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Abstract

Farming and fisheries are two sectors with strong intergenerational ties. The occupational choice of farmers' and fishers' children is therefore of central importance when it comes to future industry structure and the total number of workers in these sectors. In this paper, we provide a detailed analysis of the intergenerational links in agriculture and fisheries in Sweden using a large administrative database covering the entire farmer and fisher population. The use of intergenerational matched administrative data is new to the literature and makes it possible to avoid problems associated with survey response data. To identify the factors that affect children's occupational choice, we estimate an instrumental variable probit model, where we focus on the importance of the father's earned income. We show that father income during childhood affects children's decision to follow in their father's footsteps.

Key words: Occupational choice; occupational inheritance; intergenerational data; instrumental variable probit

JEL classification: Q12; Q22; J43; J24.

1. Introduction

Intergenerational mobility in the labour market has long been an active area of research among economists and other social scientists.[1] This literature has established a robust finding: sons have a higher than random probability of following in their father's occupational footsteps. While strong intergenerational ties have been found in several occupations, e.g. doctors and lawyers (Laband and Lentz 1992; Lentz and Laband 1989, 1990), the intergenerational links seem to be particularly strong in farming (Blau and Duncan 1967; Laband and Lentz 1983). In fact, as shown in recent work by Long and Ferrie (2013) and Xie and Killewald (2013), around 80% of fathers of US farmers have a background in farming, and this holds true for both the nineteenth and twentieth century.

Commercial fishing is another occupation where intergenerational links seem to be particularly strong. Anecdotal evidence and survey studies suggest that in many coastal communities, fishermen come from a long line of fishing families (e.g. van Ginkel 2001; Urquhart and Acott 2013). In contrast to the literature on agriculture, however, there are no quantitative studies investigating the extent to which children of fishers follow in their parents' occupational footsteps and what factors influence this decision.

Issues relating to occupational inheritance in farming and fisheries have also received attention from a policy perspective. This is especially true in Europe, where the lack of 'new blood' entering agriculture and fisheries and the long-term consequences of this are a serious concern in many countries (DGIP 2012; DG Mare 2013; Zagata and Sutherland 2015). The dependence on intergenerational succession, especially in small-scale family farming (DGIP 2014), suggests that it is important to examine factors influencing the occupational choice of farmers' and fishers' children. The inflow of young workers also influences the future structure and practices of farming and fishing in general. There are several studies showing that age of farmers relates to views on e.g. environmental policies (Vanslembrouck et al. 2002), sustainable production (van Passel et al. 2007) and organic farming (Laepple and Van Rensburg 2011).

The aim of this paper is to provide a detailed analysis of the intergenerational links in agriculture and fisheries in Sweden using a large administrative database covering the entire farmer and fisher population, their family ties and relevant labour market data (including e.g. educational attainment and occupational choice). First, we provide a descriptive analysis of the degree of occupational inheritance in these sectors, focusing on differences between gender and age groups. Second, an empirical model of children's occupational choices is developed, focusing on the importance of father income. The main question of

[1]The literature on intergenerational mobility is reviewed in e.g. Solon (1999) and Black and Deveruex (2011).

interest reads: Does father income during childhood affect the probability of choosing farming (fishing) as an adult? As a measure of future income potential, we expect father income to have a positive effect on the probability of entering farming (fishing). However, farming and fishing are frequently referred to as 'a way of life' and farms are often also dwelling places with potentially great symbolic and emotional value. Farming and fishing families may therefore refrain from selling or closing their business even if income is low (see e.g. Chambers and Vasavada 1983; Gasson et al. 1988; Gardner 1992).[2]

This paper contributes to the literature in at least three ways. First, to the best of our knowledge this is the first quantitative study examining occupational following in fishing families. Second, on the methodology side, our estimation approach treats father income as a potential endogenous factor. As will be discussed later, it is possible that having a probable successor provides an incentive for parents to earn higher income in order to make farming/fishing a more attractive occupation. Therefore, it is important to be specific about the direction of the income effect, which is addressed in this study using an instrumental variable approach. Third, previous studies in this area are based on survey responses that represent future plans of farm families (e.g. Glauben et al. 2004; Hennessy and Rehman 2007; Glauben et al. 2009; Mishra et al. 2010). As discussed later in the paper, this may introduce bias in the empirical estimates if expectations are not realised. An important benefit of using administrative data is that the actual occupational choices of the children are recorded. Another advantage of our empirical approach relates to the fact that we observe father income and the occupational choice of their children in different years (1997 and 2012, respectively). This is an important advantage. While previous studies have demonstrated a positive relationship between farm performance and farm succession, it is not clear whether this effect indicates that: a) taking over an economically successful farm is more attractive (e.g. Glauben et al. 2009) or b) the child contributes to the economic performance of the farm prior to taking over the business (e.g. Lobley, Baker and Whitehead 2012). Since this study measures father income during childhood and the occupational choice during adulthood, the empirical estimates capture the first but not the second effect.

The rest of the paper is organised as follows. First, we provide a review of previous papers investigating the relationship between occupational following and the economic performance of the farm. Next, we describe our data and provide some descriptive statistics, followed by an empirical investigation of factors affecting the occupational choice of farmer and fisher children. The final section provides some concluding remarks.

[2]In line with the latter view, Nordin et al. (2016) report that farmer and fisher children who follow in their father's occupational footsteps have lower income than their siblings with a career outside these sectors.

