Landholding and the Demand for Children in Rural Nepal

by
Melanie Frost
University of Southampton

1.1 Introduction

The notion that fertility decisions may be related to arable landholdings (that is land suitable for cultivation) in agricultural areas of the developing world is long established and intuitively appealing given the centrality of landholding to rural life. However, there is widespread disagreement about the importance of this link and even its existence. Very little has been done to rectify the situation in recent years.

It is postulated that the lack of consensus is due to the methods used in previous attempts to solve this problem and evidence for this is provided by the literature review within this paper. Put simply, there is no conclusive evidence on either side of the argument. This paper seeks to redress the gap using evidence gathered from Nepali survey data. Through use of survival analysis and panel data the method used avoids the majority of problems that beset earlier attempts.

The results confirm that there is a relationship between landholding and fertility and given the methodology used this is strong support for the hypothesised causality. This is also support for the more general notion that fertility decisions are, on average, made rationally.

1.2 Hypotheses

There are two major separable dimensions to land – the ownership of land and the amount of land available to cultivate. It is hypothesised that the relationship between landholding and fertility operates via separate causal pathways for these two

dimensions: one of these relates to fertility as insurance while the other is concerned with the use of children to help cultivate land.

1.2.1 The land-security hypothesis

The first hypothesis (referred to as the land-security hypothesis from now on) is linked heavily to the idea of children as an informal insurance good and is concerned with owned land. It might be economically rational to have a large number of children in an environment of harsh risk, even if intergenerational transfers do not flow from child to parent, since children provide insurance. In other words in the event that parents cannot purchase any formal insurance they can produce their own through their offspring. In many developing world countries old-age and widowhood are likely to bring poverty due to a lack of necessary institutional arrangements (pensions, credit/savings markets, social security etc.). There are also a variety of other sources of risk including natural disaster Children can provide for elderly parents when there are no sensible alternative mechanisms for providing old-age security and, indeed, "in the absence of institutions that provide various kinds of insurance and permit the reallocation through savings of resources to old age, children may…be the best deal around, although the extent to which such assets as land or livestock fulfil the same functions in agricultural society is unclear" (Lee 2000, p. 47). Whilst Caldwell (2005) argues optimistically that "There is a near consensus on the premodern insurance value of children. Childless parents… faced almost insurmountable problems in converting surpluses from their young adulthood into support for their old age. Financial institutions evolved relatively recently and most ignore the poor and illiterate" (p.735).

This idea is mainly attributed to Mead Cain (1981,1985) though he was not its original instigator; he was, however, its most enthusiastic proponent during the 1980s and 1990s.

The land-security hypothesis holds that landownership is also able to provide security in old age or in the case of other "events that threaten normal consumption streams" (Cain 1981, p.435) and that if a couple owns a sufficient amount of land then they will not need the insurance provided by having many children. Or, rather than a threshold effect it may simply be that children and landholding may be used as straightforward substitutes for one another when being used as a form of insurance. This hypothesis does not, however, suggest that fertility rates can be reduced by simply arranging agricultural land-ownership in such a way as to make everyone more secure; it is an individual level hypothesis – a point which is often neglected. There are also many institutional factors which need to be considered before allowing that the hypothesis might be viable in any specific setting.

First there must be a non-natural fertility regime i.e. fertility must be a conscious decision on some level. It may be the case that conscious decisions are not made at every parity; parents may have two children before they begin making conscious decisions about contraception and future childbearing. At some level, though, fertility must be within the realm of conscious choice.

Second, it must be possible to gain security from land-ownership. By that I mean that it must be possible to make money through rentals, sharecropping or other arrangements – otherwise, it must be possible to live securely off your own land possibly with the use of labour that is hired in. Therefore it is important to understand the institutional arrangements surrounding the market for agricultural land before blithely accepting that a correlation might indicate genuine causation.

Third, the possibility of other mechanisms explaining any correlation between size of landholdings and fertility needs to be discounted. For example Cain (1986b) argues that the relationship can be explained away by "systematic differences in fecundability stemming from different periods of spouse separation" (p.316). However, it should also be noted that this refers to an analysis of rural Bangladesh when it was still experiencing a natural fertility regime. Cain's argument is that such explanations could easily hold true in areas where a non-natural fertility regime exists. So, while the actual analysis of Bangladesh is irrelevant to our hypotheses, there is the possibility that there are alternative causal paths leading to a correlation between landholding and fertility.

1.2.2 The land-labour demand hypothesis

The second hypothesis (referred to as the land-labour hypothesis from now on, though the longer phrase is generally used in the literature) is concerned with the idea that a larger area of land available to be cultivated by a family will lead to higher fertility since children are the cheapest and securest (and sometime the only) form of additional labour available to them. Families with access to larger agricultural holdings are, it is hypothesised, are able to use additional family labour more profitably. It is also possible when we are considering very small landholdings that women may be forced to find work away from the family farm if that farm is below a certain size and thus an increase in farm size would allow the woman to stay at home and thus decrease the cost of child rearing. This hypothesis is not confined to owned land, but relates to any and all land that a household is likely to be able to use for purposes of cultivation over a sustainable amount of time.

However, there are complications: the state of the labour market, the produce market and the land market will all have intermediary effects on the effect of arable

landholdings on childbearing decisions. As the labour market improves the advantages of family labour will diminish, while if the produce market is good then the profitability of employing extra labour will increase meaning a greater return to family labour. The land market also needs to be relatively stable and fixed otherwise it would be more logical for land to adjust to family size.

The possibility that landholding may adjust to family size is known as the reverse causation hypothesis and its plausibility depends greatly on the country context and the precise nature of the market for land. It seems reasonably implausible in a country where the majority of land is acquired as inheritance.

The relevance of this hypothesis is also restricted to areas where the agricultural process is not highly mechanised since in this situation the marginal returns to labour will diminish fast with increasing farm size. Also, of course, if increasing farm size were associated with increasing use of labour-saving machinery and opportunities to use non-family labour then the marginal productivity of children would again decrease with increases in farm size. In both instances it would no longer be expected that agricultural landholdings would bear a positive relationship with childbearing.

1.2.3 Complications and the Pure Income Effect

Clearly the two hypotheses already discussed work in opposite directions; the land-labour hypothesis states that fertility and land are complements while the land-security hypothesis states that they are substitutes. The other fundamental difference (which is crucial in order for us to be able to test these hypotheses) is that they refer to different types of landholding; the land-security hypothesis relates to land that is owned whilst the land-labour hypothesis relates to all forms of arable land available to a family that is operational (including any communal land). The challenge is to

disaggregate these two effects and to test them separately; this is a challenge which is yet to be met successfully even though in theory (and hopefully in reality) it is more than practicable.

