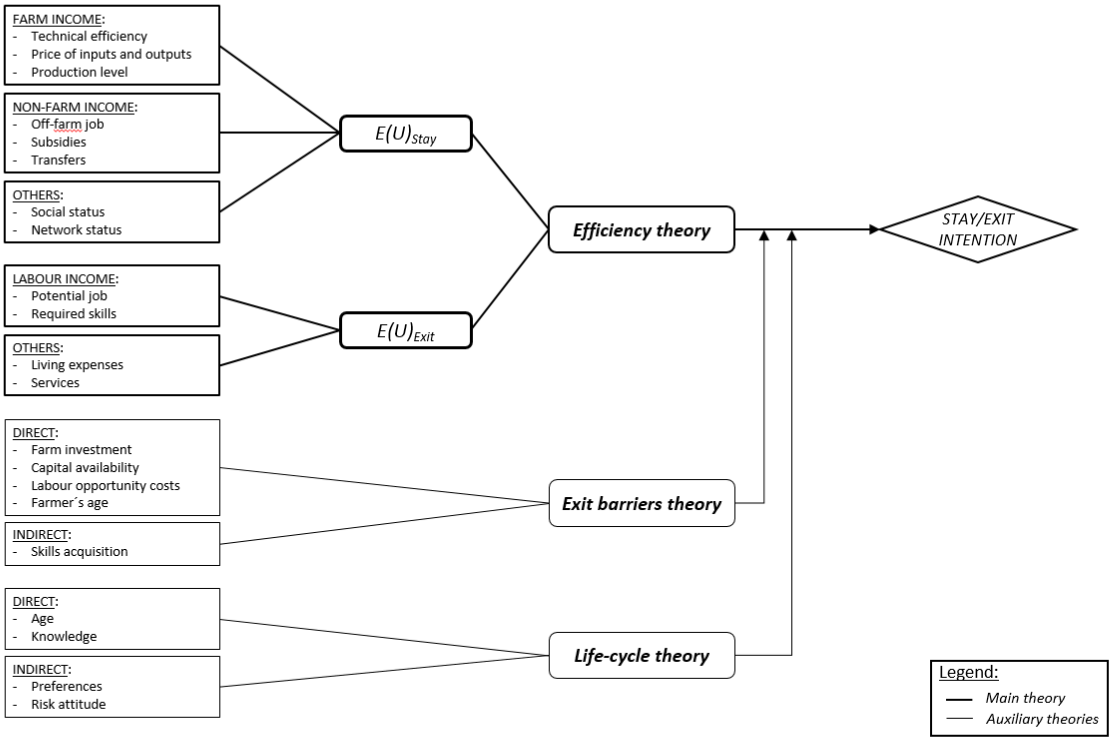

Figure 1. Theories and their main driving factors involved in stay-exit intention problem.

Life-cycle theory focuses on specific human capital (Gale, 1994). This theory assumes that farmers make input, production, and investment plans that are optimal given their biological life cycle (Boehlje, 1992). In this theory, factors that influence the stay-exit decision include farmer's age, family size, own knowledge, and risk attitude.

The developed framework allowed to categorise all the variables in a logical order and certain hierarchical way, providing a consistent theoretical foundation for selecting the variables[3] we have used in this study.

Questionnaire development

We used the holistic framework shown in Fig. 1 to develop a questionnaire focused on factors that might influence the stay-exit intention of the farmers. It included both qualitative and quantitative close-ended questions[4] on characteristics of the farmer and his family, farm production, satisfaction level, and expectations of the farmer. The variables we analysed in this study and their expected effects on the stay-exit intention are summarised in Table 1.

The variables we identified as having potential impact on stay-exit intention and their expected effect on this intention are the following: from the *Efficiency* theory, we used *INCENO, HA, MIXFARM, LIVESMIXFARM,* and *DIVERSIFICATION* to capture the effect of farm income (Bragg & Dalton, 2004; Foltz, 2004; Pushkarskaya & Vedenov, 2009). We expected these variables to have a positive impact on the intention to stay. We used *OFFINCREL* to capture the effect of off-farm activities (Bragg & Dalton, 2004; Pushkarskaya & Vedenov, 2009; Zhan *et al.*, 2012). We expected this variable to have either a positive or negative effect on the intention to stay. We used *ASSOCIATION, NETWORK, RECOGNIZE*, and *INDEPENDENCY* to capture the effect of non-financial variables (Gasson *et al.*, 1988; Fairweather & Keating, 1994). We expected these four variables to have a positive association with the intention to stay. From the *Exit barrier* theory, we used *BUILDINGS* and *LEACOST* to capture the effect of sunk costs (Rosenbaum & Lamort, 1992; Karakaya, 2000; Goetz & Debertin, 2001; Foltz, 2004). We expected these variables to have a positive association with the intention to stay. We also used the variable *DISTANCE* (Goetz & Debertin, 2001) and we expected this variable to have either a positive or negative association with the intention to stay. From the *Life-cycle* theory, we used *AGE, AGESQ, FEMALE, MARRIED, SCHOOLING, AGRIEDUC*, and *NONAGRIEDUC* to capture the effect of characteristics of the farmer (Boehlje, 1992;

[3]A detailed explanation of the selected variables can be found in the Appendix [suppl.].
[4]This document is available upon request to authors.

