DISSOLUTION OF EXTENDED-FAMILY HOUSEHOLDS IN NORTHERN ORKNEY, SCOTLAND, 1851-1901

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Background

It is widely regarded as one of the most important findings in European historical demography that, in northwest European populations of the early-modern to modern period, extended households were very rare. As Peter Laslett (1984:90-91) famously put it,

> [It is commonly held] that our ancestors lived in large familial units. Family groups, it seems to be almost universally agreed, ordinarily consisted in the pre-industrial past of grandparents, children, married as well as unmarried, grandchildren and often relatives, all sleeping together in the same house, eating together and working together.... [If so,] households would have had to be bigger than our households are, and more complicated in their inner relationships as well: extended families is the phrase which is almost always used.
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> Now all these statements have been demonstrated to be false.... It is not true that most of our ancestors lived in extended families.

This may well be true as a loose empirical generalization, but may also need to be modified as new information becomes available. For example, in our historical demographic research in the northern islands of Orkney, Scotland, from 1851 to 1901, we have encountered numerous cases of what we call *hidden* household extension – “hidden” in the sense that the documentary evidence does not explicitly identify the household as extended but ancillary information (in this case, from historical archaeological remains and cadastral or OSGB maps) does.

A particular case will serve as illustration. On the island of Westray, there once existed a croft of 1.8 hectares called South Hammer (abandoned in the 1980s and absorbed into a neighboring farm). According to the 1901 UK census, the inhabitants of South Hammer were as listed in Table 1. If that record were the only source of information available, would we code South Hammer as a single extended family or as three more or less independent nuclear-family households? Since a "head" is listed for each of the three units, we might be inclined to call them separate households, especially if we have in mind Laslett's dictum about extended families being anomalous in this part of the world. Archaeological investigation and detailed mapping, however, suggest we would be wrong. Our survey of the physical remains of South Hammer show that the three domiciles were either very close or attached; more importantly, it shows that the entire complex had but one barn, byre, stackyard, kailyard, and muckyard, the minimal structures needed for a *single* farming unit. Moreover, the 1901 OSGB map shows that the same structures existed contemporaneously with the inhabitants in Table 1. Whatever else they may do, crofters are farmers on their own holdings and everyone living at the croft helps with the farming if physically able. Therefore, South Hammer should be regarded as one extended household whose members pool resources as a single farming unit.[1]

By this criterion, household extension is, in accord with Laslett (, not common in north Orkney but nor is it terribly *rare*, and its frequency varies extensively across islands and periods (Table 2). Why the high frequency of extension compared to the rest of NW Europe? And, if household extension is advantageous under some circumstances, why is it not even *more* common? Some recent ideas from Gene Hammel (2005) may provide a way to think about these questions. Building upon models of the economics of the household life cycle originally

[1] Genealogical linkages reveal that the three "heads" in Table 1 are all full siblings who grew up at South Hammer when a single nuclear-family household lived there.

developed by Chayanov (1923), Hammel suggests that household extension may dampen unfavorable fluctuations in household consumer/producer (C/P) ratios by combining nuclear-family units at differing phases of their life cycle. Preliminary analyses suggest that this idea works in the Orkney example. But in theory there is an important limit to the process that was ignored by Hammel: as households become more extended, they also, generally speaking, become larger. In rural Orkney, allotments of arable and pasture are fixed (at least over a time scale of a few decades) and cannot be expanded as the household grows. We hypothesize, therefore, that household size should be an important predictor of the dissolution of extended households, at least when controlled for size of holding (both its main effect and in interaction with HH size).

In most cases we do not have holding size for the farmsteads in Orkney. We do, however, have rents for all holdings, taken from valuation rolls held in the Orkney Archives in Kirkwall. We also have cadastral maps that provide size of holding in acres for certain estates, and these can be used to validate the rents as proxy measures for size of holding. It turns out that rents are almost entirely a reflection of the sizes of holdings ($r^2 = 0.98$).[2] We therefore believe that rents are valid proxies for landholding size.

[2] More specifically we regressed rent on amount of arable and pasture (both in acres) and on the interaction between arable and pasture. The regression coefficients were all highly significant and, as noted, the fit was excellent. We also did analyses that combined data from different estates and included main effects and interactions of lairds (landholders) – to test the idea that different lairds were translating acreage into rent using different scales; none of these laird effects was significant. As a result we believe we can combine rents from different estates without introducing bias.