The relationship is further complicated by the possibility that any association may actually reflect a pure income effect. The meaning of "pure income effect" in this context is the change in the demand for children directly attributable to a change in income. Lee & Bulatao (1983) suggested that this was the most likely reason for the positive relationship, which was observed in 11 of 13 studies reviewed by Mueller & Short (1983, pp.618-19). In most of these 13 studies the measure of fertility is children ever born (CEB) while the landholding variable was simply the total amount of land owned (though this was sometimes restricted to operational landholding). Lee & Bulatao argue that "this positive association may indicate that the pure income effect on the demand for children is strong enough…so that the net effect…is positive [and] because in these settings there are fewer opportunities for investing in child quality" (p.267).[1] This possibility makes it important to control both for income and the level of investment in child quality and the failure of most studies to do both (or indeed either) is one of the reasons why these hypotheses remain both contentious and neglected.

The matter is further complicated by the fact that motives cannot be directly observed; unfortunately, since it is the intensity of these childbearing motivations that are of interest it is necessary to devise some way of establishing them from the data available. Nugent (1985) argues that the solution to this problem is to "proceed indirectly by identifying a priori circumstances that could be expected to influence the intensity of the motive… one would have to observe fertility behaviour in

[1] By "these settings" the authors meant the developing world.

circumstances differing in the intensity of the old-age [and labour] motive while holding other factors as constant as possible" (p.75-76). It is with this in mind that this paper proceeds to look at the relevant literature and ultimately consider how to construct a model that will test both hypotheses.

1.3 Literature Review

Early papers purporting to prove a relationship attempt this proof using very simple techniques. Tuladhar et al. (1982) simply present the difference in family size by farm size in Nepal, controlling only for age of woman. The study tells us virtually nothing about the landholding-fertility relationship, although fertility is higher for those women whose husbands have the largest category of landholding. A similar technique was earlier used by Hawley (1955) for data from the Philippines, although he also controls for women's education and the positive relationship between operational landholdings and fertility is much clearer. Hawley (1955) also presents data illustrating that farm tenants generally have smaller families than farm owners (p.24), which could be taken as support, albeit tentative, for the land-security hypothesis. Farm tenants were also found to have larger families than farm labourers indicating support for the land-labour hypothesis. However, the only control used is the age of the wife and moreover this study is based on data from 1952 - long before the beginnings of a fertility transition - it is not sensible to use this study in support of any hypotheses where deliberate fertility control is a necessity.

A more fundamental problem with the techniques employed in both papers is that the relationship illustrated could simply be between income and fertility. Unless income is controlled for separately then there is no evidence to support this correlation reflecting anything other than a pure income effect.

Another technique used was to study the relationship between population density and fertility as Firebaugh (1982) did in a study of 22 farm villages in India. He took the Crude Birth Rate (CBR) as the dependant variable in a regression which controlled for literacy and Caste as well as population density. He found that "population density had an inhibiting effect on fertility" (p.481). Density could be related to the land-labour hypothesis because in areas with a higher population density there is less probability that extra child labour will yield returns. It is a tentative link though; furthermore, despite Firebaugh's enthusiasm concerning his results the predicted effect of density upon the CBR was actually found to be rather small (an increase in density of 11.2% was associated with a decrease in the CBR of 2.7%). Furthermore the CBR is a problematic dependant variable since it is misleading for comparison between populations in the event of differences in composition; indeed, it was only used due to the aggregated nature of the data. The use of aggregated data is extremely problematic of itself: "it is not justifiable to draw conclusions at the individual level from data collected at a more aggregated level" (Thomas 1991, p.387). The point is that conclusions cannot be inferred about the hypotheses on the basis of this type of analysis; the hypotheses concern individual level decisions while the data provides information at a group level.

Further evidence comes from Good et.al. (1980) who found that those who did not own land desired more children (3.14 as opposed to 3.51 – p.317). The difference, of less than half a child is too small to draw any conclusions. Controls were in place for a variety of social status measures, but ultimately the evidence is flimsy.

Schutjer et. al. (1983) used data from Egypt and also Thailand (see Cain 1985, p.7) and ran a regression analysis with children ever born as the dependant variable

and farm size, land ownership and some basic controls (income, education and age) as the independent variables. They found that the effect of the variable for land ownership was negative and statistically significant at the 5% level. The variable for land ownership used was, however, problematic since they used the ratio of cultivated land to owned land. This does not test directly for the land-security hypothesis since it is the amount of land owned that is important. Stokes et. al. (1986) explain their use of this variable by arguing that "the amount of land owned would be expected to bear a positive, not negative, relationship to fertility, consistent with the land-labour demand hypothesis" (p.308). However, data allowing, it would be possible and preferable to use variables for the amount of land owned and the amount of land operated separately; this seems like a more sensible solution than that proposed by Schutjer et. al. (1983) and Stokes et. al. (1986).

Cain (1985) argues that even were the research to be redone with the use of more sensible variables then it would not be tenable to support the land-security hypothesis since land is not a good substitute for children; his arguments are that land must be managed in order to give returns, that children provide other benefits and that land is an insecure investment. However, a variety of research has argued that children are also an insecure investment and that parents are fully aware of this (Vlassoff & Vlassoff 1980, Vlassoff 1990 and Subedi 2006). The argument that children provide other benefits cannot be discounted, but it was never suggested that landholding could be a complete substitute for childbearing, merely that decreased security from lack of landholdings would increase desire for children (particularly sons).

The possibility of reverse causation has also been mooted as an objection: In a country where land markets are relatively flexible (at least in comparison to the

commitments entailed with having children) it is possible that people adapt the size of their landholdings (rented or owned) to fit with the size of family that they presently have. The question is whether the absence of credit and savings opportunities and a well defined, regulated property market would prevent any causal relationship from existing in this form. A large amount of land may increase a couples' need for farm labour, but it could also be the case that having a large number of children increases a couples' desire for landholdings. Furthermore, this relationship could easily be reciprocal.

Clay et al. (1992) attempted to test, among other things, which direction the causation might work using data from Rwanda. They used a two-stage-least-squares regression with farm size and family size as the two endogenous variables and eight other relevant exogenous variables. They found that farm size had a strong positive effect on fertility, whilst the reverse was not true. Interestingly this paper also found that farm size failed to have an effect on desired number of children and the authors argued that the mechanism explaining the strong correlation they found between farm size and fertility was on the supply side (though they failed to explain precisely how this might work). Clay et al. further attempted to look at the different relationship between land rented and land owned on fertility, and report that their results are suggestive of a difference but are nonetheless inconclusive. This paper goes further than previous ones and the results of the two-stage-least-squares regression indicates that farm size affects fertility and not vice versa. The main problem with these findings is that the contraceptive prevalence rate in Rwanda was just 2% at the time of the research, which is why the authors favoured a supply side explanation. Again, while the findings are interesting, they tell us nothing about *conscious* fertility decisions.