Table 1. Definition and expected effect of the variables used in the empirical model.

Dependent variables		
STAY	Dummy for intention to stay on farm (1 if yes, 0 if no)	
Independent variables		**Expected effect**
Efficiency theory related variables		
INCENO	Dummy for enough income from farm to cover expenses (1 if yes, 0 if no)	+
HA	Hectares of land	+
MIXFARM	Dummy for production of livestock and crop (1 if yes, 0 if no)	+
LIVESMIXFARM	Dummy for main production is livestock (1 if yes, 0 if no)	+
DIVERSIFICATION	Dummy for diversification preference (1 if yes, 0 if no)	+
OFFINCREL	Dummy for importance of off-farm income (1 if yes, 0 if no)	+/-
ASSOCIATION	Dummy for participation in associations (1 if yes, 0 0 if no)	+
NETWORK	Dummy for importance of social network (1 if yes, 0 if no)	+
RECOGNIZE	Dummy for importance of being recognised as good farmer (1 if yes, 0 if no)	+
INDEPENDENCY	Dummy for making own decisions about resource use (1 if yes, 0 if no)	+
Exit barrier theory related variables		
BUILDINGS	Number of buildings	+
LEACOST	Dummy for high leaving (opportunity) cost (1 if yes, 0 if no)	+
DISTANCE	Distance to the nearest city (in kilometers)	+/-
Life-cycle theory related variables		
AGE	Farmer's age	+
AGESQ	Farmer's age squared	+
FEMALE	Dummy for farmer's gender (1 if female, 0 if male)	+
MARRIED	Dummy for married (1 if yes, 0 if no)	+/-
SCHOOLING	Years of formal education of the farmer.	+/-
AGRIEDUC	Dummy for farmer has agricultural education (1 if yes, 0 if no)	+/-
NONAGRIEDUC	Dummy for farmer has non-agricultural education (1 if yes, 0 if no)	+/-
FAMSIZE	Number of people living at the farm	+
FAMLAB	Dummy for presence of family labour (1 if yes, 0 if no)	+
SUCCESSOR	Dummy for presence of defined successor (1 if yes, 0 if no)	+
RETIREAGE	Dummy for defined retirement age (1 if yes, 0 if no)	-
SALEPRICE	Dummy for defined sale price for the farm (1 if yes, 0 if no)	-
SATISFY	Dummy for overall satisfaction (1 if yes, 0 if no)	+
LIFEEXP	Dummy for positive expectation of future farming life (1 if yes, 0 if no)	+
Location area		
ARAUCANÍA	Dummy for farms located in La Araucanía region (1 if yes, 0 if no)	
RÍOS	Dummy for farms located in Los Ríos region (1 if yes, 0 if no)	
LAGOS	Dummy for farms located in Los Lagos region (1 if yes, 0 if no)	

Bragg & Dalton, 2004; Baylina & Salamaña, 2006; Pushkarskaya & Vedenov, 2009; Charatsari *et al.*, 2013). We expected *AGE, AGESQ*, and *FEMALE* to have a positive effect on the intention to stay; while we expected the other four variables to have either a positive or negative effect on the intention to stay. We used *FAMSIZE, FAMLAB*, and *SUCCESSOR* to capture the effect of the characteristics of family of the farmer (Zollinger & Krannich, 2002; Glauben *et al.*, 2006; Breustedt & Glauben, 2007; Hennessy & Rehman, 2008). We expected these variables to have a positive association with the intention to stay. We used *RETIREAGE* and *SALEPRICE* to capture the effect of farmer willingness to exit farming (Pushkarskaya & Vedenov, 2009). We expected these two variables to have a negative association with the intention to stay. We include *SATISFY* and *LIFEEXP* to capture the effect of overall satisfaction and positive expectation, respectively (Hellman, 1997; Zollinger & Krannich, 2002, Kuehne, 2013). We expected these variables to have a positive association with the intention to stay. Finally, we also included the regions to identify the effect of the area.

Study area and sampling population

We conducted this study in three administrative regions in southern Chile: La Araucanía, Los Ríos, and Los Lagos (see Fig. 2).