2. Previous research

The previous literature on intergenerational links in agriculture is quite disparate and focuses on different aspects of occupational following. Issues related to farm succession have attracted most attention (see e.g. the review by Mishra et al. 2010). One question that has generated particular interest is whether the economic performance of the farm is important for farm children's occupational choice. The evidence on this is quite mixed. Using Austrian survey data, Glauben et al. (2004) found that the gross margin has a positive effect on farm succession, with a 10% increase in the gross margin raising the probability of succession by 0.9 percentage points. Glauben et al. (2009), who used survey data on German farms, also found that more profitable farms have a higher probability of being transferred within the family. Using survey data on US farmers, Mishra et al. (2010) found a positive impact of farm household wealth on the likelihood of succession, with a $10,000 increase in household wealth increasing the probability of planned succession by 0.38%. However, they found no effect of farm output on the likelihood of having a succession plan. Hennessy and Rehman (2007) used survey data on farms in Ireland to analyse the occupational choice of nominated farm heirs and found no effect of family farm income on the occupational decision of the children. However, they found that farm size (the number of livestock units) was positively related to the probability of planning to enter full-time farming.

One problem facing studies estimating the effect of farm income on children's occupational choice is potential endogeneity, i.e. the perceived likelihood of having a successor may influence the parents' farm investment decisions. In fact, there are empirical studies focusing on this aspect of farmers' behaviour. Potter and Lobley (1992) surveyed 165 farmers in England and Wales and found that farm investment behaviour differed radically between farmers with and without an appointed successor. In comparison with elderly farmers with an appointed successor, farmers without a successor were less likely to invest capital and intensify production. Similar findings were made by Calus et al. (2008) and Sottomayor et al. (2011). For example, Calus et al. found that once a successor is recognised, farmers become more likely to undertake farm investments, and that this can occur a decade in advance. These studies highlight the importance of being specific about the direction of the income effect, an issue addressed in this paper using an instrumental variable methodology.

The empirical studies cited above are based on survey data, which means that they typically consider farmers' opinion of what their children will do, rather than the actual decisions made by their children (see e.g. Glauben et al., 2004; Hennessy and Rehman, 2007; Mishra et al., 2010). The use of survey data is problematic if parent's expectations are not realised. This is especially problematic in cases where the probability of the succession plan being realised is related to the farm and family characteristics used to

explain the occupational choice of the children. For example, if fathers of economically successful farms systematically overestimate their sons' willingness to inherit the family farm, this will introduce bias in estimates of the effect of farm income on the probability of occupational succession. An alternative approach is to use intergenerational matched administrative data, as done by e.g. Bennedsen et al. (2007), Corak and Piraino (2011) and Kramarz and Nordström Skans (2014). However, these studies focus on other aspects of intergenerational links in the labour market, such as job finding though parental networks and the effects of appointing a family member as a chief executive officer, and do not analyse the specific features of the agricultural sector. Thus the present study is the first to analyse intergenerational links in agriculture using administrative matched data. However, as mentioned in the Introduction, it differs from previous studies in that we do not explicitly examine (planned) farm succession (no information about succession is available in our data). Instead, we analyse occupational choices of farm children and do not differentiate between working on a farm and taking over the family farm.

To sum up, the previous empirical literature on farming families gives some support to the hypothesis that future income possibilities are important for the occupational choice of farmers' children. When it comes to fisheries, to the best of our knowledge there are no previous studies that empirically examine intergenerational linkages. Bjarnason and Thorlindsson (2006) analyse migration expectations among youth in Icelandic fishing and farming communities and suggest that children with parents working in the fishing or agricultural sector are less likely to expect to migrate out of the community. However, the extent to which children of fishers choose to follow in their parents' footsteps and the factors influencing this decision are not known. This is somewhat surprising since fishing, like farming, is a profession where occupational specific skills are likely to be transferred within families (e.g. Laband and Lentz 1983; Rosenzweig and Wolpin 1985). Examples of fisher-specific skills are knowledge about local fishing grounds and gear choices for different seasons and weather conditions. Indeed, in interviews with fishermen in Hastings, UK, many respondents reported that following in their father's footsteps was expected since "boats, gear, knowledge and skills have been passed on from father to son for generations and there is a sense of pride coming from a local fishing family" (Urquhart and Acott 2013, p. 51).

3. Data and descriptive statistics

3.1 Data

Our data were obtained from Statistics Sweden's *Longitudinal integration database for health insurance and labour market studies* (LISA) and *Multigenerational register*. LISA is based on annual registers and includes all individuals, 16 years of age and older, registered in Sweden as of December 31 each year. The database provides a broad battery of information on demographics, labour market outcomes and

educational attainment. Through the LISA database, we have access to data on all individuals that hold a fishing licence and all individuals receiving income from work or a business which, according to its industry code[3], is classified as having activity in agriculture or fishing.[4] To construct the dataset needed for the analysis, we proceed as follows. First, we construct a relevant sample of fathers working in agriculture or fishing between 1997 and 1999.[5] In a second step, we establish the intergenerational links between these fathers and their children, by matching information from the *Multigenerational register*. Finally, we observe the occupational choice of the children in the year 2012 using information from the LISA database.

In the first step, we set some restrictions on the farmers and fishers in order to construct a relevant sample of fathers. For example, we excluded fathers with only a marginal involvement in farming and fishing. For fathers in fisheries this is not a problem, because holding a fishing licence guarantees that the individual receives the majority of their income from fisheries. As regards farmers and fishers without a licence, however, we require that their main income (over 50%) should come from farming/fishing in all three years 1997-1999. The intergenerational links between fathers and their children are then established using the *Multigenerational register*, which gives us a total number of 41,787 children (who were working in 2012) and a total of 15,211 fathers.