The evidence surveyed thus far is consistent with the hypothesis that any correlation between landholding and fertility reflects a pure income effect. Mueller & Short (1983) claimed that "in rural areas, land is a good proxy for permanent income [and] the land effect is more consistently positive than the income effect" (p.630). They do, however, accept that this land-fertility relationship wherein a "striking consistency was found" (p.267, Lee & Bulatao, 1983) could easily reflect mechanisms other than the income effect and they call for more research to be done in this area. The relationship was still under fierce debate up until the early 1990s when Cleland (1993) stated that the "evidence is inconclusive" and thereafter showed no further interest in the topic. This attitude has persisted amongst a great deal of demographers ever since. While Thomas (1991) agrees that "the statistical evidence in support of the two land-fertility hypotheses, based on *14* sets of data, is inadequate" (p.389) this does *not* lead him to conclude that this line of research should be ceased, but rather that any new attempts should look very carefully at where previous research went wrong.

Vlassoff & Vlassoff (1980) attempted to look at the land-security hypothesis through extended interviews in an Indian village. In this study respondents were asked if they ever reflected upon what would happen to them during old age: the authors argue that their results disparage any idea of an old-age security motive since more than half of the respondents claim not to have thought about their own old-age. However this belies the fact that 44% of all respondents said that they *were* worried about old-age security. What is more - they say that "thoughts about senescence were more prevalent in older age groups and among the economically disadvantaged" (p.491), which is precisely what would be expected if the land-security hypothesis were correct. It is particularly important that worries about old-age support are most

apparent amongst those with a lower income. They were found to be particularly concerned about whether their sons would support them and be obedient: "Optimism concerning security in old age was linked as closely to landholding as to the presence of sons." (Vlassoff & Vlassoff 1980, p.498). Again, this seems to be evidence *for* the land-security hypothesis, though the authors themselves meant, by this, to belittle the old-age security motive for fertility.

One of the most major failings of this study was the decision to interview men alone. If (and this is a big if) their study indicates that men do not consider old-age security as a fertility motive then this certainly does not mean that their wives feel the same. Women are much more susceptible to the problems of old age and are more likely to have to rely on sons for a longer period of time than their husbands. Indeed Datta & Nugent (1984) view the Vlassoff & Vlassoff paper as "merely serv[ing] to indicate that the motive could be expected to be more important for women than for men" (p.509). This is a point which is partly accepted by Vlassoff (1984) since it is admitted that the study has nothing to say on the motivations or position of women. Indeed Vlassoff (1990) concentrates a study of old-age security motives in rural India exclusively on widows for precisely these reasons. She found that those widows living alone had, on average, the most money per day (8.16Rs per day compared with 5.75Rs for those living with married sons). Those widows who lived alone mainly supported themselves and were predominantly childless due to the fact that their husbands had died when they were very young (and in some cases before the marriage had been consummated). In this situation "there was no question of the widow remarrying" (p.16). Thus this group is rendered irrelevant to the question of fertility motives since the majority did not have the option of bearing children. While it is true, as Vlassoff (1990) points out, that "this finding does not bear out the contention

that those supported by sons in old age are better off financially than those without male offspring" (p.17) it still does not have any bearing on fertility motivations. Women who were put in a position that prevented them from having a family of their own would have to find other means of supporting themselves and the fact that they managed this successfully does not mean that they would not have preferred the more traditional route of bearing sons had this been an option for them. A further major failing is that barely any widows in the study could actually be described as elderly. Vlassoff (1990) also claims that the old-age security motivation was improbable in this specific setting because the widows in their study claimed that they had not controlled their own fertility voluntarily; if this is the case then the whole study becomes essentially irrelevant for this discussion since it is looking for causal relationships in a place where theory does not predict any.

Vlassoff (1984) argues that an old-age security motive will only exist if the level of fertility is "low enough to imply on average begetting only one son." The precise level of fertility this refers to will depend on infant and child mortality but it is likely to imply a TFR greater than 2.1 and lower than 3.0. Furthermore it will only be observable among families yet to have a son. This seems very restrictive, but the point that the effect may only have any substantive effect for specific parities is a salient one and one to which we shall return. This further reinforces the fact that the studies by Vlassoff & Vlassoff (1980) and Vlassoff (1990) might have been asking the right questions but not in the right places. Their failure to find the relevant relationships is therefore, for want of a better word, unsurprising; as Cain (1991) points out: "Vlassoff must sharpen her focus: concentrate on widows aged 60 and older: possible confounding factors need to be controlled" (p.521). Vlassoff (1991) counters that she never claimed to have found that economic considerations were

irrelevant but "rather that the value of sons transcends economic considerations" (p.530); it seems to me that these two things amount to much the same thing. She further states that "Cain's reservations about fertility motivations are well taken" (p.533) thereby admitting that her research was fundamentally flawed with respect to the land-security or land-security hypotheses.

Recent attempts to look at the relationship between landholding and fertility have been, for the main part, wasted opportunities. Ghimire & Hoelter (2007) looked at the relationship between first birth timing and land use in an area of South-Central Nepal (the Chitwan Valley). The first problem with their method is the use of first birth timing, which is not a sensible dependant variable because in Nepal marriage is virtually universal (although the age at marriage is increasing (Karki & Krishna 2008)) and once a couple is married they will be expected to bear children with very little delay. The gap between marriage and first birth will depend, almost exclusively, on biological and social mechanisms that lack any deliberate consideration on the part of the couple involved. A couple is unlikely to exercise deliberate control over their fertility until they have already had at least 2 children; the mean ideal family size in Nepal was reported as 2.7 in the 2001 Demographic and Health Survey (Ministry of Health (MOH) 2002) and 2.4 in the 2006 Demographic and Health Survey (MOH 2007). On the basis of the hypotheses landholding is not expected to affect first birth timing. It would therefore be substantially more effective to look at the transition from second to third and third to fourth birth in this kind of setting (which is precisely what is don in this paper).