These regions cover 24% of the total land used for livestock and forestry in Chile, but account for 49% of all livestock and forestry farms. Sixty per cent of bovine producers are situated in these regions, who manage 63% of all beef cattle and 91% of all dairy cows in Chile (INE, 2007). Eighty percent of the farms are managed by farmers older than 45 years, and 70% of farmers have no more than 8 years of formal education, *i.e.* preparatory school (Apey & López, 2011). It is also where 45% of the total number of INDAP users are located (INDAP, 2013b). In these regions INDAP assists above 60% of the small farmers, reaching the 82% of them in the Araucanía region (INDAP, 2015). Farm sizes range from 10 to 200 ha of land with 0.62 to 1.16 AU[5]/ha. Feed comes either solely from pastures, or in combination with supplementary concentrates (Vera, 2006). The coexistence of small farms (focused on timber logging, livestock breeding, and small-scale cultivation of cereals and potatoes) with larger and more entrepreneurial farms is common in this area (Barrett *et al.*, 2002; Vera, 2006). We chose this area because one of the participating research centers is located here, allowing access to the names and addresses of farmers.

In January 2014, we obtained a database from each INDAP Regional Office, containing the age of the farmer and the size of the farm. We selected the INDAP users that had at least basic information about their farming system, *i.e.* production level records. From this database 300 farmers were selected using a stratified random sampling method (Neyman, 1934). We used the farm size as a proxy to determine the optimum sample size by region. The questionnaire was applied by the agriculture advisors of the farmers to increase participation and obtain personal information. At the end of the process, 212 questionnaires were returned between January and March 2014 by those farmers who gave their consent to participate in this study. The representativeness of the sample in terms of farm size and age of the farmer is shown in Table 2, where the mean and standard deviation for these two variables are shown for the sample and total population.

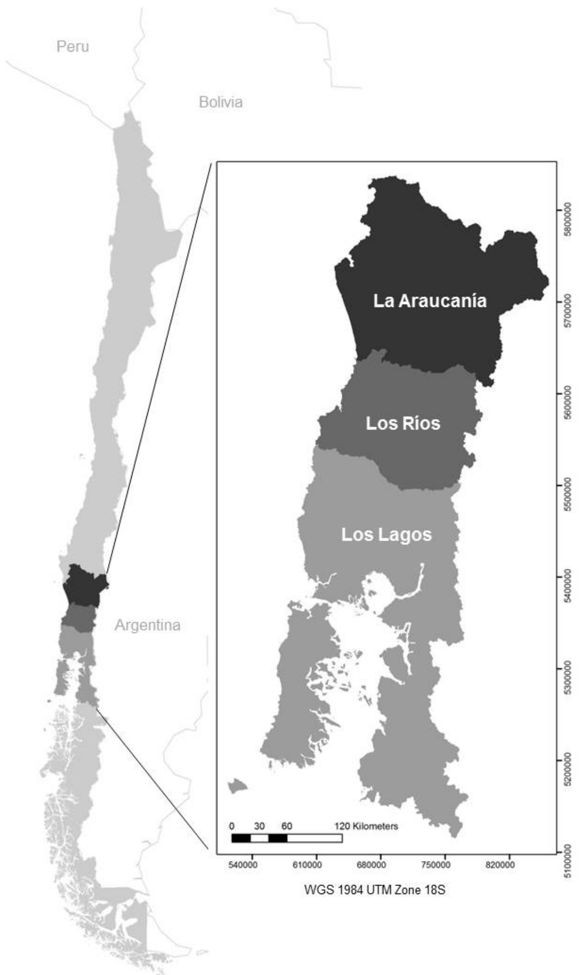

Figure 2. Map of the study area.

There is a small difference in the variance of the farm size for Los Lagos region, which is attributable to the larger size of this region and the fact that larger farms are located in more remote areas. Otherwise the sample is considered to be representative, as no other differences in regional values between the sample and population were found.

The authors acknowledge the fact that there is a possible bias by including only INDAP users in the sample, which could lead to results and conclusions only applicable for them. Nevertheless, this sample was the best alternative considering the focus of the study and the data used.

Statistical modelling

After database development, potential variables of having an impact on stay-exit intention (Fig. 1) were pre-tested for multicollinearity using a correlation

[5]AU: Animal Unit is a standard unit used in calculating the relative grazing impact of different kinds and classes of livestock and is defined as the amount of forage consumed by a 1,000 pound (454 kg) mature cow, either dry or with a calf up to 6 months of age, with a daily dry matter forage requirement of 26 pounds (11.8 kg).

Table 2. Descriptive statistics of the age and farm size of INDAP beneficiaries of commercial programs in 2013 (population and sample) in the study area.