3.2. Descriptive statistics

Table 1 shows some descriptive statistics of the intergenerational links in the data. The upper and lower panels show the statistics for children of farmers and fishers, respectively. Column two shows the number of children who followed in their father's footsteps and column three shows the number who chose another occupation (children without earned income excluded). The first thing to note is that sons are much more likely to follow their father's footsteps than daughters, and this holds true for both agriculture and fisheries. The average fraction following in agriculture is 0.29 for males and 0.09 for females, while the corresponding values for fisheries are 0.18 and 0.02.

To further illustrate the intergenerational ties in agriculture and fishing, we continue with a graphical analysis of the data. We begin looking at occupational following in agriculture. Figure 1 shows the proportions of children working in agriculture in 2012 for different age groups and sexes. We see that on

[3]The Swedish Standard Industrial Classification (SNI) code.
[4]The registry of commercial fishing licences is provided by the Swedish Agency for Marine and Water Management and is matched to the LISA database.
[5]We observed that if the mother is a farmer or a fisher, the father is almost always also a farmer or a fisher. The sample of farmer (fisher) mothers was too small to analyse separately, so we restricted our analysis to fathers in agriculture and fishing.

average, 29% of the sons choose to follow in their father's footsteps, whereas only 9% of the daughters follow their fathers'. Figure 1 also reveals another interesting pattern, namely that young individuals, both sons and daughters, are more likely to work in agriculture. The highest numbers are found for children still in upper secondary school (aged between 16 and 18 years), which suggests that their main work is during weekends and school breaks.[6]

Table 1. Number of children of Swedish farmers and fishers and their choice of occupation

	Father in agriculture (N=13,613)		
	Children in agriculture	Children in other occupation	Total
Male	5,564	13,721	19,285
Female	1,601	16,613	18,214
Total	7,165	30,334	*37,499*

	Father in fisheries (N=1,598)		
	Children in fisheries	Children in other occupation	Total
Male	392	1,822	2,214
Female	37	2,037	2,074
Total	429	3,859	*4,288*

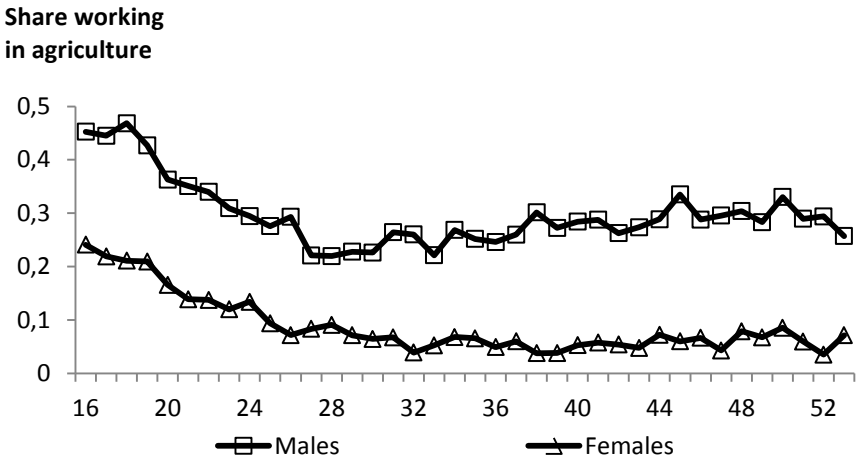

Figure 1. Share of male and female children working in Swedish agriculture in 2012.

[6]This high proportion is not because of dropouts from upper secondary education working on the family farm. About 95% of those aged 16-18 are students (the data include a variable explaining if the individual is a student).

Figure 2 presents the corresponding statistics for children of fishermen, i.e. the proportions of children working in fisheries in 2012 for different age categories and sexes. As with farmers' children, it is evident that sons are more likely to follow in their father's footsteps than daughters. For sons aged between 16 and 40 years, the proportion is around 15%. Figure 2 also shows that very few daughters of fishermen become fishers themselves, although the proportion of young daughters (aged between 16 and 19 years) with some income from fishing is around 10%.

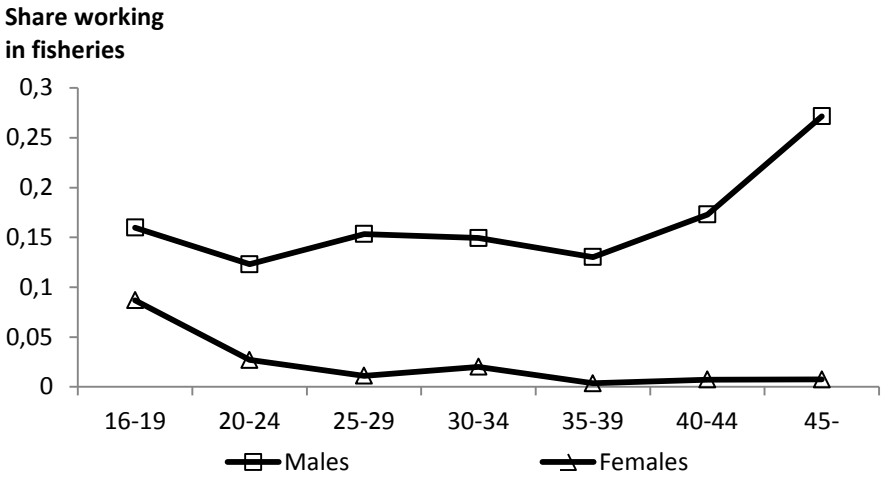

Figure 2. Share of children working in fisheries in 2012.