A further problem with Ghimire & Hoelter's paper was that they simply took the proportion of land used for agriculture and public infrastructure in each neighbourhood and looked at the relationship between these variables and fertility;

this would be unlikely to illustrate the real relationship between landholding and fertility even if a sensible measure of fertility used. The proportion of agricultural land in a community does not, of itself, have any theoretical relationship to the level of security a family is likely to feel nor does it have any particular bearing on the value of child labour. The authors found the proportion of agricultural land did, in fact, have a significant effect on first birth timing, but in the absence of any sensible theory it is unclear what this result means. The authors argue that "higher proportions of agricultural land should motivate young women for early childbearing through higher returns to child labour" (p.314) since "opportunities for child employment are not limited to household operational landholding but also apply to the local community" (p.293). While it is true that in Nepal the opportunities to gain useful work from children are not limited to an individual family's land in Nepal due to the existence of communal land, it has been argued that rich families are far more able to take advantage of any such communal resources (Macfarlane 2003, p.46). In other words, land ownership is likely to be a good proxy for the utility a family can gain from any communal land and it would be unwise to surmise that all families have equal opportunities to take advantage of the commons.

An anthropological study of another area in Nepal (Lamjung in the Western Hills) by Subedi (2006) found that, "parents intend to depend on children and that there is a sense of moral obligation for adult children to take care of their parents in old age" (p.75). This study looks at pensions as an alternative means of old-age support as well as landholding. Unfortunately, the comparison is made between those who depend on land alone and those who also have an income of some form (i.e. a pension). No difference was found between these two groups, but then the hypotheses would not necessarily predict one. No effort is made to distinguish

between the quantity or type of landholding or the level of support provided by the other income, which is a major failing. Subedi comes to the conclusion that "social security benefits played no role in fertility transition" (p.76) but nonetheless he is convinced that old-age security is a pervasive motive for childbearing. The question raised by this article is whether the individuals involved would consider any means of old-age security provision other than children as sufficient in order to limit fertility; to answer this question it would be necessary to compare those with some means of old-age security other than children and those with *no* means.

Nothing in Subedi's study disproves the hypotheses, whilst the setting described is one in which children are seen as a source of old-age security, contraception is used and it appears that people are aware of their own childbearing decisions; furthermore, there are no "traditional extrafamilial welfare institutions…[and] no profitable and reliable means of accumulating financial assets" (p.74). Therefore, this is the perfect setting to look for evidence of the land-security hypothesis.

The landholding-fertility relationship has long been neglected in mainstream demography, despite the fact that there is a dearth of proper evidence on the topic. Admittedly, trying to separate the land-labour and land-security hypotheses is not easy, but previous attempts have failed for reasons that are rectifiable. The hypotheses have often been tested in settings where a natural fertility regime persists and while a correlation has been found in these settings, such a correlation is not pertinent to the testing of the hypotheses.

In order to establish whether these hypotheses hold it is first necessary to test the relationship between different types of landholding and fertility; this needs to be done with *all* the relevant controls in place and in a setting exhibiting the kind of

fertility regime where the hypotheses would be expected to hold according to the theory. If the hypotheses are supported by data in the right setting then it would be necessary to establish, through fieldwork, if the mechanism causing the relationship is actually the hypothesised one or if there are other factors at work. There is no reason why we should not ultimately find answers through this course of action and it is perplexing that so few people have tried in recent years.

The proceeding analysis is viewed as a contribution towards the first step that has been suggested.

1.4 Data and the Nepali Setting

The analysis in this paper is based on data from the 1996 Nepal Living Standards Survey (NLSS I) and the 2004 Nepal Living Standards Survey (NLSS II), both of which follow the methodology of the World Bank's Living Standards Measurement Surveys (LSMSs).

The primary analysis uses the NLSS II wherein a two stage stratified sampling scheme was used and a total of 3912 households were enumerated from 326 Primary Sampling Units (PSUs). The PSUs were spread throughout the majority of Nepal (see figure 4.1 below) and provide a nationally representative sample with the exception of the far-western development region where an insurgency (since resolved) prevented 96 households from being enumerated.

The analysis is based exclusively on the rural sample from the NLSS due to the fact that the two hypotheses being tested are not relevant to a city setting such as Kathmandu, Bhaktapur or Banepa (all in the Kathmandu Valley, where the majority of the urban sample was taken from – as can be seen from figure 1).

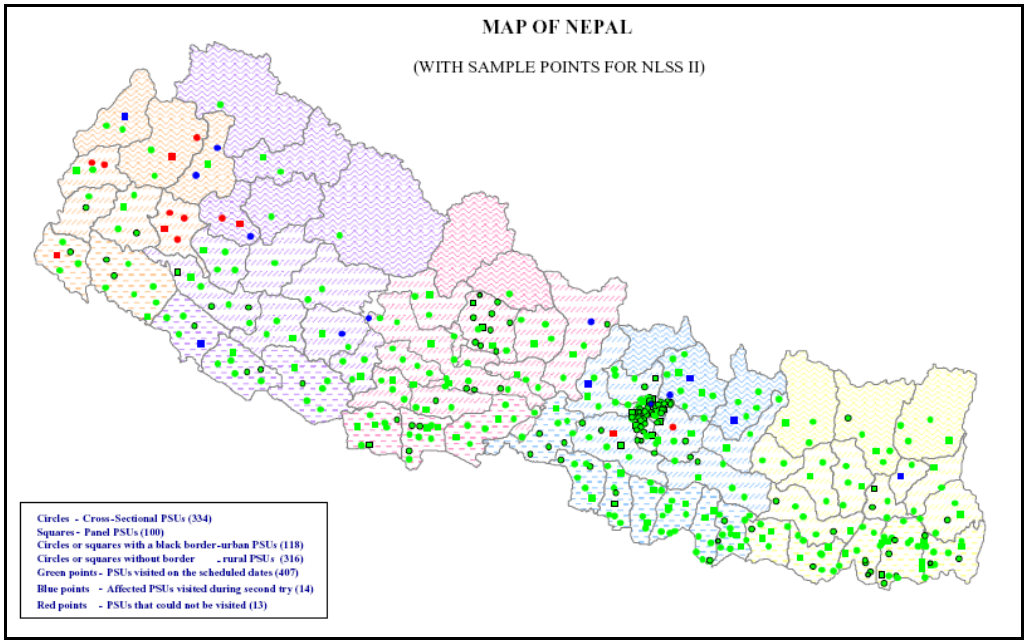

Figure 1 Map of Nepal with Sample Points for NLSS II

The small amount of panel data available was also used. 1,232 who were initially interviewed for the NLSS I were also interviewed for the NLSS II. The sample size for the panel is, thus, substantially smaller than that of the cross sectional sample. Nonetheless, the panel is a highly useful tool for considering the plausibility of a causal relationship. It allows us to analyse the stability of household landholdings and household income over time and the relationship between these variables and subsequent childbearing. The comparison of analyses from the panel and cross-sectional samples allows us to edge closer to proving the causal relationship we are searching for.

Nepal has been chosen as the basis for analysis since it is one of a small number of countries where recent LSMS surveys have been carried out and full birth histories are available for the women surveyed. The LSMS data is essential because there is extensive information on land ownership, land occupancy and income in addition to the demographic information that is required.