Region	N	INDAP beneficiaries' age				Farm size (ha)			
		Mean	(SD)	Min	Max	Mean	(SD)	Min	Max
Population descriptive statistics[a]									
La Araucanía	699	57	(13)	22	90	24.8	(24.9)	0.5	228.6
Los Ríos	833	60	(13)	24	96	36.2	(28.3)	2.0	250.0
Los Lagos	1,023	58	(13)	21	93	33.1	(39.5)	0.5	375.0
Total area	2,555	58	(13)	21	96	31.9	(32.8)	0.5	375.0
Sample descriptive statistics									
La Araucanía	57	55	(12)	27	85	30.5	(22.6)	3.0	136.0
Los Ríos	67	58	(11)	30	84	33.3	(25.7)	6.0	140.0
Los Lagos	88	56	(12)	28	81	26.7	(18.5)[b]	5.0	90.0
Total area	212	56	(12)	27	85	29.8	(22.2)	3.0	140.0

[a]Based on information provided by INDAP Regional offices 2014. *Note*: no differences between regional values for the population and the sample were confirmed using a z-test for the mean and χ^2-test for the variance at the 0.05 significance level. [b]Except for the variance of farm size for the Los Lagos region.

matrix. In this way, the number of the variables to be included in the following model was reduced.

We used a binary choice model to identify the impact of the selected variables on the intention to stay of the farmer, considering that his/her final intention has two possible outcomes *i.e.* stay or exit. This kind of model holds only two values for the unobserved dependent latent variable y_i^*: 0 or 1 (Verbeek, 2012). In our study, the dependent variable indicates the likelihood that the i_{th} farmer will stay on the farm during the next five years; where a value of 1 indicates the likelihood to stay and a value of 0 indicates the likelihood to exit. Since each farmer has his/her own preference, which is determined by many independent and individual factors, we assumed a standard normal distribution for the error. Therefore, we used a probit model as following (Eq. [1]):

$$\begin{aligned} y_i^* &= x_i'\beta + \varepsilon_i, \quad \varepsilon_i \sim NID\,(0,1) \\ Stay_i &= 1 \quad \text{if } y_i^* > 0 \\ &= 0 \quad \text{if } y_i^* \le 0 \end{aligned} \qquad [1]$$

where the explanatory variables are represented by $x_i^{'}$, the coefficients to be explained are represented by β, and the random error term is represented by ε_i (Verbeek, 2012).

We measured the goodness-of-fit for this model in terms of the significance-of-fit and the proportion of correct predictions between calculated probabilities and observed response frequencies[6] (Domencich & McFadden, 1975; Dhrymes, 1986; Hoetker, 2007). Since no single pseudo-R^2 covers these points[7], we chose McFadden pseudo-R^2 and Count R^2 to evaluate the goodness-of-fit (Veall & Zimmermann, 1996; Hoetker, 2007; Wooldridge, 2012). The McFadden pseudo-R^2 is the most frequently used measure in discrete choice models because it uses the log-likelihood provided by the probit model, and because it is less sensitive to misspecification in the error term[8] (Veall & Zimmermann, 1996). The McFadden pseudo-R^2 indicates a percent increase in the log-likelihood function (Eq. [2]):

$$\text{McFadden's pseudo} - R^2 = 1 - \frac{\log L_M}{\log L_0} \qquad [2]$$

where L_M and L_0 are the likelihood of the model with and without regressors, respectively, subject to the constraint that all the regression coefficients except the constant term are zeros. The Count R^2 transforms the continuous predicted probabilities into a [0-1] scale, and gives the proportion of correct predictions (Eq. [3]) (Hoetker, 2007).

$$(\text{Count})\ R^2 = \frac{\#\,Correct}{Total\ Count} \qquad [3]$$

We also compared the key characteristics of the exit and stay groups after the probit model estimation. This comparison provides potential insights that can be used to design efficient policies. A t-test was used for metric variables and a *Mann-Whitney U* test was used for non-metric variables.

[6]The pseudo-R^2 cannot be interpreted as the square of the correlation coefficient between 'predicted' and 'actual' observations (Dhrymes, 1986).
[7]For a detailed coverage of pseudo-R^2 measures see Veall & Zimmermann (1996).
[8]Compared with McKelvey & Zavoina R^2, which scores best under the comparability OLS criterion (McKelvey & Zavoina, 1975).

Results

The descriptive statistics of the variables used in this study and the empirical results obtained from the estimation of the probit model are summarised in Table 3. Table 3 shows the descriptive statistics of the variables we use in this study (columns 2 and 3). It also shows the coefficient estimates, the marginal effect, and the *p*-value for the probit model (columns 4 to 6). Since space is limited, independent variables that are found significant for the probit model are described only.