It is interesting to compare the numbers above with those found in other studies. Using data from a US survey conducted in 1973, Long and Ferrie (2013) estimated that the proportion of farmers' sons working in their father's occupation was 0.14.[7] It is also interesting to compare our values with the intergenerational links in other occupations. In an influential study, Laband and Lentz (1992) investigated the attitudes of sons of lawyers towards following in their father's footsteps and found that as many as 29% mentioned law as a prospective career. Among these individuals, about half (51%) actually became lawyers. Compared with these numbers, the intergenerational links among farmers' sons in Sweden are stronger.

5. Probability of following in father's footsteps - empirical framework

As discussed in the Introduction, an important advantage of our approach is that we are able to measure fathers' income during childhood (in 1997) and labour market outcomes during adulthood (in 2012). By doing so, we avoid including adult children who were already working in their father's business in 1997

[7]In the sample used in Long and Ferrie (2013), the sons were between 33 and 39 years old in the survey year. As can be seen in Figure 1, the intergenerational links are considerably stronger in Sweden.

and therefore contributing to their father's income (reversed causality). We therefore impose two age restrictions. First, we restrict the estimation sample to children who were under 32 years in 2012, which means that they were 16 years or younger in 1997. The reason for restricting the age to 16 years is the compulsory school attendance law, which stipulates that children must attend school to the 9th grade. This implies that practically all 16-year-olds are precluded from working full-time and could therefore not contribute (significantly) to their father's income.[8] We also impose a lower age restriction because we want to observe the children at an age where they had made their occupational choice. We set this restriction to 25 years, which means that we observe the occupational choice 5-6 years after the individual had finished upper secondary school.[9] After implementing these restrictions, the total samples add up to 7,630 and 762 children in agriculture and fisheries, respectively (see summary statistics in Table 2). Of course, it is not clear at what age individuals make their (first) occupational choice and in the regression analysis below we examine what happened when these restrictions were changed. In addition, regarding the effects of other variables than father income, such as, first child, gender etc. reversed causality is not considered a problem. It may therefore be interesting to examine the effects of such variables in the complete sample of children (without age restrictions). These results are presented in Appendix 1.

The empirical model used in this section follows earlier studies of occupational choice in agriculture (e.g. Hennessy and Rehman 2007; Mishra et al. 2010) and is drawn from the theory of rational occupational choice (see e.g. Boskin 1974; Barkely 1990). In the model, the choice of occupation is determined by comparing the discounted utilities derived from each possible occupation and the individual chooses the occupation that maximises their lifetime utility. Following Barkely (1990), we assume that the children face the following choice: (a) follow their father's footsteps and work as a farmer (fisher) or (b) search for an occupation outside farming (fishing). The child would choose farming (fishing) if the latent utility index U_i^F is greater than the utility derived from non-farm (non-fishing) employment, U_i^N. Thus, we define a variable, *FOLLOW*, which takes the following values:

$$FOLLOW_i = \begin{cases} 1 & \text{if } U_i^F - U_i^N \geq 0 \\ 0 & \text{otherwise.} \end{cases} \quad (1)$$

In practice, the non-farming (non-fishing) occupations are many and varied. However, as in previous studies, we treat these as a single occupational category, since our main interest is to identify what factors affect the probability of choosing farming (fishing), as opposed to not choosing farming (fishing). We are particularly interested in whether or not the decision to become a farmer (fisher) is related to the

[8] We recognise (Figure 1) that many children who are 16 years old have income from farming and fishing. However, their income is very low, on average well below 10.000 SEK annually (1 EUR ≈ 9 SEK), which suggests that they work during weekends and school breaks.

[9] The vast majority (97%) of the children in our sample continued to upper secondary school and most graduated at age 19.

economic performance of the father's business. To capture this, the utility associated with choosing farming (fishing) compared with another occupation is modelled as the sum of a deterministic and an unobserved random component: $U_i^F - U_i^N = \boldsymbol{X'}_i\boldsymbol{\beta} + \delta y_i + \epsilon_i$, where the random component ϵ_i represents unobserved characteristics of the child and y_i is an income variable measuring the father's total income from work and business in 1997 (total earned income). Additional explanatory variables, including characteristics of both the fathers and their children, are gathered in the vector $\boldsymbol{X}_i$.

Assuming that ϵ_i is normally distributed, the parameters $\boldsymbol{\beta}$ and δ can be estimated using standard probit regression. However, as discussed above, one concern is that having a probable successor may provide an incentive for fathers to earn higher income (to make farming/fishing an attractive occupation). To deal with this issue, consider the following model:

$$FOLLOW_i = \boldsymbol{X'}_i\boldsymbol{\beta} + \delta y_i + \epsilon_i \quad (2)$$

$$y_i = \boldsymbol{X'}_i\widetilde{\boldsymbol{\beta}} + \boldsymbol{z'}_i\boldsymbol{\alpha} + v_i \quad (3)$$

where the error terms (ϵ_i, v_i) have a zero mean bivariate normal distribution and are independent of the variables in $\boldsymbol{X}_i$ and the set of instrumental variables $\boldsymbol{z_i}$. The variable y_i is determined endogenously in the model if ϵ_i and v_i are correlated (endogenous probit model). This situation may occur if unobserved omitted variables, such as the child's attitude towards farming (fishing), affect both the probability of following in their father's profession and father income (which will be the case if it provides an incentive for fathers to earn higher income). Estimation of model (2) without accounting for this may result in misinterpretation of the parameter δ. It is possible to alleviate this problem if we can find instrumental variables, $\boldsymbol{z_i}$, that are correlated with father income, but unrelated to the probability of choosing farming (fishing), conditional on the other explanatory variables. Finding such variables is not easy, however. Mishra et al. (2010) used an index measuring progressive management practices of the farm operator as an instrument for accumulated farm household wealth and used the debt-to-asset ratio of farm households as an instrument for the value of farm production. However, it is questionable whether these instruments are truly exogenous.

