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Abstract

This study explored an apparently paradoxical finding in farming and fishing: low economic returns to farming and fishing, but a high rate of occupational transmission across generations of farmers and fishers. Using a sibling model containing 11,924 children of Swedish farmers and fishers in 2012, we estimated that farmers' sons who became farmers received 28 per cent lower income than same-sex siblings with a career outside farming. For farmers' daughters and fishers' sons, the income gap was about 22 per cent relative to same-sex siblings. Thus, the sibling approach confirmed that the returns to farming and fishing are low, and not caused by negative selection into these sectors. Our conclusion was that the decision to become a fisher or a farmer is largely determined by non-pecuniary factors.

JEL classification: J43, Q12, Q22

Key words: income penalty, agriculture, farming, fishing, intergenerational

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1. Introduction

Although income within farming and fishing is low (Gardner, 2000; Hill, 2000; EC, 2014), the children of farmers and fishers frequently follow their parents into these occupations (Blau and Duncan, 1967; Laband and Lentz 1983; Long and Ferrie, 2013; Blomquist et al., 2015). This is somewhat paradoxical, since other occupations with strong intergenerational ties, e.g. doctors and lawyers (Lentz and Laband 1990, 1989; Laband and Lentz, 1992), generally hold the attraction of being well paid.

However, estimating the return to farming and fishing for children taking over the occupation is difficult, because the decision to be a farmer or fisher is not random. For example, farmers' skills are assumed to explain the strong intergenerational links in farming (Laband and Lentz, 1983; Rosenzweig and Wopin, 1985); children of farmers adopt specific skills that are rewarded in that sector, but not elsewhere on the labour market. Similar arguments may apply to the children of fishers, but to our knowledge this has not been explored in the empirical literature. Consequently, farming or fishing skills influence both the decision to become a farmer or fisher and future income. If children with high farming or fishing skills choose farming or fishing, the income penalty (i.e. how much lower the income from farming/fishing is compared with alternative occupations) is smaller than if the average skilled child had chosen the occupation. Thus, it is not a good option to simply estimate the observed income difference between children who have followed in their parents' footsteps and children who have not. An alternative approach is to compare income of farmers with and without a farming background, as done by Laband and Lentz (1983). They found that farmers who take over the occupation from their fathers earn more than farmers without a farming background. However, they compared farm children and non-farm children, which revealed little about the return to farming compared with other occupations for farm children. To estimate the true return for these children, a different identification strategy is necessary.

In this study we This paper use an identification strategy that controls for inherited occupational skills - a sibling comparison framework - to estimate the returns to farming and fishing for farmers' and fishers' children. We use a rich dataset containing information on the entire farmer and fisher population in Sweden, their family ties (parent-child, siblings and spouses) and register labour market data (including level of education, farm and non-farm incomes). The sibling variation in the incidence of becoming a farmer or fisher identifies the return and the estimate should not be subjected to any bias due to unobservable family characteristics. By comparing the labour market returns of full-siblings raised in farmer or fisher families, we contribute with key findings on an important topic where knowledge is still scarce.

The sibling approach is commonly used in labour economics (e.g. Card, 1999; Griliches, 1979; Holmlund, 2005; Lindahl and Regnér, 2005), but to our knowledge it has not been used in the literature on agriculture and fishing or for estimating occupational returns in general. The approach is typically used for controlling for shared scholastic skills (Card, 1999),[1] but has not been used previously to control for farming or fishing skills.

Farming skills comprise two types of skills: farm-specific and farm-general (Rosenzweig and Wopin, 1985). Farm-specific skills include knowledge about weather conditions, soil, appropriate fertilisation etc. that is specific to the family farm. Farm-specific human capital is cited as being an important factor explaining why farm enterprises are passed on within the family (Laband and Lentz, 1983). On the other hand, farm-general skills create incentives for children to become farmers, whether by taking over the family farm or not (Rosenzweig and Wopin, 1985). There is no reason to assume that fisheries differ in this respect, although there is no literature on the topic. Examples of fisher-specific skills are

[1]Ability is the more common concept, but as ability is vague but closely related to scholastic skills, we prefer the term scholastic skills.

knowledge about local fishing grounds and gear choices for different seasons and weather conditions.