Table 3 shows that 63% of the farmers indicate they will stay on farming during the next five years (our dependent variable: *STAY*).

Regarding the efficiency theory, Table 3 shows that in terms of financial variables a 77% of the farmers indicate that their income from farming is enough to cover their expenses (*INCENO*). It also shows that 28% of these farms produce both crops and livestock (*MIXFARM*), 17% of them produce livestock as the main product (*LIVESMIXFARM*). In terms of non-financial variables, almost half of the farmers indicate that they belong to a formal association (*ASSOCIATION*), while over 60% indicate that farming allows them to make their own decisions (*INDEPENDENCY*). Table 3 also shows that, with regards to the exit barrier theory, the average distance to the nearest city is 21 km (*DISTANCE*), and regarding the life-cycle it was found that 21% of the farms are owned by women (*FEMALE*) while the average family size is 2.5 members (*FAMSIZE*). Furthermore, it is also shown that about 30% of the farmers indicate to have either a defined retirement age (*RETIREAGE*) or a defined sale price for the farm (*SALEPRICE*). The farmers indicating to have a positive expectation of their farming life in the future (*LIFEEXP*) accounted for 75%.

Our findings for the probit model show that 12 out of the 30 parameters are significant at the 10% critical level (in bold in Table 3). Although the coefficient estimates are presented in Table 3 (column 4), the effect of changes in the explanatory variables should be interpreted considering the marginal effects (column 5); a positive value of the latter means the probability of the stay intention increases with that variable.

We found strongly positive associations ($p<0.05$) with the stay intention for two variables related with life-cycle theory, *i.e. FEMALE* and *LIFEEXP.* However, we found intermediate positive associations ($p<0.10$) with three variables related with the efficiency theory, *i.e.*, *INCENO, MIXFARM*, and *ASSOCIATION*; with one variable related with the exit barrier theory, *i.e.*, *DISTANCE*, and with one variable related with the life-cycle theory, *i.e. AGESQ*. Additionally, we also found another weaker positive associations ($p<0.20$) for *OFFINCREL, AGE*, and *FAMLAB*.

Moreover, we found strongly negative associations ($p<0.05$) with the stay intention for two variables related with the life-cycle theory, *i.e. RETIREAGE* and *SALEPRICE*. However, we found intermediate negative associations ($p<0.10$) with two variables related with the efficiency theory, *i.e. LIVESMIXFARM* and *INDEPENDENCY*; and with one variable related with the life-cycle theory, *i.e. FAMSIZE*. Additionally, we also found other weaker negative associations ($p<0.20$) for both AGRIEDUC and LAGOS.

The goodness-of-fit measures of the model show a McFadden pseudo-$R^2 = 0.25$, which is within the range considered to be extremely good, *i.e.* between 0.2 - 0.4 (Louviere *et al.*, 2000)[9] . The Count R^2 value indicates that the model correctly predicted the intention to stay for 76% of the observations. These values indicate that the explanatory power of the variables in the model is relatively high.

The comparison between groups of farmers likely to stay and those likely to exit is shown in Table 4. Table 4 shows that 15 of the 30 variables are significantly different between these two groups at the 10% critical level, with 9 of the 30 variables significantly different at the 5% critical level. We found strong statistical differences between groups ($p<0.05$) for two variables related with efficiency theory, *i.e. INCENO* and *DIVERSIFICATION;* and for five variables related with life-cycle theory, *i.e. AGE*, *AGESQ, FEMALE, RETIREAGE*, and *LIFEEXP*. We also found strong statistical differences between groups for RIOS and LAGOS. We found intermediate statistical differences between both groups ($p<0.10$) for two variables related with the efficiency theory, *i.e. OFFINCREL* and *RECOGNIZE*; for three variables related with the life-cycle theory, *i.e. FAMLAB, SALEPRICE*, and *SATISFY.* We also found intermediate statistical differences between groups for *ARAUCANIA*.

Discussion

The aim of this study was to identify the main factors driving the stay-exit intention of small sized livestock farmers in Chile to provide useful information for policy/decision-makers, which can be used to design well targeted and efficient rural policies. To do this, we reviewed the related literature to design a questionnaire

[9]These values are approximately equivalent to a range from 0.7 to 0.9 for a linear regression Domencich & McFadden, 1975. Urban travel demand: a behavioral analysis: a Charles River Associates research study. North-Holland Publishing Company Limited, Amsterdam.

Table 3. Descriptive statistics and probit estimates of the variables used in the empirical model.