In this study, the following dummy variables are included as instruments: *FA EDU* (years of schooling of fathers), *FA EDUA* (dummy variable, equal to one if the father has an education in agriculture) and, for fathers in fisheries, *FA EDUF* (dummy variable, equal to one if the father has an education in fishing and/or shipping).[10] We argue that these instruments are valid since the educational decisions of the fathers

[10]All three variables measured in 1997. Education in shipping includes both sea captain and coxswain.

are typically made long before planning for their children's future.[11] One could claim that the instrumental variables do not satisfy the exclusion restriction, since educated fathers may be more likely to send their children on to higher education instead of introducing them to farming (fishing). If so, father education has an indirect effect on the probability of choosing farming (fishing). However, this indirect effect goes though the educational choice of the children, which is controlled for by including years of schooling and the presence of agriculture/shipping education in $\boldsymbol{X}_i$. At the very least, the reverse relationship – from having an appointed successor to farm investments (and thus father's income) – should not be captured when instrumenting father's income with the father's education.

It is also important that the instrumental variables have predictive power for y_i. Previous research has used education as a proxy for human capital to capture farmers' ability to adopt innovation and increase income (e.g. Welch 1970; Khaldi 1975; Wozniak 1984). Furthermore, since the equation of the endogenous variable in (3) is linear, standard tests such as *t*-tests for significance of the set of parameters $\boldsymbol{\alpha}$ and the *F*-test may be used to assess the strength of the instruments.

Summary statistics of the variables used in the model is presented in Table 2.

[11]A potential issue is genetic traits that can affect both income and the willingness to work in farming/fishing. Such factors are not possible to control for in this study.

Table 2. Definitions and averages of variables used in the model

Variable	Definition	Means	
		Farmers	Fishers
Dependent variable			
FOLLOW	= 1 if child farmer/fisher; 0 otherwise	0.16	0.09
Child characteristics			
EDU	Years of schooling	13.18	12.51
EDUA	= 1 if education in agriculture; 0 otherwise	0.14	-
EDUF	= 1 if education in fishing/shipping; 0 otherwise	-	0.01
FEMALE	= 1 if female; 0 if male	0.49	0.47
ONLY CH	= 1 if no siblings; 0 otherwise	0.04	0.05
FIRST CH	= 1 if firstborn child; 0 otherwise	0.32	0.33
AGE CH	Age of child	28.04	27.93
Father characteristics			
FA MAR	= 1 if father married; 0 otherwise	0.83	0.75
FA AGE	Age of father	59.87	58.52
FA SELF	= 1 if father self-employed; 0 otherwise	0.89	0.74
FA INC 1997	Father income (10.000 SEK)	12.79	13.30
Family			
BOTH PAR	= 1 if both parents farmers/fishers; 0 otherwise	0.27	0.03
SIBLING	= 1 if sibling in farming/fishing; 0 otherwise	0.26	0.14
Instruments			
FA EDU	Years of schooling (fathers)	10.51	10.20
FA EDUA	= 1 if education in agriculture (fathers); 0 otherwise	0.38	-
FA EDUF	= 1 if education in fishing/shipping (fathers); 0 otherwise	-	0.15
Number of observations		9,630	762

Notes: To separate the effects of the variables *FIRST CH* and *ONLY CH*, the variable *FIRST CH* does not include children without siblings (they appear in *ONLY CH*).

6. Results and discussion

6.1 Results from the probit model

We begin by presenting the results from the probit regression model without instrumental variables (equation 2).[12] Table 3 shows the coefficients, standard errors and marginal effects for children with a father in agriculture. The first thing to notice is that the coefficient of father income (*FA INC 1997*) is positive and significantly different from zero. An increase of 10,000 SEK in father income in 1997 increases the probability of his child working in agriculture in 2012 by 0.2%. This effect seems rather small; if father income increases from 128 TSEK (the average in our sample) to e.g. 192 TSEK (an

[12] The results from the probit regression without age restrictions are presented in Appendix 1.

increase of 50%), this would increase the probability of occupational following by 1%. This can be compared with the overall probability of following in the father's profession (Table 2), which is 16% for children of farmers. In the probit model, the effect of a change in father income depends on the values of the explanatory variables. To provide a closer look at this relationship, the probability of working in agriculture as a function of father income is plotted in Figure 3.[13] Looking at the most interesting income interval 0-300,000 SEK (which includes more than 95% of the observations), it can be seen that the effect increases linearly with father income. We also re-estimated the parameters in Table 3 while varying the age restrictions, i.e. setting the lower age restriction to 20 or 22 years. The results (available upon request) showed exactly the same effect of father income (0.2%).

Table 3. Probit regression estimates and marginal effects for fathers in Swedish agriculture

Variable	Parameter	Standard error	Marginal effect
Intercept	0.225	0.314	-
Child characteristics			
EDU	-0.134***	0.011	-0.025
EDUA	1.444***	0.041	0.427
FEMALE	-0.524***	0.038	-0.098
ONLY CH	0.335***	0.085	0.075
FIRST CH	0.047	0.043	0.009
AGE CH	-0.014	0.009	-0.003
Father characteristics			
FA MAR	0.058	0.049	0.011
FA AGE	0.006	0.004	0.001
FA SELF	0.062	0.060	0.011
FA INC 1997	0.008***	0.003	0.002
Family characteristics			
BOTH PAR	0.162***	0.039	0.032
SIBLING	0.539***	0.038	0.117
Number of observations	9630		

Notes: *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. The marginal effects are computed holding other explanatory variables constant at their mean values. The estimations are performed using the commands probit and margins in STATA 12.