Besides farming and fishing skills, the children’s scholastic skills may also influence their decision to be a farmer or a fisher. Farm children with low scholastic skills may be more likely to choose the career path of the parents, whereas those with high scholastic skills may choose to commit to higher education and thus end up in more highly paid job in other parts of the economy. In this regard, Berlinschi, Swinnen and Van Herck (2014) found that education pushes farm children away from the agriculture sector, while Artz, Kimle and Orazem (2013) reported that graduates in agricultural science generally earn an higher income outside the agricultural sector than within.

The returns in agriculture and fisheries depend on government policy and management systems, but in fisheries the management system is particularly important. Swedish fisheries are part of the EU Common Fisheries Policy (CFP), which defines the regulatory framework but also delegates important issues such as access to national fish quotas to member states. The majority of Swedish fisheries can be described as regulated or restricted open access, as defined by Homans and Wilen (1997). This does not generate maximum economic returns from the fisheries. Homans and Wilen point out that most fisheries are regulated like this, and on a global scale the returns to fisheries can be expected to be lower than optimal (Worm et al., 2009; World Bank, 2009).

2. Data and descriptive statistics

The longitudinal database used in this study combines datasets from Statistics Sweden. It includes administrative data for the period 1997-2012; where the *Longitudinal Integration Database for Health Insurance and Labour Market Studies* (LISA) is linked with the *Multigenerational Register.* These data were complemented with the registry of commercial fishing licences provided by the Swedish Agency for Marine and Water Management. The LISA database includes a broad range of indicators on demographics, labour market outcomes and level of education for the entire Swedish population (16 years and older) living in Sweden. The sample used in this study comprised: i) individuals receiving their income from work or business classified according to its industry code[2] as having some involvement in agriculture or fishing, and ii) their children. To this population, we added all individuals holding a fishing licence in any year between 1997 and 2012 and their children.[3]

To estimate the returns to farming and fishing for children taking over the occupation from parents, we need to create a sample of farmers' and fishers' children. First, fathers working in the agriculture or fishery sector are identified.[4] We restrict the sample of fathers to individuals: i) obtaining their main income from farming between the years 1997 and 2000[5], ii) born between 1936 and 1972, and iii) who have children. By requiring that the main income derive from farming (for several years), we ensure that farmers with secondary involvement in farming are excluded. Farmers born before 1936 are excluded so that the sample members have not reached the legal retirement age of 65 by 2000. For the sample of fishers, all males holding a fishing licence and born before 1972 are included in the sample. Holding a commercial fishing licence guarantees that the fisher is active and receives the majority of his income from fisheries. Of the total number of male farmers and fishers, around

[2]The Swedish Standard Industrial Classification (SNI) code, which is identical to the classification of economic activities in the European Community (NACE).

[3]For some unclear reason, the industry code is missing for many fishers in the beginning of the sample. To overcome this, we use the information in the fishing licence registry on all fishers holding a licence in any year between 1997 and 2012.

[4]We observe that if the mother is a farmer or a fisher, the father is almost always also a farmer or a fisher. The farmer or fisher mothers without a farmer or fisher partner are too small a sample to analyse separately. Due to this, we restrict the sample of parents to those where at least the father is a farmer or a fisher.

[5]In intergenerational transmission studies, it is important that the parental variables are correctly measured. The recommendation is that parental variables are calculated using several yearly observations. Studies show that the intergeneration association in income is about three-fold higher when using several income years for parents compared with a single year (see e.g. Solon, 1999).

50 per cent (51.3%) have at least one child, according to the *Multigenerational Register*.[6] These 20,858 farmers and fishers have 53,338 children.

Next we turn to the sample of interest, i.e. the children of farmers and fishers. The aim is to estimate income equations, which implies that only working children are included in the sample. The long-term sick or unemployed are not included because of lack of information about their occupational investment decision. This decreases the sample to 41,091 children, of whom 36,920 are farmers' children and 4,176 fishers' children. Divided by gender, the sample comprised 21,220 sons and 19,925 daughters.

When estimating income equations, it is common practice to apply an age restriction, since income at an early age is a poor measure of lifetime income, meaning biased parameters.[7] We chose to restrict the sample of children to those aged 27 or older[8]. A very few fishers' children are above retirement age (>65 years) and therefore also excluded. Farmers' children are below retirement age in 2012 because we restricted the farmer father's year of birth to 1936 or later. Because the data includes annual income (and not wages, or working hours so that we could construct wages), we apply an income restriction. Applying a restriction instead of simply using positive income excluded short employment spells and part-time jobs with low pay. We chose a relatively low income barrier, SEK 50,000 (about $7,000), so that we do not exclude too many fishers (in a sensitivity analysis we test a higher income barrier). The income and age restrictions mean that we exclude 34 per cent of the 41,091 children (the percentage reductions below are calculated using the same base).