		Descriptive statistics		Probit estimates		
		Mean	**(SD)**	**Coefficient**	**Marginal effect (dF/dx)**	***p*>z**
Dependent variable						
	STAY	0.63	(0.48)			
Independent variables						
Efficiency theory related variables						
	INCENO	0.77	(0.42)	**0.541**	**0.206**	**0.061***
	HA	29.79	(22.16)	0.004	0.002	0.419
	MIXFARM	0.28	(0.45)	**0.740**	**0.247**	**0.072***
	LIVESMIXFARM	0.17	(0.38)	**-0.789**	**-0.303**	**0.074***
	DIVERSIFICATION	0.50	(0.50)	0.093	0.034	0.689
	OFFINCREL	0.40	(0.49)	0.342	0.123	0.134
	ASSOCIATION	0.47	(0.50)	**0.420**	**0.152**	**0.088***
	NETWORK	0.61	(0.49)	0.104	0.038	0.656
	RECONGNIZE	0.82	(0.39)	0.367	0.140	0.225
	INDEPENDENCY	0.58	(0.49)	**-0.422**	**-0.152**	**0.081***
Exit barrier theory related variables						
	BUILDINGS	2.94	(1.24)	-0.004	-0.002	0.962
	LEACOST	0.79	(0.41)	-0.230	-0.082	0.411
	DISTANCE	20.68	(16.03)	**0.011**	**0.004**	**0.107***
Life-cycle theory related variables						
	AGE	56.31	(12.04)	0.099	0.036	0.147
	AGESQ	3315.19	(1352.25)	**-0.001**	**0.000**	**0.081***
	FEMALE	0.21	(0.41)	**0.771**	**0.248**	**0.011****
	SCHOOLING	9.83	(3.01)	0.017	0.006	0.684
	AGRIEDUC	0.43	(0.50)	-0.318	-0.117	0.163
	NONAGRIEDUC	0.23	(0.42)	-0.080	-0.030	0.772
	MARRIED	0.82	(0.39)	0.098	0.036	0.728
	FAMSIZE	2.50	(2.00)	**-0.106**	**-0.039**	**0.068***
	FAMLAB	0.33	(0.47)	0.346	0.123	0.166
	SUCCESSOR	0.56	(0.50)	-0.270	-0.098	0.237
	RETIREAGE	0.28	(0.45)	**-0.572**	**-0.217**	**0.018****
	SALEPRICE	0.34	(0.47)	**-0.538**	**-0.202**	**0.035****
	SATISFY	0.90	(0.31)	0.336	0.128	0.415
	LIFEEXP	0.75	(0.44)	**0.637**	**0.242**	**0.020****
Location area						
	ARAUCANÍA	0.27	(0.44)			
	RÍOS	0.32	(0.47)	-0.054	-0.020	0.883
	LAGOS	0.41	(0.49)	-0.371	-0.137	0.201
	cons			-3.008		0.139
McFadden’s pseudo-R^2:			0.25			
Count R^2:			76%			

Marginal change (dF/dx) is for discrete change of dummy variable from 0 to 1. Bold denotes: * significant at 10% critical level, ** significant at 5% critical level. cons: Probit constant value

Table 4. Comparison of the mean values (standard deviations in parentheses) between exit-farmers and stay-farmers.

Variable	Exit n=79		Stay n=133		(Asymp.) Sig. (2-tailed)
Efficiency theory related variables					
INCENO	**0.684**	**(0.468)**	**0.820**	**(0.386)**	**0.023****
HA	28.497	(16.713)	30.562	(24.871)	0.471
MIXFARM	0.253	(0.438)	0.293	(0.457)	0.530
LIVESMIXFARM	0.190	(0.395)	0.165	(0.373)	0.651
DIVERSIFICATION	**0.418**	**(0.496)**	**0.556**	**(0.499)**	**0.051****
OFFINCREL	**0.316**	**(0.468)**	**0.444**	**(0.499)**	**0.068***
ASSOCIATION	0.430	(0.498)	0.496	(0.502)	0.354
NETWORK	0.557	(0.500)	0.647	(0.480)	0.196
RECOGNIZE	**0.759**	**(0.430)**	**0.850**	**(0.359)**	**0.102***
INDEPENDENCY	0.595	(0.494)	0.579	(0.496)	0.820
Exit barrier theory related variables					
BUILDINGS	2.924	(1.207)	2.947	(1.269)	0.895
LEACOST	0.772	(0.422)	0.797	(0.404)	0.670
DISTANCE	19.873	(14.825)	21.167	(16.745)	0.571
Life-cycle theory related variables					
AGE	**59.190**	**(12.592)**	**54.602**	**(11.403)**	**0.007****
AGESQ	**3660.000**	**(1458.806)**	**3110.376**	**(1245.804)**	**0.004****
FEMALE	**0.139**	**(0.348)**	**0.256**	**(0.438)**	**0.046****
SCHOOLING	9.506	(2.828)	10.015	(3.109)	0.235
AGRIEDUC	0.430	(0.498)	0.429	(0.497)	0.980
NONAGRIEDUC	0.190	(0.395)	0.248	(0.434)	0.328
MARRIED	0.835	(0.373)	0.805	(0.398)	0.575
FAMSIZE	2.620	(2.126)	2.421	(1.920)	0.484
FAMLAB	**0.253**	**(0.438)**	**0.376**	**(0.486)**	**0.067***
SUCCESSOR	0.620	(0.488)	0.519	(0.502)	0.151
RETIREAGE	**0.418**	**(0.496)**	**0.195**	**(0.398)**	**0.000****
SALEPRICE	**0.418**	**(0.496)**	**0.293**	**(0.457)**	**0.065***
SATISFY	**0.848**	**(0.361)**	**0.925**	**(0.265)**	**0.077***
LIFEEXP	**0.595**	**(0.494)**	**0.835**	**(0.373)**	**0.000****
Location area					
ARAUCANÍA	**0.203**	**(0.404)**	**0.308**	**(0.464)**	**0.094***
RÍOS	**0.228**	**(0.422)**	**0.368**	**(0.484)**	**0.034****
LAGOS	**0.570**	**(0.498)**	**0.323**	**(0.470)**	**0.000****