[13]The marginal effects at different levels of father income are computed holding other explanatory variables constant at their mean values.

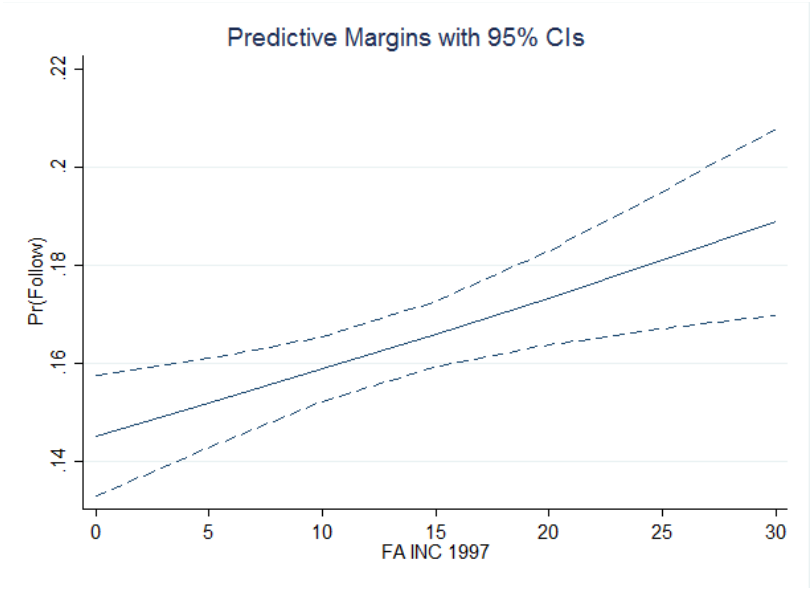

Figure 3. Simulated probabilities of occupational following in agriculture as a function of father income in 1997.

Regarding the other explanatory variables, the results are quite in line with our prior expectations. The marginal effect of one more year of education lowers the probability of working in agriculture by 2.5%. This can be compared with the results in Hennessy and Rehman (2007), who found that nominated heirs with tertiary education are around 4% less likely than heirs without tertiary education to be willing to work on the family farm. As emphasised by Hennessy and Rehman, the occupational choice and the educational decision are most likely made jointly. We find that the probability of following in the father's profession is strongly affected by family-related characteristics; the probability of working in agriculture increases if both parents work as farmers in 1997 (3.2%) and if one, or more, siblings work as farmers in 2012 (11.7%). These effects capture the fact that family farming is a salient feature in the Swedish agricultural sector. We also see that children without siblings have 7.5% higher probability of following, which can be expected given that farms are often retained within the family. Thus, although the estimation does not explicitly address succession, the occupational choice will be influenced by similar factors. It is therefore somewhat surprising that we find no significant effect of being the firstborn child, which is in contrast to several previous studies on family business succession planning suggesting that firstborn sons are often accepted as the appointed successor of the family business (see e.g. the review by Wang 2010).[14]

[14]We also included an interaction variable between gender and firstborn, without any changes to the results (not reported).

The corresponding results for children with fathers in fisheries are shown in Table 4.[15] The main variable of interest (*FA INC*) is found to be positive and significantly different from zero. Interestingly, as column 4 of Table 4 shows, the marginal effect of father income is the same as in Table 3; an increase of 10,000 SEK in father income in 1997 increases the probability of his child working in fisheries in 2012 by 0.2%. Figure 4 shows the probability of working in fisheries as a function of father income. In the most interesting income interval up to 300,000 SEK (which includes more than 97% of the observations) we see some evidence that the effect increases at higher income levels. For example, an increase in father income from 100,000 to 150,000 SEK increases the probability of his children following in his footsteps by 0.9%, while an increase from 250,000 to 300,000 SEK increases the probability of his children following on by 1.5%. As in the regressions for farmers, we varied the age restriction to see whether the effect of father income stayed the same (not reported). Setting the lower age restriction to 20 or 22 years produced exactly the same effect of father income (0.2%).

Table 4. Probit regression estimates and marginal effects for fathers in Swedish fisheries

Variable	Parameter	Standard error	Marginal effect
Intercept	-0.136	1.364	-
Child variables			
EDU	-0.068	0.047	-0.006
EDUF	0.870	0.725	0.149
FEMALE	-1.088***	0.200	-0.098
FIRST CH	0.225	0.180	0.021
AGE CH	-0.035	0.041	-0.003
Father variables			
FA MAR	0.290	0.207	0.022
FA AGE	-0.002	0.016	0.000
FA SELF	0.197	0.187	0.016
FA INC 1997	0.021**	0.009	0.002
Family variables			
BOTH PAR	0.977***	0.306	0.174
SIBLING	0.919***	0.178	0.138
Number of observations	762		

Notes: *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. The marginal effects are computed holding other explanatory variables constant at their mean values. The estimations are performed using the commands probit and margins in STATA 12.

[15]The variable ONLY CH was dropped because of perfect multicollinearity.