The research done by Subedi (2006), which was discussed in the previous section, indicates that people in modern day, rural Nepal would be expected to be

affected by security motives and labour motives for childbearing. Ghimire & Hoelter (2007) have provided some of the only recent evidence for the landholding-fertility hypotheses and the fact that this research is from Nepal makes the setting even more relevant.

Nepal is a small landlocked country bordered by China's Tibetan Autonomous Region (TAR) to the North and India on all other sides. The population size is more than 29 million, the Total Fertility Rate (TFR) was estimated to be 3.1 by the 2006 Demographic and Health Survey (DHS), the Contraceptive Prevalence Rate (CPR) was estimated to be 48% and 40% of the population is aged 0-14. Nepal is a diverse country with three distinct ecological zones running east to west along the length of the country. These consist of the Terai (or plains) which are a hot and humid region in the south of Nepal, the Hills and the Mountains that are at such a high altitude that subsistence agriculture is often not viable. At least 103 ethnic groups co-exist with only 49% of the population speaking Nepali as its mother tongue. For this reason it is clear that the data provide sufficient variety in the intensity of motivations in order to stringently test the hypotheses (as stipulated by Nugent 1985).

The analysis was restricted to rural households enumerated in the NLSS II. This is because the hypotheses are only applicable to agricultural areas. Moreover, at least 80% of the Nepali population gather their main income through agriculture and this figure is not declining at any great speed.

1.5 Method

This paper uses survival analysis to study the transition of couples from second order children to third order and from third order to fourth order. The reason for concentrating on this part of the fertility schedule is that these are the parities at which economic factors are expected to impact on contraceptive decisions in Nepal.

There is little room for economic factors to operate at lower parities, as most couples desire to have at least two children; on the other hand, a substantial proportion of couples who have four or more children are not using contraception even though they express a desire not to have further births (Dahal, et al., 2008). If landholding does have an impact on fertility then this is where that effect should be apparent.

The next issue we must address is how we expect the hypotheses to impact upon individual fertility decisions among couples in various different circumstances.

For any individual couple the two land-fertility hypotheses may result in either harmonious or competing childbearing motivations. A relatively wealthy couple who have a lot of land available to them to cultivate, but who do not own that land should theoretically desire more children on the basis of the land-security hypothesis and the land-labour hypothesis. Those who cultivate large amounts of land and also own that land will have competing motives according to the hypotheses since the land-security hypothesis suggests that they will desire fewer children while the land-labour hypothesis suggests that they will desire more children. Landless families will also have competing aims since they will desire the security of more children, but will not be able to make use of the extra labour that a large number of children provide; the landless are also likely to be constrained by their income in terms of the number of children they can actually afford.

It is, however, possible to disaggregate the effects of the land-labour and land-security hypotheses in situations where couples have competing motivations by controlling for the sex composition of previous children. Those couples who desire children for security reasons should exhibit a strong sex preference since daughters are rarely able to provide security; the difference between couples with two sons and two daughters as their first borne should be marked. Son preference is expected to be

most marked amongst landless couples since those who occupy land they do not own will still desire children of both sexes to assist in cultivation of land and general labouring. A landless couples main motivation for childbearing is expected to be security on the basis of the hypotheses; landless couples have little use for daughters.

Couples whose fertility decisions are dominated by the labour motivation should not exhibit such a marked sex preference since females can provide as much labour as their male counterparts in childhood. Even allowing for some son preference built into the fabric of Nepali culture it should be possible to see a distinction here.

It is still necessary to account for the possibility that any land-fertility relationship merely reflects a wealth or income effect. It is also necessary to account for the fact that a wealth/income effect may confound the results, even if the land hypotheses are true. By the wealth/income effect we mean that wealthier couples are able to afford more children and therefore a positive relationship between size of landholdings and fertility may reflect this rather than be evidence in support of the land-labour hypothesis. The best solution to this problem is to control for income sources available to the household since the NLSS includes this data. Furthermore, since those owning land tend to be wealthier than those who simply occupy land and the land-security hypothesis tells us that such people should desire fewer children, then a negative relationship between land ownership and fertility is strong evidence for the land-security hypothesis. A possible counter argument to this is that those who own large amounts of land and have fewer children have simply invested in quality over quantity. While we can (and will) control for this through consumption and education this does not sufficiently solve the problem, since child quality is an elusive concept and extremely difficult to quantify. Education and consumption

indicate the general level of investment that a couple is likely to wish to bestow upon their children and thus they roughly indicate preferences for child quality. Child quality will also partly be determined by sex in rural Nepal since in general only sons are able to provide old age security; daughters leave their parent's household when they get married and provide no economic benefit to their parents from then on. Furthermore, dowries are common amongst most Nepali groups.

It may be more useful to use the amount of land owned and the amount of land cultivated as continuous variables rather than simply comparing those who own land, those who occupy land and those who are landless since this should allow us to see the effects of security and labour motivations separately. The theory predicts that increasing amounts of land owned should be associated with decreasing ideal family size and decreasing son preference. It also predicts that increasing amounts of land available to be cultivated should be associated with an increasing ideal family size. In the event that some people own land they do not cultivate and some people cultivate land they do not own then I would expect the effect of land ownership on fertility to be negative and the effect of land occupancy to be positive. If this is not the case then the hypotheses need to be questioned.

A further complication comes from the existence of communal land. Communal land provides more opportunities for the useful employment of children and therefore it has implications for the land-labour hypothesis. There are two ways of dealing with the problem: either area can be controlled for or a variable for the amount of communal land available can be included. It would undoubtedly be interesting to see if communal land availability has an effect on childbearing

decisions, but the NLSS does not include full information on such land.[2] This has the potential to confound the results. However, it is likely to be the case that those who already have large amounts of land have the resources to make use of communal land better than those who are landless or rely on sharecropping. It could therefore be the case that the existence of communal land actually makes the land-labour and land-security hypotheses clearer.

1.6 The Model

A Cox proportional hazards model is used to study the transition from second birth to third conception and third birth to fourth conception; the reason for this approach is discussed above (see section 1.5).

The parameters of interest that are included within this model are listed below where the expected sign of the coefficient is also discussed. Controls will also be included for ethnicity, region, age of mother and cohort of mother in order to avoid the results reflecting these other relationships.

Amount of land owned: This variable is expected to have a negative coefficient on the basis of the land-security hypothesis.

Amount of arable land cultivated: This variable is expected to have a positive coefficient on the basis of the land-labour hypothesis.