We also remove single children, half-siblings and children for which we lack sibling status, excluding a further 12 per cent. Finally, since we estimate same-sex sibling parameters, we have to have either two boys or two girls from the same family that cleared the age and

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[6] A small proportion (755) of these children are adopted. We remove these and include only biological children.

[7] See e.g. Böhlmark and Lindquist (2006), who showed that for young individuals current income is a poor proxy for lifetime income.

[8] The age restriction was included to reduce the risk of including children funding their higher education by working on the family farm.

income restrictions. This is demanding and reduces the sample by a further 25 per cent. Following all these restrictions, the sample of fishers' daughters where at least one sister is a fisher is too small to analyse in our sibling approach. The final sample of farmers' children and fishers' sons used in the sibling analysis is 11,924 in total.

The most important variable in the analysis is the income variable. In the EU-15 in 2012 (EC, 2014), hourly wages in agriculture is reported to be 57% of average hourly wages in the rest of the economy. However, to evaluate the income position of farmers', off-farm income has to be included (Hill 2000a, 2000b). Accordingly, we analyse combined farm (fishing) and off-farm (off-fishing) income. Moreover, the children's income in 2012 includes both income from work and business[9].

2.1 Descriptive statistics

A descriptive inspection of the data (Table 1) shows the share of farmers' and fishers' children working as farmers or fishers in 2012 for those with: i) some income and ii) their main income from farming or fishing, and separately for sons and daughters. The upper part of the table shows the proportion of the full sample of children aged 27 and older with income above SEK 50,000, and the lower part of the table the proportion of the sibling sample (i.e. the sample of full-siblings that included at least two same-sex siblings).

Table 1 shows that sons are considerably more likely to work as farmers than daughters. Around 22 to 27 per cent of sons are farmers, but only about 4 to 6 per cent of daughters. The lower figures are for those with their main income from farming, but the relatively small difference indicate that most children that are farmers receive their main income from farming. When comparing the full sample and the sibling sample, we find that the shares are almost identical, indicating that the sibling sample is not unrepresentative in this sense.

[9]Farm subsidies are included in farm revenues and therefore affect the income from businesses.

For fishers' sons, the proportion of the full sample choosing fishing is around 14 to 19 per cent. As with farmers, most fishers' sons that are fishers receive their main income from fishing. On the other hand, in the sibling sample, the proportion of fishers' sons who are also fishers are larger, around 23 to 29 per cent. This is because single children - who are removed from the sibling sample - are less likely to become fishers (the opposite is found for farmers). The reason for this is uncertain.

Table 1. Proportion (%) of Swedish farmers' and fishers' children choosing their father's occupation, for the full sample and the sibling sample, 2012.

	Farmers' children		Fishers' children	
	Sons	Daughters	Sons	Daughters
	Full sample			
Observations	12,690	11,445	1,536	1,378
Some income in father's occupation	26.2	5.9	19.1	1.0
Main income in father's occupation	22.2	3.7	14.5	0.4
	Sibling sample			
Observations	6,160	5,195	569	
Some income in father's occupation	26.9	6.3	29.2	
Main income in father's occupation	23.0	4.1	23.2	

Notes: The full sample constitutes all children of farmers and fishers aged 27 and older, and with income of SEK 50,000 or higher. The sibling sample constitutes full siblings with a same-sex sibling in the sample.

The characteristics of individuals in the full sample and the sibling sample (averages of variables) are shown in Table 2. The statistics are reported separately for children inheriting the father's occupation and children choosing another occupation. As in the following econometric analysis, we classify the children as farmers or fishers if *some* (and not only if their main) income is from the inherited occupation. In a sensitivity analysis, we elaborate on this in detail. By comparing the samples, we find that the sibling sample is not a selective group of children.

First, we conclude that the statistics show almost the same pattern for the full sample and the sibling sample, with somewhat higher income (around 2 per cent) in the full sample that could be explained by somewhat greater age of individuals in that sample. We find that farmers' sons and daughters have around 30 and 19 per cent lower income, respectively, than non-farmers. The sons who chose to become fishers have about 16 per cent lower income than sons working in another occupation.