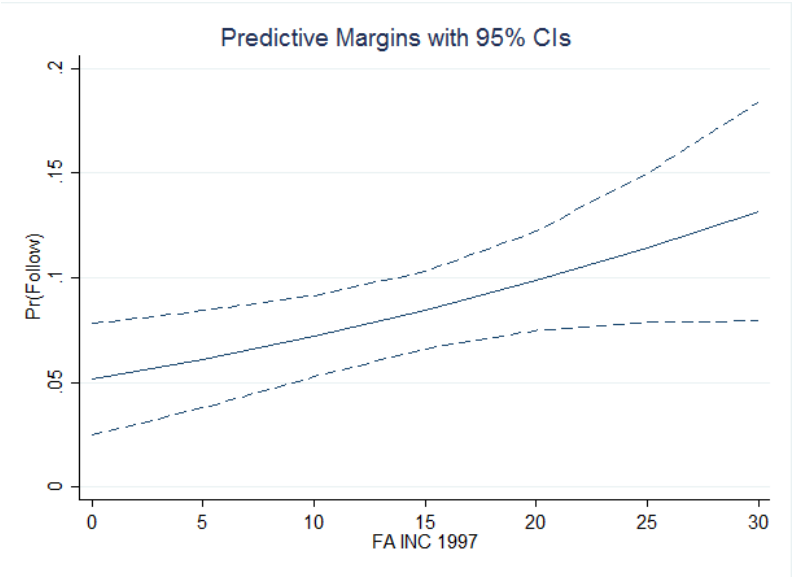

Figure 4. Simulated probabilities of occupational following in fishing as a function of father income in 1997

It is also interesting to note that family-related variables are important. The probability of working in fisheries increases if both parents work as fishers (17.4%) and if one or more siblings work as fishers (13.8%). These effects are large and may be compared with the overall probability of following (Table 2), which is around 9%.

6.2 Results from the endogenous probit model

So far, our regression results suggest that father income is indeed a relevant predictor of the probability of choosing farming/fishing as an occupation. However, to make sure that the positive relationship is not caused by reversed causality, this section investigates whether this relationship remains in the instrumental variable model. The results from equation (3) are shown in columns one to five of Table 5.[16] Looking at the coefficients on the instrumental variables, it can be seen that all variables but one are significantly different from zero. The Wald tests for joint significance of the instruments produce a test statistics of 278.00 and 27.74 for agriculture and fisheries, respectively, which can be compared with the

[16]This equation is similar to the first-stage regression in a two-stage least squares approach. Here, equation (2) and (3) are estimated jointly by maximum likelihood to account for the non-linearity of the probit model (see Wooldridge, 2002, pp. 475-477, for details).

5% critical value of 5.99 (the chi-squared distribution with two degrees of freedom). In other words, except for years of schooling (fathers in fisheries), the instruments seem to be relevant.[17]

Table 5. Factors affecting father income - estimation of equation (3)

	Father in agriculture		Father in fisheries	
Variable	Parameter	Standard error	Parameter	Standard error
Intercept	10.73***	1.25	16.21***	5.36
Instruments				
FA EDU	0.59***	0.04	0.10	0.18
FA EDUA	0.33**	0.16	-	-
FA EDUF	-	-	4.20***	0.94
Child characteristics				
EDU	0.16***	0.04	0.27	0.17
EDUA	-0.22	0.20	-	-
EDUF	-	-	-1.00	4.06
FEMALE	-0.22	0.14	-1.33**	0.60
ONLY CH	-0.38	0.35	-	-
FIRST CH	-0.50***	0.16	-0.43	0.71
AGE CH	0.08**	0.04	-0.12	0.16
Father characteristics				
FA MAR	0.50***	0.19	3.96***	0.70
FA AGE	-0.05***	0.01	-0.06	0.06
FA SELF	-6.34***	0.22	-5.26***	0.68
Family characteristics				
BOTH PAR	-0.37**	0.15	-3.32*	1.77
SIBLING	0.16	0.16	3.89***	0.85
Tests	Father in agriculture		Father in fisheries	
Test relevance of instruments	Test statistic	p-value	Test statistic	p-value
Wald test (instruments are all zero)	278.00	0.00	27.79	0.00

Notes: *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. The estimations are performed using the commands ivprobit in STATA 12.

Table 6 presents the results from the instrumental variable estimation of the parameters in equation (2) for children with fathers in agriculture. It is interesting to note that the coefficient on father income (*FA INC*) is positive and more than twice the magnitude of the values from the standard probit model presented in Table 3. The standard error of the coefficient is higher in the instrumental variable model, but the

[17]One indication of weak instruments is a low value of the *F*- (or Wald) statistic; for the linear two-stage least squares model, Stock and Yogo (2005) suggest that an *F*-statistic below 10 indicates weak instruments.

coefficient is significantly different from zero at the 10% level. According to the results in Table 6, an increase of 10,000 SEK in father income in 1997 increases the probability of his child working in agriculture in 2012 by 0.5%. The corresponding results for children of fishermen are presented in Table 7, where *FA EDU* and *FA EDUF* are used as instrumental variables. Similarly to the findings in Table 6, the marginal effects of father income is positive (0.6%) and statistically significant at the 10% level. Given the insignificance of *FA EDU* in Table 5, we re-estimated the model without this instrument, but with no changes in the results (not reported). We conclude that the positive effects of father income in the standard probit models are not caused by reversed causality. Regarding the other explanatory variables, the results are quite similar to those in Tables 3 and 4.