Couple has at least one surviving son: This variable will be coded 1 if the couple has at least one surviving son and 0 otherwise. This coefficient will tell us the degree of son preference; it tells us the likelihood of having another child in the event that the woman already had a living son at the point of conception of the next child compared to a woman with no living sons at that point. It is expected that the coefficient will be negative and highly significant since strong son preference is

[2] See Biddlecom et al. (2005) for one attempt to look at possible links between communal land and fertility in Nepal.

widely acknowledged to be a very important factor in childbearing decisions in Nepal (see, for example, Stash 2004).

Interaction between land owned and a surviving son: The coefficient for this variable will tell us how son preference varies with land ownership. Son preference is expected to be less marked with increased land ownership but due to cultural factors it is likely to exist still. Therefore this coefficient is expected to be positive, which would indicate less son preference as landholding increases.

Household income: The inclusion of this variable is intended to remove the possibility that associations between fertility and landholding might reflect a pure income effect. In theory greater income allows a family to have more children since their budget constraint is relaxed. However, this depends on whether a family concentrates resources on the quantity or quality of children they desire. In a setting such as rural Nepal we would expect the effect of household income to be positive.

Mother's education: Child quality is partially controlled for by use of mother's education. This is a very crude control for child quality, but the nature of the data means that the use of children's education would be too heavily censored to be of any use. Child quality is of itself unobservable but education is generally thought to be a good proxy and the mother's education is highly correlated with their children's education. It is expected that increasing levels of education will be associated with decreasing fertility.

Household Consumption: Consumption is included as a further control for child quality – it includes food consumption and non-food expenditures (see Central Bureau of Statistics (CBS) 2004b, pp.22-26 and CBS 1996, pp.8-14 for further details). Of course consumption is a crude measure of child quality (much like the mother's educational level) and is likely to be measuring preferences as well in as

much as higher consumption implies a preferences for consumer goods that will likely lead to a partial substitution away from children. Therefore higher consumption is expected to be associated with lower fertility.

Household Size: It is necessary to control for household size since household size will mediate the affect of landholding and income on fertility. A high household income may simply reflect the large size of that household; the income will also need to be divided between more people meaning that the income of the couple making their fertility decisions will be less than the absolute figure would suggest. This is also the case with landholding. A large area of land either owned or cultivated will be considered by the individual couple to be of less import if that land is split between a very large household. Of course the composition of the household will make a significant difference to the precise nature of the intermediary effect that household size will have. If the household is large due to elderly incumbents the nature of fertility decisions will be different from a household where the additional people are another couple (perhaps the brother of the household head and his wife – though this is uncommon in Nepal) or if those additional people are in fact mainly children (in which case the variable is of course partly endogenous).

1.7 Stability of Landholdings

Using the panel data it is possible to study the stability of landholding over time; in particular it is possible to see the extent to which landholding changed over the eight year period from 1996 to 2004.

1.7.1 Owned Landholding

Land was categorised into 4 groups: landless, small landholding (<0.5 Ha), medium landholding (0.5-1.5 Ha) and large landholding (>1.5 Ha). Of the 962 households with data available for both surveys 63% did not change landholding

category, while 16% moved to a larger landholding category and 21% moved to a smaller landholding category (table 1). Of those that moved category 86% moved to one of the adjacent categories. Of those households with medium or large landholdings in 1996 3% were landless by 2004 and of those households with any land in 1996 7.7% were landless in 2004. Becoming landless is therefore quite a rare event, especially for those households with more than 0.5 hectares of arable land. That said a fifth of households had lost some land between 1996 and 2004. Nonetheless landholding in the earlier time period was highly correlated with landholding in the later time period.

Holdings in 1996 \ Holdings in 2004	LL	S	M	L	
LL	154	24	7	2	187
S	45	212	74	11	342
M	13	71	166	34	284
L	2	16	59	72	149
	214	323	306	119	604

LL = Landless; S = 0.01-0.5 Ha; M = 0.5-1.5 Ha; L = 1.5+ Ha

Table 1 Stability of Household Landholding between the NLSS I and NLSS II

In terms of individual plots 2174 plots were held in both 1996 and 2004, while 751 were acquired after 1996 and 875 were lost after 1996. This raises the question as to who is losing land and who is gaining. The Lorenz curves for 1996 and 2004 are shown below (in figure 2). The 2004 Lorenz curve dominates the 1996 Lorenz curve indicating that the distribution of arable landholding may have decreased slightly. The Gini coefficient for 1996 was 0.70, while in 2004 it was 0.68. On this basis there was a slight decrease in the inequality of arable landholdings, but it was very slight

and during the 8 year period between the two rounds of the NLSS the overall distribution altered very little.

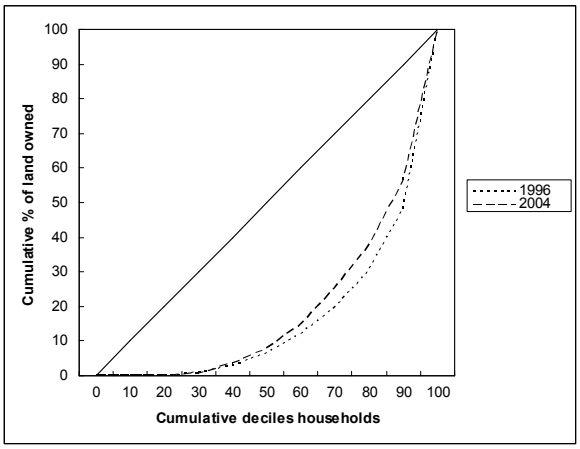

Figure 2 Lorenz curves in 1996 and 2004 for distribution of arable land owned by households in the NLSS panel sample

Another important point to note is that the majority of land was acquired through inheritance. 88.9% of all the plots surveyed in the NLSS I were inherited. The NLSS II did not ask how land was acquired by the household, but in the panel sample 66.1% of the plots were inherited prior to 1996 (when the NLSS I was carried out), 8.3% were not inherited and 25.7% were unclassified since they were acquired after 1996. It is clear from this that the vast majority of landholding is passed down through familial connections and thus a couple is likely to have a very good idea concerning the total size of their future landholdings quite early on allowing decisions to be made on that basis.

1.7.2 Arable Landholding Cultivated Within the Household

For the sake of consistency the Lorenz curves for land cultivated within the household were also calculated (figure 3). The Gini coefficient was 0.70 for the NLSS I and 0.67 for the NLSS II. The only real difference in the distribution of cultivated land to owned land was that fewer households are landless on this definition.