Children inheriting the occupation of farmer or fisher have almost one year less education, but a large proportion of children choosing farming (54 per cent of sons and 31 per cent of daughters) invests in agricultural education.[10]

Table 2. Descriptive statistics on the full sample of farmers' and fishers' children, for the full sample and the sibling sample, 2012.

	Sons		Daughters		Sons	
	Non-farmer	Farmer	Non-farmer	Farmer	Non-fisher	Fisher
			Full sample			
Ln Income	12.76	12.46	12.43	12.24	12.75	12.59
Age	37.1	37.9	37.5	37.5	41.9	42.0
Years of schooling	12.8	11.9	13.6	12.8	12.0	11.1
Agricultural education (percent)	10	55	5	31	2	1
			Sibling sample			
Ln Income	12.73	12.44	12.42	12.24	12.72	12.54
Age	36.4	37.2	36.9	36.2	40.0	42.3
Years of schooling	12.7	11.9	13.6	12.9	12.0	11.1
Agricultural education (percent)	10	54	5	31	3	2

Notes: The full sample constitutes all children of farmers and fishers aged 27 and older, and with income of SEK 50,000 or higher. The sibling sample constitutes full siblings with a same-sex sibling in the sample.

5. Estimating the return to farming and fishing

5.1 Empirical strategy

Our main concern when estimating the farming and fishing income penalty is that the earnings potential of children who chose farming or fishing differ from that of children who chose another career path. For example, it may be the case that children with high academic skills systematically choose a career outside farming and fishing, while children with lower academic skills choose to follow their parents' footsteps. In this case, there is negative selection into farming and fishing that has to be dealt with in order to avoid biased estimates of the income penalty. Of course, there may also be positive selection if children with high farming and fishing skills choose to become farmers or fishers. The main benefit of the

[10] An agricultural education in defined as an education in agriculture, garden, forestry, and veterinary. The formal coding also includes fishery but since the education is about mainly fish preservation and conservation, and almost no fishers have this type of education, we do not see it as an education in fishery.

sibling fixed effect model used in this study is that it is able to deal with the selection problems described above. The basic empirical strategy is illustrated by the following equation for sibling *i* in family *j*:

$$lny_{ij} = \alpha + \delta_j + \beta F_{ij} + \theta \, Birth\ order_{ij} + \gamma X_{ij} + \varepsilon_{ij} \qquad (1)$$

where lny_{ij} is logarithmic income from employment and self-employment in 2012; α is the intercept; δ_j represents family fixed effects capturing family characteristics common to all siblings within the same family *j*; F_{ij} is a dummy variable indicating whether the child works as a farmer or a fisher in 2012; X_{ij}, is a vector of control variables and ε_{ij} is the error term. As such, the model removes skill differences between sibling pairs and estimates a within-sibling pair income penalty from farming and fishing.

Identification of β thus relies upon the sibling variation in the incidence of becoming a farmer or fisher, and β should not be subject to any bias due to the influence from unobservables captured in δ_j that are also associated with the outcome. Family background (including same neighbourhood, school and peers) and, on average, half of all genes are shared for full siblings (half siblings share, on average, 25 per cent of the genes and are therefore excluded). However, the model relies on the assumption that older and younger siblings have the same earnings potential. Because older siblings may be more likely to take over the family farm, and studies show that birth order has an impact on labour market outcomes (see for example Black et al., 2005), β may be biased due to birth order effects. Therefore we include a variable measuring the birth order of the child. Because families may raise boys and girls differently, and women may suffer from labour market discrimination, we estimated the model separately for same-sex siblings.

The sibling estimate can still suffer from a bias due to skill differences between siblings. However, we argue this bias is small because: i) we use only farming and fishing children with a family background in farming and fishing and ii) we control for educational differences within sibling pairs. In particular, the vector of control variables, $\boldsymbol{X_{ij}}$, includes age and age squared, years of schooling (which captures academic skills), farming education (dummy variable), civil status (captures skills important on the marriage market), and location of residence (controls for migration patterns). We find (see below) that these covariates have no impact on the estimated sibling income penalty and therefore concluded that the estimate is unbiased because: as education (which is generally the most important human capital determinant) has no impact on the income penalty, we perceive it to be unlikely that some other unobserved sibling difference would bias the estimate.

In a sibling fixed effect (FE) model, parameters are identified from the sample of sibling pairs where there is a difference in the independent variable. Consequently, if neither of the siblings, or both, choose to work as farmers or fishers, this sibling pair does not help to identify the income penalty parameter. However, such sibling pairs help estimate the covariates which give overall strength to the model. For 24 per cent of children in the sibling sample, the siblings have chosen different career paths.