Table 6. Instrumental probit regression estimates and marginal effects for fathers in Swedish agriculture

Variable	Parameter	Standard error	Marginal effect
Intercept	-0.109	0.411	-
Child characteristics			
EDU	-0.139***	0.011	-0.026
EDUA	1.436***	0.044	0.427
FEMALE	-0.515***	0.040	-0.097
ONLY CH	0.339***	0.085	0.077
FIRST CH	0.050	0.043	0.009
AGE CH	-0.016*	0.009	-0.003
Father characteristics			
FA MAR	0.039	0.051	0.007
FA AGE	0.007*	0.004	0.001
FA SELF	0.196*	0.119	0.034
FA INC 1997	0.028*	0.015	0.005
Family characteristics			
BOTH PAR	0.165***	0.039	0.033
SIBLING	0.534***	0.039	0.117
Number of observations	9,608		

Notes: *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. The estimations are performed using the commands ivprobit and margins in STATA 12.

Table 7. Instrumental probit regression estimates and marginal effects for fathers in Swedish fisheries

Variable	Parameter	Standard error	Marginal effect
Intercept	-0.985	1.486	-
Child characteristics			
EDU	-0.078*	0.045	-0.008
EDUF	0.808	0.721	0.152
FEMALE	-0.960***	0.257	-0.102
FIRST CH	0.234	0.172	0.026
AGE CH	-0.026	0.040	-0.003
Father characteristics			
FA MAR	0.082	0.279	0.008
FA AGE	0.001	0.016	0.000
FA SELF	0.445	0.272	0.040
FA INC 1997	0.062*	0.035	0.006
Other			
BOTH PAR	1.009***	0.298	0.208
SIBLING	0.684**	0.310	0.105
Number of observations	762		

Notes: *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. Two instruments are used (FA EDU and FA WEST) to identify the effect of *FA INC 1997*.

7. Concluding remarks

Issues relating to occupational inheritance in farming and fishing have been raised in the European policy debate, as the lack of young individuals entering these sectors is seen as a serious concern in many countries. A plausible explanation for the shortage of young farmers and fishers is low earning prospects in these sectors (e.g. DGIP 2012; DG Mare 2013). A positive relationship between income in farmer/fishing families and the probability of occupational following can be expected. It is therefore surprising that previous studies on the determinants of farm children's occupational choice have found only weak support for such a relationship.

This study tests the hypothesis that farmer/fisher income is a determinant of their children's occupational choice. To do so, we use a large administrative database covering the entire farmer and fisher populations in Sweden, their family ties and register labour market data. The use of intergenerational matched administrative data is new to the research area and makes it possible to avoid problems associated with survey response data. Our results show that father's income during childhood is indeed a determinant of

the occupational decision, and that this result holds true when controlling for potential reverse causality. A positive relationship between father income and the probability of following also exists for children of fishermen.

From a policy perspective, this study provides at least two interesting findings. First, children of farmers and fishers react to financial incentives when deciding whether or not to follow in their parents' footsteps. Low income, a variable that is affected by policy measures, makes the children more inclined to search for jobs outside agriculture and fishing. If future policy reforms lower income for farmers and fishers, we can expect a drop in the number of children who follow in their parents' footsteps. However, as is evident from our results, the income effects are rather small. Second, our results suggest that other factors, largely beyond the control of policymakers, are probably more important for the occupation decision. For example, family characteristics, such as having both parents and siblings involved in farming/fishing, are strongly related to occupational following. Furthermore, our results confirm the findings in Hennessy and Rehman (2007) of a negative relationship between higher education and farming.

It would be interesting to extend the analysis to include information on farm size, farm property value, fish catches etc., in order to get a more comprehensive understanding of factors determining occupational following in these sectors. Such information is often available in national farm and fisheries registers and should be possible to match with the type of data used in this study. Obtaining such a rich dataset is on our future research agenda.

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Appendix 1

In this appendix we present the results from the probit model without the age restrictions imposed above. These restrictions were imposed to avoid including adult children who were working in their father's business in 1997, and therefore contributing to their father's income (reversed causality). However, when looking at the effects of other variables, such as, first child, gender etc. reversed causality is not a problem. It may therefore be interesting to examine the effects of such variables in the complete sample of children.

In Table A1 we present the results from the probit model for children (18 years and older) with a father in agriculture. The corresponding results for children of fishermen are presented in Table A2.

Table A1. Probit Regression Estimates and Marginal Effects. Children of farmers.

Variable	Parameter	Standard error	Marginal Effects
Intercept	0.528***	0.103	-
Child variables			
EDU	-0.140***	0.005	-0.029
EDUA	1.314***	0.021	0.403
FEMALE	-0.621***	0.019	-0.129
ONLY CH	0.329***	0.044	0.081
FIRST CH	0.106***	0.020	0.022
AGE CH	-0.018***	0.002	-0.004
Father variables			
FA MAR	0.055***	0.025	0.011
AGE FA	0.006***	0.002	0.001
FA SELF	0.068***	0.029	0.014
FA INC 1997	0.010***	0.001	0.002
Family variables			
BOTH PAR	0.185***	0.019	0.041
SIBLING	0.528***	0.019	0.127
Number of observations	37,008		

Table A2. Probit Regression Estimates and Marginal Effects. Children of fishers.

Variable	Parameter	Standard error	Marginal Effects
Intercept	-0.914**	0.362	-
Child variables			
EDU	-0.131***	0.018	-0.012
EDUF	0.769***	0.156	0.129
FEMALE	-1.241***	0.092	-0.126
ONLY CH	0.025	0.163	0.002
FIRST CH	0.034	0.078	0.003
AGE CH	-0.004	0.007	0.000
Father variables			
FA MAR	0.270***	0.093	0.023
AGE FA	0.013*	0.007	0.001
FA SELF	0.109	0.080	0.010
FA INC 1997	0.017***	0.004	0.002
Family variables			
BOTH PAR	0.365**	0.155	0.046
SIBLING	0.994***	0.078	0.165
Number of observations	3,733		