Methods

Households were observed at each decennial census from 1851-1901. Information about household composition and extended status is only known from census data so that the event of interest, extended household dissolution, is interval censored. Because of this interval censoring, a discrete-time logit hazard model was used to predict the dissolution of extended households. In the sample, drawn from the island of Faray and a portion of the island of Westray, 87 extended households were observed. For the purposes of this study, extended households are characterized by the presence of a married or formerly married household member who is not the head or head's spouse. Households with more than one head listed in the census, such as in the case of South Hammer, are also categorized as extended (see Table 3). Nuclear households were not at risk of dissolution, and were therefore not included in these analyses. The estimated hazard function of the breakup of extended households increases over the five census intervals (see Figure 1). A larger sample, which will be available once record linkage is complete, will give a clearer estimate of the temporal trend in the hazard function. At this time, we speculate that the increasing risk of extended household dissolution over time may be attributable to depopulation over the study period or changing economic conditions.

We ran several models of the effect of household size on the breakdown of extended households into nuclear families with controls for the effects of time, in the form of census intervals, and other covariates. Household size was modeled as a time-varying covariate with no lags, such that the relevant household size for a given dissolution event was that immediately prior to the event. Births and deaths that occurred in the census interval were also modeled as time-varying covariates. While the exact dates of the births and deaths are known from vital records, it was necessary to sum them over the census interval to make them consistent with the intervals in which the outcome variable is observed. Land values were modeled as a time-constant covariate. Although records of land values were recorded for every year in the study period, the size and quality of landholdings remain very consistent over time, so value changes can be primarily attributed to inflation. Modeling land value as a time-varying covariate would therefore capture inflation effects rather than changes in relative land value. We therefore consider a single measure of land value sufficient for this particular set of research questions. Consumer-producer ratios were computed for each household at each census interval using the weighting system outlined by Hammel (see Table 4). This weighting system was chosen because it included earlier productive contributions of children than was proposed by Chayanov. We have reason to believe that children in 19^{th} century Orkney began assisting on the farm, albeit in limited capacities, at young ages.

Results and Discussion

The results of the discrete time hazard model are given in Table 5. We present both the main effects (Model 1) and the interactions between main effects (Model 2). In both models, household size remains significant at the p=.02 level or better. C-p ratio and deaths in the interval are no longer significant once controls for the interaction effects of household size with the other covariates are included. The interaction terms, however, do not improve model fit, as both the likelihood-ratio test ($\chi^2_{(4)}=1.59$, $p=0.81$) and the Bayesian Information Criterion indicate no improvement in fit relative to the number of parameters added.

Surprisingly, the estimated coefficients of household size in both models were significant and *negative*, suggesting that large households are *less* likely to split than small households, even controlling for access to land. This result is so utterly counter-intuitive that we are convinced there is some unidentified confounding problem involving variables not included either in Hammel's model or our extension of that model. It may be that these findings are sensitive to the specific type of household extension present. For instance, if extension occurs because of vertical kin links, such as those among generations, this result is more sensible. Imagine an extended household consisting of a married couple, their children, and the household head's widowed mother. It is likely that these types of "vertically extended" households are smaller than "horizontally extended" households, such as South Hammer. These smaller households may also be more unstable than larger households, as the death of the member that provides the intergenerational link would cause the household to revert immediately to the nuclear form. In contrast, horizontally extended households are likely to be larger and have more linking members, so that dissolutions are more likely to occur because of intra-household conflicts or pressure related to limited landholdings rather than through the death of a sole linking member. Unfortunately, our current sample size will not support distinctions between these two types of extended households, but once the sample is increased through progress in data linkage, it may be possible to test this idea.

In the main effects model, the coefficient of c-p ratio was positive, indicating that as the c-p ratio increases, or becomes more economically unfavorable, the more likely an extended household is to break apart. However, this finding does not persist in the interaction model, as the sign of the coefficient changes. This finding is interesting and worthy of further investigation. If extended households are, in general, economically advantageous to nuclear households, why are extended households with unfavorable c-p ratios more likely to split up? It may be that individuals in struggling households may leave to seek work or other economic opportunities outside of the household, thereby contributing to the risk of the household returning to a nuclear form. However, household size may be a mitigating factor in this process, as the interaction of c-p ratio and household size approaches significance (p=.17). Larger sample sizes may better illuminate the effects of household composition as measured by c-p ratios, both alone and in combination with household size, on the risk of extended household dissolution.

The estimated coefficients for births and deaths in the inter-census interval were positive in both models. However, once interactions with household size are included, these terms are no longer significant (or in the case of births, nearly significant). It is somewhat counter-intuitive that as both the number of births and deaths in the household increase, the likelihood of dissolution increases. It may be the case that decisions about living arrangements are often made during times of change in household composition, through either birth, death, or a combination of both. The effect of deaths may also be related to the death of linking household member, as discussed above.