To examine the importance of the sibling fixed effects, we compare the results with a model in which family fixed effects, δ_j, are excluded (cross-sectional model). This cross-sectional model uses both within-sibling variation and between-sibling pair variation to identify parameters.

Measurement errors are commonly assumed to bias estimates toward zero, and it has been argued that problems with measurement errors are exacerbated by using survey data in a sibling framework (see e.g. Griliches, 1979; Bound and Solon, 1999). If measurement errors are present, the sibling estimate is a lower bound of the true income penalty from farming and fishing. However, since we use register data, the measurement errors in the present case are small (Holmlund, 2005).

5.2 Results

Table 3 shows the sibling FE results and the cross-sectional results for each sample. We begin with the cross-sectional results, as columns (2), (4) and (6) show, the penalty for choosing the father's occupation is approximately -25, -14 and -17[11] per cent for farmers' sons, farmers' daughters and fishers' sons, respectively. In column (1), (3) and (5), where we add sibling FE, the income penalty increases to -28, -23, and -21. The main finding is that the income penalty is substantial, particularly for farmers' sons. The penalty is about 10 to 20 per cent higher for farmers' and fishers' sons in the sibling FE model (Table 3). The similarity between the estimates in the sibling FE model and the cross-sectional model indicates that potential selection problems only marginally bias the sons' income penalty for choosing their father's occupation.

For farmers' daughters the sibling income penalty is larger, about 60 per cent larger than the cross-sectional estimate (Table 3). This indicates that the cross-sectional model underestimates the farming penalty for daughters, and that there is some kind of positive selection into farming among daughters in the sample. In other words, because the income penalty is smaller when using the variation within *and* between sibling pairs, this indicates that daughters who chose farming have higher earnings potential in agriculture than the average farmer's daughter. Since the higher earnings potential is the same for siblings, this is captured by the family fixed effect in the sibling model. There is some logic to this, as daughters may be less expected to take over the family farm, but the daughters who actually do choose faming may have high farming skills (or other skills) and therefore a high return to farming. Sons may take over the farm to a higher extent because of family expectations.

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[11] The tables report estimates in log point. To receive the estimates in percentages we take 100×(exp(β)-1).

Table 3. Estimated income penalty from farming and fishing in a sibling fixed effect (FE) model and a cross-sectional model (OLS), 2012.

	Farmers' sons		Farmers' daughters		Fishers' sons	
	Sibling FE	Cross-sectional	Sibling FE	Cross-sectional	Sibling FE	Cross-sectional
	(1)	(2)	(3)	(4)	(5)	(6)
Farmer	-.254***	-.222***	-.209***	-.133***		
	(.0208)	(.0150)	(.0399)	(.0300)		
Fisher					-.193**	-.159***
					(.0907)	(.0521)
Age	.0701***	.0708***	.0241	.0362***	.0310	.0424**
	(.0153)	(.0099)	(.0192)	(.0123)	(.0455)	(.0212)
Age²	-.0007***	-.0008***	.0001	-.0001	-.0003	-.0005*
	(.0002)	(.0001)	(.0002)	(.0002)	(.0005)	(.0003)
Years of schooling	.0376***	.0471***	.0424***	.0507***	.0256	.0462***
	(.0050)	(.0031)	(.0055)	(.0036)	(.0180)	(.0120)
Years of schooling×Ag.	-.0038**	-.0039***	.0059**	.0003		
	(.0016)	(.0012)	(.0029)	(.0022)		
Married	.0290*	.0384***	-.0558***	-.0640***	.0497	.101**
	(.0152)	(.0115)	(.0196)	(.0136)	(.0567)	(.0437)
Sibling order	-.0009	-.0043	-.0163	-.0072	-.0087	-.0045
	(.0158)	(.0051)	(.0199)	(.0060)	(.0623)	(.0216)
Sibling FE	yes	no	yes	no	yes	no
Municipality FE	yes	yes	yes	yes	yes	yes
Observations	6,160	6,160	5,195	5,195	569	569
R-squared	0.216	0.220	0.185	0.205	0.248	0.333
Number of Fathers	2,755		2,339		249	

Notes: The dependent variable is logarithmic income work and business. Income is restricted to be above SEK 50,000. The samples include same-sex full siblings. Columns (1) to (4) include children of male farmers. Columns (5) and (6) include children of male fishers. Robust standard error in brackets. ***p<.01, **p<.05, *p<.1.