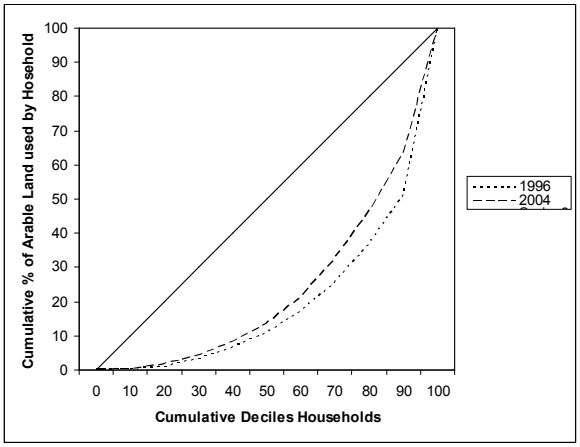

Figure 3 Lorenz cures to show the distribution of arable land cultivated by households in the NLSS panel sample

The majority of households without any owned land do, nonetheless rent in or sharecrop in some land to provide them with crops to consume and sell. Those households with no arable land are in a poor situation indeed since the purchase of food is expensive and wages extremely low.

1.8 Results

1.8.1 Cross-Sectional Analysis

The results of the survival analysis for the cross-sectional NLSS II data are presented below (in table 2) where the final Cox proportional hazards models selected are presented in full.

Table 2 Cox proportional hazards model for the transition from second birth to conception of the third child and the transition from third birth to conception of the fourth child

	Second birth to third conception[3]							Third birth to fourth conception[3]						
Variable	Coeff	St.Er.	z	p>|z|	95% CIE		Haz. ratio	Coeff	St.Er.	z	p>|z|	95% CIE		Haz. ratio
Land Owned (Ha.)	-0.150	0.054	-2.76	0.006	-0.257	-0.044	0.861	-0.239	0.066	-3.61	0.000	-0.369	-0.110	0.787
Land Cultivated (Ha.)	0.174	0.056	3.13	0.002	0.065	0.283	1.190	0.272	0.066	4.11	0.000	0.142	0.402	1.313
Land Owned, but Cultivated by Others (Ha.)	0.206	0.069	3.01	0.003	0.072	0.341	1.229	0.269	0.089	3.04	0.002	0.095	0.443	1.309
Living Son	-0.374	0.050	-7.44	0.000	-0.472	-0.275	0.688	-0.648	0.071	-9.15	0.000	-0.787	-0.509	0.523
Age at birth of 2nd or 3rd child	-0.045	0.006	-7.26	0.000	-0.057	-0.033	0.956	-0.055	0.007	-7.47	0.000	-0.070	-0.041	0.946
Education of Mother														
Ref category: None														
Primary/ Lower Secondary	0.057	0.072	0.78	0.435	-0.085	0.198	1.059	-0.225	0.101	-2.24	0.025	-0.423	-0.028	0.799
Secondary	-0.434	0.173	-2.52	0.012	-0.773	-0.096	0.648	-0.871	0.298	-2.92	0.003	-1.455	-0.287	0.419
Upper Secondary/ Tertiary	-0.727	0.198	-3.66	0.000	-1.115	-0.338	0.483	-1.181	0.418	-2.82	0.005	-2.001	-0.361	0.307
Low Income Household[4]	-0.397	0.102	-3.90	0.000	-0.596	-0.198	0.672	-0.268	0.141	-1.91	0.056	-0.543	0.007	0.765
Birth Date	-.0002	0.001	-0.21	0.833	-0.002	0.002	1.000	-0.004	0.002	-2.53	0.011	-0.007	-0.001	0.996
Birth Date * ln(Time)	-0.001	0.000	-2.11	0.035	-0.001	-0.000	0.999	0.000	0.001	0.56	0.572	-0.001	0.001	1.000
Household Size * ln(Time)	0.014	0.003	5.34	0.000	0.009	0.020	1.014	0.023	0.004	6.32	0.000	0.016	0.030	1.023

[3] These models were stratified by consumption quintile since this variable violated the proportional hazards assumption but was deemed to be important to include in the model.

[4] Low income households are those in the lowest octile of income.

In light of the hypotheses the two most important covariates are those for the total area of land owned by the household and the total area of arable land cultivated by the household. In both models the coefficients for these covariates work in the same direction, are of a similar magnitude and are highly significant.

The coefficient for area of land owned is -0.150 ($p=0.006$) for the first model and -0.239 ($p<0.001$) for the second model. This equates to a hazard ratio of 0.861 in the first model and 0.787 in the second model, which means that for every extra hectare of land owned the hazard rate of a third conception decreases by 13.9% and the hazard rate of a fourth conception decreases by 21.3%. This supports the land-security hypothesis since an increase in land ownership is related to a decrease in the propensity of women of parities two and three to have another child even when so many other factors have been controlled for.

The coefficient for arable land cultivated within the household is 0.174 ($p=0.002$) for the first model and 0.272 ($p<0.001$) for the second model, which is equivalent to a hazard ratio of 1.19 for the first survey and 1.31 for the second model indicating that for every extra hectare of land the household has available to cultivate the hazard rate of a third conception increases by 19% and the hazard rate of a fourth conception increases by 31%. This is strong support for the land-labour hypothesis.

The third landholding variable included was for land owned but cultivated by others through various arrangements (sharecropping, renting out etc.). The effect of this type of land on childbearing is strongly positive with an extra hectare accounting for an increase in the hazard of a third child of 22.9% ($p=0.003$) and 30.9%($p=0.002$) for the fourth child. This along with the negative effect of being a low income household (defined as being in the lowest octile of household income) indicates that

there may be an income effect operating separately to the landholding hypotheses discussed.

The controls included all behaved as expected with fertility decreasing amongst older women and those from later cohorts; increasing female education had a negative effect. This, however, masks the fact that several covariates that might have been expected to be significant were dropped from the models due to the fact that they had very little explanatory power once sufficient economic variables were included – caste/ethnicity was not significant however the variable was categorised and region was also found to be insignificant. Though, not directly relevant to the main hypotheses, this is indicative of the great explanatory power of economic variables and also supports the economic approach to fertility transition as a whole.

Son preference was very marked with woman who already had a living son at the time of conception being 31.2% ($p<0.001$) less likely to have a third birth and 47.7% ($p<0.001$) less likely to have a fourth child. Interactions were tested to see if such son preference varied with landholding status and were found to be non-significant; the fact that no significant interaction was found may simply be a reflection of the very strong and robust nature of son preference in rural Nepal. While a significant interaction would have been further evidence of the hypotheses it is not particularly problematic that these interactions were not observed.

It should be noted that the two models include terms interacted with time (or rather duration from the birth of the relevant parity); these terms were necessary in order to ensure that the proportional hazards assumption held (see Appendix I and Appendix II for more details). Both birth date of the mother and household size were interacted with time. The results indicated that the generational effect increased with the length of the birth interval between the second and third child, but was not

affected by the length of the birth interval between the third and fourth child. The positive effect of household size increased with the duration of both birth intervals.