The small estimated coefficients and lack of significance of land value was surprising. We expected that access to land would function as a limiting factor in the number of people a farmstead could support. However, it does appear that land value affects the role of household size in predicting the risk of extended household dissolution. Given this finding, we need to consider the potential effects of other economic activities, such as secondary occupations and other sources of income. Indeed, often two occupations are given in the census for household head and other males, such as farmer and fisherman. These multiple occupation listings may prove to be one way to address this issue of economic activities external to the operation of the family farmstead.

Future Directions

Further insight into formation and dissolution of extended households can be gained by considering the short-term costs as well as the long-term benefits of extension. Hammel (2005) demonstrates that in the long-term, extended households exhibit dampened c-p ratios relative to nuclear households. Extended households are thereby less subject to the economic pressure caused by cyclic changes in household composition because their component nuclear-family units do not experience Chayanovian cycles in lock step. However, the group benefit gained by cooperation comes at the expense of the portion of the household that would have a more favorable c-p ratio if it were living independently. This short-term cost to some household members could create intra-household conflict and contribute to the break up of the extended kin-group. Indeed, it is likely that in any extended household, individuals or segments of the household may have conflicting economic and personal interests. In the example of an extended household formed by the cooperation of a pair of linking siblings and their associated nuclear families, these conflicts may fall along kin lines, such that the spouses of the siblings are likely to favor their own children over those to which they are unrelated when distributing food and other resources. Thus, the degree of relatedness of household members may be an important predictor of household dissolution that could be explored in future work. In addition, in the case of horizontally extended households, some measure of the degree of relative costs and benefits to each component unit may also be predictive of household fissioning. However, the exact method by which such a variable could be constructed remains unclear to us at this time.

References

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Hammel EA (2005) Chayanov revisited: A model for the economics of complex kin units. *Proceedings of the National Academy of Sciences* 102:7043-46.

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Table 1 Inhabitants of the croft of South Hammer, Westray, 1901 (from 1901 UK national census)

Name	Relation to head	Marital status	Sex	Age (years)	Occupation
1. Stewart Patersonhead		m	♂	64	farmer
1. Mary Paterson	wife	m	♀	58	
1. Robert Paterson	son	s	♂	24	assisting on farm
2. William Paterson	head	m	♂	63	fisherman, blacksmith
2. Isabella Paterson	wife	m	♀	56	
2. Robert Paterson	son	s	♂	29	fisherman
3. Janet Rendall	head	w	♀	51	housekeeper
3. William Rendall	son	s	♂	27	ploughman at Tirlot[1]
3. John Rendall	son	s	♂	17	ploughman at Tirlot
3. Charles Rendall	son	s	♂	13	scholar[2]
3. Jessie Rendall	dau	s	♀	11	scholar

[1] The home fields of the large estate that owned South Hammer
[2] I.e. student at the local grammar school

Table 2 Frequency (percentage) extended households, northern Orkney 1851-1901 (from UK national censuses 1951-1901, Murtha archaeological survey)

Island	Ave. no. HHs ea. year	1851	1861	1871	1881	1891	1901
Eday	176	3.2	5.9	7.3	6.6	6.3	5.3
N. Ronaldsay	92	7.9	5.2	8.0	6.6	4.5	3.4
Papay	77	4.8	8.5	5.1	6.3	2.9	3.0
Faray	13	7.1	5.9	16.7	38.5	22.2	12.5
Sanday	419	5.5	4.6	5.5	4.0	3.6	2.8
Westray	461	4.6	4.4	4.7	6.6	4.0	3.9

Data sources: 1851-1901 UK national censuses, Murtha archaeological survey

Table 3 Count and percentage of extended households in the study sample

Year	Total Households	Total Extended	Percent Extended
1851	82	39	0.476
1861	90	53	0.589
1871	101	51	0.505
1881	105	56	0.533
1891	104	47	0.452
1901	104	38	0.365

Figure 1 Observed hazard of extended household dissolution, 1851-1901 (95% confidence intervals)