In general, the covariate estimates are as expected. Income increases with age at a diminishing rate; the return to education is positive but somewhat smaller than in other studies (see for example Nordin, 2008); and the marriage premium is positive for men, but negative for women (see for example Ginther and Sundström, 2010). More importantly, neither the farming nor the fishing income penalty change when control variables are removed, indicating that skill differences between same-sex siblings is not biasing the results. Notably, the return to years of agricultural schooling is lower than the general return to schooling for farmers' sons, but higher for farmers' daughters.

Sensitivity analysis

In the next step, sensitivity tests are performed. Children have been found to be more likely to adopt their father's occupation if the father's income is high (Blomquist et al., 2005). In the sibling FE model this mechanism is removed, because father's income is one part of siblings' common family background. However, to understand the direction of the bias in the cross-sectional income penalty, we add father's income to the cross-sectional model. The father's income is taken as the average income over four years, 1997 to 2000, and it included both farm and non-farm income from work and business (Table 4). Thus, this sensitivity analysis tests whether the size of the income penalty is related to the finding in Blomquist et al. (2015) that children are more likely to inherit their father's occupation if the family business is doing well economically. As columns (1) to (3) in Table 4 show, the father's income is positively related to farmers' children's income, but the income penalty is unaffected by adding father's income (compared with the cross-sectional estimates in Table 3). The conclusion is that the performance of the father's business is not determining the income penalty, as otherwise we would have expected the income penalty to be closer to that of the sibling FE estimate.

In a second sensitivity analysis we examine whether the large income penalty is partly caused by lower working hours, because if farmers and fishers work fewer hours the income difference between siblings may actually relate to employment differences rather than income differences. In columns (4) to (6) of Table 4, the income restriction is increased to SEK 100,000 (about $14,000) or above.[12] If working hours are driving our income penalties, we expect this restriction to decrease the income penalty. We find that the income penalty decreases by about 3 percentage points for farmers' sons and daughters and hence is only marginally caused by part-time work. The same conclusion is reached for fishers' sons.

[12] When estimating income equation in Swedish register data, Antelius and Björklund (2000) have shown that, when excluding observations below SEK 100,000, hourly wages can be replaced by annual income. Thus, with such a restriction differences in working time is generally not affecting the model.

Table 4. Results of sensitivity analysis on the income penalty from farming and fishing, 2012.

	Including father's inc. in the cross-sectional model			Income>100,000 SEK			For sample with main share from		
	Farmers' sons	Farmers' daughters	Fishers' sons	Farmers' sons	Farmers' daughters	Fishers' sons	Farmers' sons	Farmers' daughters	Fishers' sons
Farmer	-.227***	-.135***		-.222***	-.173***		-.291***	-.268***	
	(.0150)	(.0300)		(.0180)	(.0322)		(.0227)	(.0492)	
Fisher			-.159***			-.179***			-.234**
			(.0520)			(.0682)			(.117)
Father's income	.0419***	.0194**	.0106						
	(.0083)	(.0099)	(.0112)						
Age	.0702***	.0351***	.0403*	.0585***	.0107	.0539	.0632***	.0270	.0147
	(.0100)	(.0123)	(.0212)	(.0136)	(.0156)	(.0349)	(.0156)	(.0194)	(.0496)
Age^2	-.001***	-.0001	-.0004*	-.0006***	.0001	-.0005	-.0006***	.0001	-.0002
	(.0001)	(.0002)	(.0003)	(.0002)	(.0002)	(.0004)	(.0001)	(.0002)	(.0006)
Years of sch.	.0463***	.0505***	.0469***	.0366***	.0334***	.0234	.0375***	.0423***	.0264
	(.0031)	(.0036)	(.0121)	(.0043)	(.0045)	(.0154)	(.0053)	(.0056)	(.0195)
Years of sch.×Ag.	-.004***	.00028		-.0028**	.0050**		-.0025	.0056*	
	(.0012)	(.0022)		(.0014)	(.0025)		(.0017)	(.0030)	
Married	.0370***	-.064***	.0968**	.0246*	-.0538***	.0556	.0323**	-.0609***	.0795
	(.0115)	(.0136)	(.0441)	(.0135)	(.0159)	(.0503)	(.0158)	(.0199)	(.0647)
Sibling order	-.0055	-.0076	-.0093	-.00068	-.0069	-.0251	-.0041	-.0197	-.0002
	(.0050)	(.0060)	(.0227)	(.0137)	(.0163)	(.0470)	(.0161)	(.0199)	(.0657)
Sibling FE	no	no	no	yes	yes	yes	Yes	yes	yes
Municipality FE	yes	yes	yes	yes	yes	yes	Yes	yes	yes
Observations	6,160	5,195	569	6,002	4,826	553	5,921	5,080	535
R-squared	0.224	0.206	0.334	0.229	0.204	0.328	0.231	0.186	0.279
No. of fathers				2,749	2,323	248	2,741	2,328	245