t-test was used for testing parametric variables and *Mann-Whitney U* test was used for non-parametric variables. Bold denotes: * significant at 10% critical level, ** significant at 5% critical level

and collect the required data from farmers. We obtained two sets of results, which are summarised in Tables 3 and 4.

Explanation of the analyses findings

Descriptive analysis showed that having enough income (provided by farming) to cover farmer expenses (77%) is not enough argument to increase the likelihood to stay in farming (63%). This supports the fact that stay-intention cannot be fully explained by the efficiency theory. We could infer that farmers believe that diversification is a good farming strategy (50%); however, only 28% of them produced both crops and livestock products. These farms are mostly owned by farmers aged 56 or older. The farmer's family size is as small as 2 or 3 people and one out of three family members work in the farm only.

Probit model showed that the effects of all variables associated with the stay intention were in line with our *a priori* expectations. Our findings regarding the capacity of farm income to cover the expenses of a whole family are supportive of the utility theory (Boehlje, 1992; Goetz & Debertin, 2001; Pushkarskaya & Vedenov, 2009; Zhan *et al.*, 2012). Therefore, it may be assumed that farming, from a financial viewpoint, provides a higher expected utility than exit from farming. Although we found a small level of diversification among these farmers, its effect is in line with other studies (Goetz & Debertin, 2001; Bragg & Dalton, 2004; Foltz, 2004; Zhan *et al.*, 2012). This diversification could indicate that small farmers commercialise more than one product as a strategy to either buffer or expand their farm income, while reducing risk. The result found for the participation in associations is supported by the theory that exit from farming implies a loss of location-specific social capital (networks) (Huffman & Feridhanusetyawan, 2007). The fact that only participation in an association was found to be significant, and that participation in a network was not (even considering that 61% of farmers reported this variable as an important one), suggests that farmers prefer 'formal' social networks providing technical and financial assistance, *i.e.* agricultural cooperatives, rather than more informal networks that share labour and machinery, *i.e.* neighborhood relationships. Average distance to the nearest city is positively associated with the intention to stay, which is in agreement with Goetz & Debertin (2001). This implies that greater distance does lead to higher transaction and opportunity costs. The age (not significant) and age squared effect are in line with both Gale (1994) and Breustedt & Glauben (2007). They showed that exit is more likely at the consolidation period than at start-up or maturity, mainly because changing from a farm job to a nonfarm job requires specific investments in human capital, which are higher for older farmers. Also, older farmers may be less willing to bear risks due to their shorter planning horizons (Polson & Spencer, 1991). Therefore, an older farmer has a higher likelihood to stay. In addition, age is statistically different between the exit-farmer and the stay-farmer groups. Although the labour market for women in rural areas is limited by their roles in the family, the availability of services, and mobility (Baylina & Salamaña, 2006; Charatsari *et al.*, 2013), the presence of a female farmer increases the likelihood to stay. This result could be related to the 'manager role' played by wives/mothers in the family farm, where they are formally the owner of the farm and their husband and/or children do the physical work on the farm. It is suggested that network, sunk costs, family size, successor presence, and overall satisfaction were significantly higher for female rather than male farmers, which reinforces the finding of the positive association between female farmer and intention to stay. The effect of having positive expectation regarding future farming life is supported by Zollinger & Krannich (2002), who showed that when a farmer perceives positives changes, the likelihood to continue the farming operation increases. Hence, having a promising future for farming is a key for the likelihood to stay.