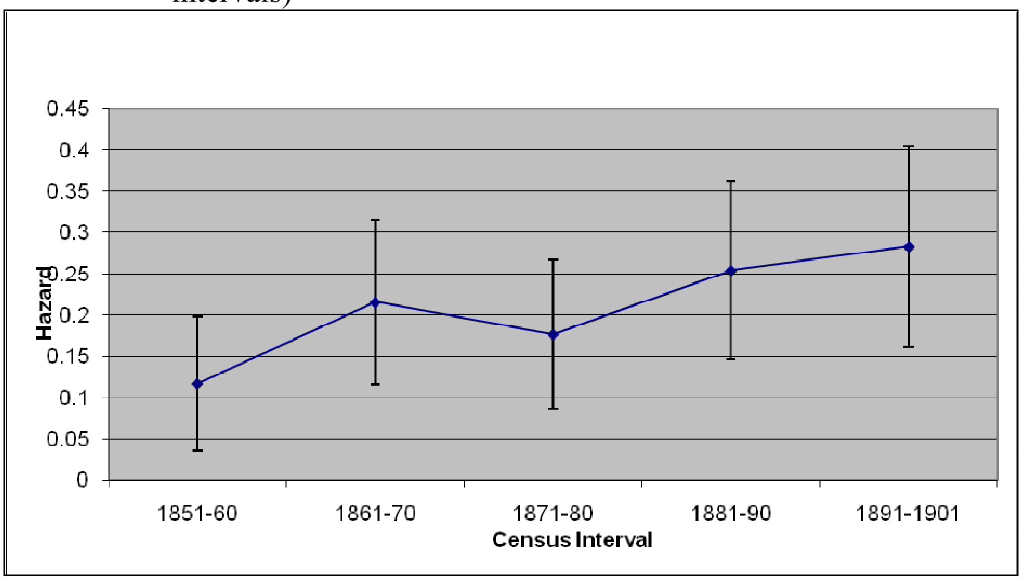

Table 4 Weights for computing consumer-producer ratios (after Hammel 2005)

Production				Consumption			
Male		Female		Male		Female	
Age	Units	Age	Units	Age	Units	Age	Units
5	0	5	0	2	0.1	2	0.1
7	0.1	6	0.2	5	0.3	5	0.3
9	0.2	10	0.5	9	0.5	6	0.5
12	0.5	15	0.7	12	0.7	10	0.7
15	0.9	20	0.7	15	0.8	12	0.8
50	1.0	60	0.8	50	1.0	60	0.8
100	0.8	100	0.7	100	0.8	100	0.7

Table 5 Estimates of covariate effects on the dissolution of extended families (*n*=87), discrete-time logit hazard model, Rapness, Cleaton, and Skelwick, Westray, and the island of Faray, northern Orkney 1851-1901*

	Main Effects Model	Interaction Model	Coef.	Std. Err.	Odds Ratio	*p*- value
	Household size		-0.801781	0.1087969	0.448529421	>.001
	Consumer-producer ratio		0.3237561	0.1268264	1.382310121	0.011
	Deaths in intercensal period		0.3423452	0.1378352	1.40824634	0.013
	Births in intercensal period		0.217354	0.1276132	1.24278397	0.089
	Land value		0.0011303	0.0277091	1.001130939	0.967
	1851-1860 Interval		-0.2152902	1.270644	0.806307416	0.865
	1861-1870 Interval		-0.3855017	1.219192	0.68010934	0.752
	1871-1880 Interval		-0.5047633	1.235485	0.603648442	0.683
	1881-1890 Interval		-0.1101575	1.247827	0.895693053	0.93
	1891-1901 Interval		-0.0224616	1.211204	0.977788784	0.985
		Household size	-1.610133	0.6343756	0.199861031	0.011
		Consumer-producer ratio	-0.0643395	0.4340878	0.937686601	0.882
		Deaths in intercensal period	0.2447942	0.3565742	1.277358406	0.492
		Births in intercensal period	0.3669085	0.4295043	1.443265854	0.393
		Land value	0.0427841	0.0830705	1.043712533	0.607
		Household size x land value	-0.0056512	0.0104004	0.994364738	0.587
		Household size x c-p ratio	0.8056253	0.5932836	2.238095543	0.174
		Household size x deaths	0.0219382	0.0461143	1.022180612	0.634
		Household size x births	-0.0310057	0.0566668	0.969470047	0.584
		1851-1860 Interval	3.523975	4.330898	33.91898883	0.416
		1861-1870 Interval	3.320156	4.299879	27.66466591	0.44
		1871-1880 Interval	3.265022	4.329295	26.18068696	0.451
		1881-1890 Interval	3.630468	4.387651	37.73047035	0.408
		1891-1901 Interval	3.729213	4.363468	41.64631961	0.393
Log-Likelihood	-105.5976	-104.80331				
BIC	268.1325	289.3189				

*Standard errors adjusted for multiple observations by clustering over household identifiers