Notes: The dependent variable is logarithmic income work and business. The samples include same-sex full siblings. FE = fixed effect. Robust standard errors in brackets. ***p<.01, **p<.05, *p<.1.

In the analysis above, children with some income from farming or fishing were classified as farmers or fishers. An alternative would be to classify children as farmers or fishers only if their main income derives from these sectors. This seems a sensible approach, because otherwise a low income share in farming or fishing might indicate that the individual has chosen another career path in the first instance and kept farming as a side-line. However, low engagement in farming or fishing may be caused by inability to make a living from such work and full-time farming or fishing might have been the preferred career choice if economically viable. For that reason, in the main analysis we opted not to restrict the sample based on the income share. However, in a sensitivity analysis to examine whether the low incomes in farming and fishing are partly compensated for by higher incomes from other sources, we restrict the sample to only those earning their main income from farming or fishing. As columns (7) to (9) in Table 4 show, this increased the income penalty by 15, 28 and 18 per cent for farmers' sons, farmers' daughters and fishers' sons, respectively (the penalty increases further when we consider the sample without off-farm and off-fishing incomes). Thus, these findings indicate that the pure returns from farming and fishing are even lower, but total income is augmented by income from other sources.

Summary and discussion

This study analysed whether a sibling who inherits their father's occupation in farming or fishing earns a different income from a sibling who chooses another career path. This was done by estimating the causal return to farming and fishing for 11,924 children of Swedish farmers and fishers in 2012.

The income penalty of choosing the father's occupation was found to be large. Farmers' sons received 28 per cent lower incomes than their same-sex sibling, while for farmers' daughters and fishers' sons the income gap was about 22 per cent to a same-sex sibling. Using a cross-sectional model without sibling fixed effects, gave lower penalty values. Thus, not controlling for shared skills between siblings resulted in underestimated income penalty, particularly for farming daughters.

In conclusion, the decision to inherit the father's occupation cannot be based on the returns to farming and fishing, and there must be other explanations for why children follow in their father's footsteps. However, taxed income may not tell the full story and informal income can represent a type of measurement error in the income variable. According to the Swedish tax authorities (2006), informal income in agriculture and fishing is high, implying that total income is underreported. Another explanation, also related to the informal economy, is that the living costs may be lower, e.g. farmers and fishers consume their own products and neighbouring farmers trade services with each other. Finally, preference formation across generations and social norms sanctioning mobility (Haagsma and Koning, 2005) favour occupational transmission between generations.

Overall, even if the decision to become a farmer or a fisher is presumably influenced by many factors, the substantial income penalty may reduce the inflow over time or make it selective. At some point, positive aspects will be unable to compensate for large penalties and low pay may change the workforce characteristics in agriculture and fishing. If entrepreneurial farmers and fishers with new ideas choose other career paths, these sectors may lose competitiveness. Further research is necessary to determine whether this is an ongoing problem.

References

Artz, G., Kimle, K., and P. Orazem. 2013. "Does the Jack of all trades hold the winning hand? Comparing the role of specialized versus general skills in the returns to an agricultural degree." *American Journal of Agricultural Economics* 96: 193–212.

Antelius, J., and A. Björklund. 2000. "How Reliable are Register Data for Studies of the Return to Schooling? An Examination of Swedish Data", *Scandinavian Journal of Educational Research* 44: 341–355.

Berlinschi, R., Swinnen, J., and K. Van Herck. 2014. "Trapped in Agriculture? Credit Constraints, Investments in Education and Agricultural Employment." *European Journal of Development Research* 26: 490–508.

Black, S., Devereux, P., and K. Salvanes. 2005. "The More the Merrier? The Effect of Family Size and Birth Order on Children's Education." *Quarterly Journal of Economics* 120: 669–700-

Blau, P., and O. Duncan. 1967. *The American Occupational Structure*. New York: Free Press.