Moreover, the variables negatively associated with the stay intention did not always show the expected effect. The negative effect of a farm focused on livestock production could be explained by an unbalanced production system or due to some specific features of the land, which might not be adequate for livestock production. It could also be explained by the fact that livestock production demands more time than crop production giving a reduced leisure time for farmers (Boehlje & Eidman, 1984). As the surveyed farmers said, for them the livestock production is an enslaving job. The possibility to make their own decisions did not show the expected effect, as opposed to the findings of Gasson *et al.* (1988) and Fairweather & Keating (1994). This might be explained by the supposed autonomy of the farmer being restricted as a consequence of the biological cycle of farming (Boehlje & Eidman, 1984). The family size did not show the expected effect. This finding is not in contrast neither with Chang *et al.* (2011) who indicated that family size, like most demographic characteristics, does not affect the stay-exit intention, nor with Breustedt & Glauben (2007), who indicated that large family size reduces the net exit rates. This result could be explained by the lack of opportunities in large families for all family members to work in the farm. Even if these opportunities exist, it is also likely that some family members prefer to find employment outside the farm. If some members of the family are employed off-farm, then this lowers the transaction costs of exiting farming and increases the opportunity cost of farm labour (Goetz & Debertin, 2001; Pushkarskaya & Vedenov, 2009). The existence of a defined retirement age and the presence of a defined sale price for the farm showed the expected effect, indicating that these variables are predictors of farmers that prepare to exit, a result that is in line with Pushkarskaya & Vedenov (2009). Besides indicating that the likelihood to stay decreases, it might also imply that no family member is available for transferring responsibilities or to take over the farm. In addition, these two variables were statistically different between the exit-farmer and stay-farmer groups.

Other variables included in our probit model did not show a statistically significant effect on the stay intention. However, when the variable region was removed from the model the presence of a successor showed a slightly negative effect, which is not in line with previous studies (Zollinger & Krannich, 2002; Gale, 2003; Glauben *et al.*, 2006). The reason behind this effect could be that the owner assumes that there is a successor for taking over the farm (56% of the answers); nevertheless, the farmer is not preparing to exit and pass on the farm to his/her successor (72% of them said they did not want to retire from farming). The education variables also showed no significant effect on the intention to stay, which is in agreement with Bragg & Dalton (2004). However, the sign of this effect suggests that more educated farmers increased their own knowledge to improve access to off-farm employment, *i.e.* exit (Huffman & Feridhanusetyawan, 2007; Chang *et al.*, 2011), rather than adopting management-intensive systems in an effort to improve farm efficiency, *i.e.* stay.

In addition to our findings from probit model, we also found statistically significant differences between the exit-farmer and stay-farmer groups for the following variables: *INCENO, AGESQ, FEMALE, RETIREAGE, SALEPRICE, SATISFY*, and *LIFEEXP*.

Farmers' profiles and implications for policy making

Based on our findings, a 'typical' stay farmer is able to cover the expenses of the whole family through the production of both livestock and crop. He or she participates in associations and considers that the distance to the nearest city is not a problem for farming. This farmer could be also characterised to be a woman, and for having a positive expectation of future farming life. In contrast, a 'typical' exit farmer is characterised as a farmer who has both a retirement age and a sale price for the farm defined. Although this farmer also produces both livestock and crop, is more focused on livestock and, accordingly, considers that there is no possibility to make own decisions about the use of resources in farming. This 'exit' farmer also considers that the larger the size of the family, the better it is to leave farming.

Our empirical findings indicate potential opportunities for the development of efficient policies aimed at increasing the likelihood of small farmers staying in rural areas in Chile. Firstly, new rural policies should focus on *farmer characteristics* such as age, gender and expectations. These policies could be developed to foster female agricultural entrepreneurship, and provide space for new jobs for family members. They should also consider a retirement plan, including benefits for those farmers that transfer the farming business to another family member. Secondly, new rural policies should also focus on the *farming system*. The emphasis should be on fostering multi-activity production at a basic level, as a buffer tool to overcome unexpected changes, and on fostering the adoption of new technologies and management skills to improve efficiency. Thirdly, new policies should also focus on the *social aspect of rural society*. Programs could be developed that foster formal associations and provide a more accessible, secure and promising future for farming.

However, to make these recommendations usable for policy makers, the following aspects need further research as a basis for designing new rural policies: characteristics of the farmer and his family, farm efficiency and factors influencing this efficiency, and socio-economic behaviour both inside and outside of rural communities. These aspects could provide a foundation for increasing the opportunities to keep family members working on the farm (or hire people), make small livestock famers competitive, generate rural jobs, and provide autonomy to farmers, which in turn should stop the migration from rural areas.

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