1.8.2 Panel Data Analysis

As discussed in the previous section analysis of the NLSS II strongly supports both the land-security and the land-labour hypotheses. However, the use of current landholding and income variables to study prior fertility throws up questions about the precise nature of the relationship. In this section the results from analyses conducted on the NLSS panel data are presented; landholding information from the NLSS I was used as the independent variables while the fertility data from the NLSS II provided information on births that occurred subsequently. Due to sample size (738 women) it was not possible to reproduce the model from the cross-sectional analysis. Indeed it was necessary to drop the majority of covariates. It was, however, possible to show that the landholding variables would be likely to have the same relationship with fertility prospectively as they bore retrospectively according to the analysis of the NLSS II.

Two models for the transition from second child to third conception were estimated: one used landholding variables from the NLSS I and one used landholding variables from the NLSS II in order to verify that the panel data was similar to the cross-sectional data used. The models looking at the transition from third child to fourth conception were also estimated but the sample size (545 women compared to 738 for the earlier transition) was too small to see significant results and consequently they are omitted.

The results are strikingly similar (tables 3 and 4). The dependant variable used is the transition from second birth to third conception and this is restricted to women who had their second birth after the NLSS I was conducted in order to ensure

that we are modelling childbearing decisions that could have been based on socio-economic circumstances at the time of the first survey. Controls were included for age at birth of second child, birth date of the woman and existence of a living son – none of these variables were time variant. The controls were all highly significant and suggested the effects that were expected; age depressed likelihood of having a third child as did being in a younger generation and having a living son as the first or second child. The sizes of all these effects were very similar to those found in the cross-sectional analysis.

Table 3 Cox proportional hazards model of the progression from second birth to third conception using NLSS panel data

Variable	Coeff.	Std. Err.	z	p>|z|	95% CIE		Haz. Ratio
Land Owned (Ha.) at NLSS I	-0.169	0.085	-2.00	0.045	-0.335	-0.004	0.845
Land Cultivated (Ha.) at NLSS I	0.203	0.092	2.22	0.027	0.024	0.383	1.225
Living Son	-0.512	0.092	-5.58	0.000	-0.692	-0.332	0.599
Age at birth of 2nd child	-0.004	0.001	-4.24	0.000	-0.006	-0.002	0.996
Birth Date	-0.005	0.001	-4.24	0.000	-0.007	-0.002	0.995
Birth Date * Time	0.0001	0.000	2.60	0.009	0.0001	0.0001	1.0001

Table 4 Cox proportional hazards model of the progression from second birth to third conception using NLSS panel data

Variable	Coeff.	Std. Err.	z	p>|z|	95% CIE		Haz. Ratio
Land Owned (Ha.) at NLSS II	-0.145	0.117	-1.24	0.214	-0.374	0.084	0.865
Land Cultivated (Ha.) at NLSS II	0.185	0.124	1.49	0.136	-0.058	0.428	1.203
Living Son	-0.530	0.092	-5.76	0.000	-0.710	-0.349	0.589
Age at birth of 2nd child	-0.004	0.001	-4.13	0.000	-0.006	-0.002	0.996
Birth Date	-0.005	0.001	-4.17	0.000	-0.007	-0.002	0.995
Birth Date * Time	0.0001	0.000	2.51	0.012	0.0000	0.0001	1.0001

Arable landholding used by the household (as reported in both the NLSS I and the NLSS II) has a positive effect on fertility, which was as expected. The area of land owned by the household has a negative effect. In both cases the NLSS I covariates are significant at the 5% level while the NLSS II covariates are not.

The effect of land owned in 1996 on the hazard is estimated to be a decrease of 15.5% ($p = 0.045$) per hectare while the effect of land owned in 2004 was a decrease of 13.5% ($p = 0.214$). The model based on the cross-sectional data (see table 4.2) estimated that the effect was 13.9%. Thus the size of effect for all the models is strikingly similar.

The effect of arable landholding in 1996 was estimated to be an increase of 22.5% ($p = 0.027$) while the effect of 2004 arable landholding was an increase of 20.3% ($p = 0.136$). The estimate from the cross-sectional data was 19%, which is again very similar.

While it is unfortunate that the sample sizes were too small to do much more in depth analysis these results indicate strong support for the hypotheses. The fact that the effect of landholding on subsequent fertility is stronger and more significant than that of present landholding on previous fertility implies that childbearing decisions may well be made on the basis of landholding. Certainly, this is precisely what would be expected if the hypotheses were true and it is hard to imagine a much stronger case given the data available to us.

As with the cross-sectional model it was necessary to include birth date as a time varying covariate in order for the Cox Proportional Hazards model assumptions to hold. In this case the effect of birth date on the hazard decreased with time (since the interaction term was positive but the main effect was negative and of a substantially larger magnitude).

1.9 Conclusions

There is clearly a relationship between landholding and fertility in modern day mid-transition Nepal. This relationship holds when large numbers of controls are included that the dissentient majority might expect to remove the landholding fertility

relationship. In reality the very opposite appears to be the case; when controls were included for all those things that are though to affect fertility and could mediate the landholding fertility relationship the predicted effect of the two important landholding variables became stronger and more significant.

It was also possible to look at the effect of landholding on subsequent fertility, which tends to discount the possibility that the observed relationship was the result of a third set of factors affecting both landholdings in the present time and fertility that has already occurred.

The analysis carried out in this paper proves that there is a need for further work in this area. The land-security and land-labour hypotheses are far from being outdated ideas that explained spurious relationships in pre-transitional societies not requiring explanation via rational choice.

This inquiry is not conclusive; it was limited geographically to the Republic[5] of Nepal and it was limited in scope by the quality of data available. A more extensive panel survey would be highly useful, as would a replication of this kind of inquiry in other regions of the world. It is possible that this relationship exists in this form only in Nepal or maybe only in the Indian Subcontinent; the geographical reach of these effects is an important area for further work. Qualitative work is also necessary in order to elucidate the effect that landholding has on fertility decisions.

What this paper has shown, though, is that the land-security and land-labour hypotheses are consistent with the empirical facts in Nepal and if the results of this paper have not proved the hypotheses to be true they have at least shown that they are highly probable. This is a definite step forwards in the search for a model of fertility transition, since these hypotheses (if true) imply that couples are acting rationally on

[5] Nepal is the world's youngest republic. It officially became the Federal Democratic Republic of Nepal on 28th May 2008, before which it was a Kingdom and home to the last remaining Hindu Monarchy.

average when making fertility decisions and that in the developing world considerations of future security are important as are the economic returns which children may provide as they are growing up.

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