Blomquist, J., Nordin, M. and S. Waldo. 2015. "Why Should I Follow? Exploring Occupational Inheritance in Agriculture and Fishing." Mimeo.

Bound, J., and G. Solon. 1999. "Double Trouble: On the Value of Twins-based Estimation of the Return to Schooling," *Economics of Education Review* 18: 169–182.

Böhlmark, A. and M. Lindquist. 2006. “'Life-Cycle Variations in the Association between Current and Lifetime Income: Replication and Extension for Sweden”, *Journal of Labor Economics* 24: 879–896.

Card, D. 1999. “The Causal Effect of Education on Earnings”. In O. Ashenfelter and D. Card, eds, *Handbook of Labor Economics*, *Volume 3*. Stanford: Elsevier, pp. 1801–1863.

European Commison (EC). 2014. “ CAP post 2013: Key Graphs & Figures, Graph 4, Evolution of agricultural income as a share of average income in the economy. DG Agriculture and Rural Development, Agricultural Policy Analysis and Perspectives Unit.

Gardner, B. 2000. “Economic Growth and Low Incomes in Agriculture.” *American Journal of Agricultural Economics* 82: 1059–1074.

Ginther, D., and M. Sundström. 2010. “Does marriage lead to specialization? An evaluation of Swedish trends in adult earnings before and after marriage.” Swedish Institute for Social Research (SOFI). Working paper 1/2010.

Griliches, Z. 1979) “Sibling Models and Data in Economics: Beginnings of a Survey,” *Journal of Political Economy* 87: 37–64.

Haagsma, R., and N. Koning. 2005. ”Endogenous norms and preferences and the farm income problem.” *European Review of Agricultural Economics* 32: 25–49.

Homans, F., and Wilen, J. 1997. A Model of Regulated Open Access Resource Use. Journal of Environmental Economics and Management 32:1-21.

Hill, B. 2000. “Agricultural incomes and the CAP.” Institute of Economic Affairs (IEA). Oxford: Blackwell Publishers.

Holmlund, H. 2005. “Estimating Long-Term Consequences of Teenage Childbearing: An Examination of the Siblings Approach.” *The Journal of Human Resources* 40: 716–743

Laband, D., and B. Lentz. 1983. “Occupational Inheritance in Agriculture.” *American Journal of Agricultural Economics* 65: 311–314.

Laband, D., and B. Lentz. 1992. “Self-Recruitment in the Legal Profession.” *Journal of Labor Economics* 10: 182–201.

Lentz, B., and D. Laband. 1989. “Why so many Children of Doctors become Doctors: Nepotism vs. Human Capital Transfers.” *Journal of Human Resources* 24: 396–413.

Lentz, B., and D. Laband. 1990. “Entrepreneurial Success and Occupational Inheritance among Proprietors.” *Canadian Journal of Economics* 23: 563–579.

Lindahl, L., and H. Regnér. 2005. “College Choice and Subsequent Earnings: Results Using Swedish Sibling Data.” *The Scandinavian Journal of Economics* 107: 437–457.

Long, J., and J. Ferrie. 2013. "Intergenerational Occupational Mobility in Great Britain and the United States Since 1850." *American Economic Review* 103: 1109–1137.

Nordin, M. 2008. "Ability and Rates of Return to Schooling - making use of the Swedish Enlistment Battery Test." *Journal of Population Economics*, vol 21: 703–718.

Rosenzweig, M., and K. Wopin. 1985. "Specific Experience, Household Structure, and Intergenerational Transfers: Farm Family Land and Labor Arrangements in Developing Countries." *Quarterly Journal of Economics* 100: 961–987.

Solon G. 1999. "Intergenerational Mobility in the Labor Market". In O. Ashenfelter and D. Card, eds, *Handbook of Labor Economics*, *Volume 3*, Stanford: Elsevier, pp. 1761–1800.

Swedish tax authorities. 2006. Svartköp och svartjobb i Sverige (Informal incomes in Sweden). Rapport 2006:4.

World Bank. 2009. *The Sunken Billions - The Economic Justification for Fisheries Reform*. Washington DC.

Worm, B., Hilborn, R., Baum, J., Bransh, T., Collie, J., et al. 2009. "Rebuilding Global Fisheries." *Science* 31 July 2009:325(5940). DOI:10.1126/science.1173146.