THE RESIDENCY DECISION OF ELDERLY INDONESIANS: A NESTED LOGIT ANALYSIS*

LISA CAMERON

This paper is the first study of which the author is aware that examines elderly Indonesians' residency decisions. The 1993 Indonesian Family Life Survey provides detailed data on the living children of a sample of elderly individuals. This allows a nested logit to be estimated, which pays due respect to the role of children's characteristics in determining the residency outcome. The estimated earnings potentials of the parents and their children are included as explanatory variables but are not found to be important determinants of coresidency.

In most countries around the world, populations are aging. In developed nations, the aging of the baby boomers' generation has caused governments to focus on ways to provide pension support for the elderly, who will constitute a larger proportion of the population than ever before. In developing countries, as a result of lowered fertility rates coupled with higher life expectancy, the elderly now make up a larger percentage of the population than in years past. This is the case in the developing nations of Asia: The number of people over age 65 in Asia is predicted to double from about 5% of the population today to 10% in 2025 (Martin 1988).

The implications of aging populations in developing countries, however, differ markedly from those in developed countries. Pension schemes are almost nonexistent, and the great majority of elderly citizens either live with their adult offspring or rely on them for financial support. Thus the burden of the aging population will fall largely on the families of elderly individuals rather than being spread over the entire tax base. Yet as the economies in these developing countries have modernized, the extended-family structure is slowly being replaced by the Western-style nuclear family. Hence, for policy makers who seek to address the welfare impact of the aging populations, it is important to understand how household structures have evolved and to what extent they are anticipated to evolve further toward the Western model.

In this study I examine the residency decision of elderly individuals in Indonesia. This paper is the only study of which I am aware that examines residency decisions in Indonesia; in addition, it offers a number of methodological contributions to the literature. Almost all previous studies of residency in other countries, largely because of data limitations, have emphasized the role of the elderly parent. Detailed data have been available on the elderly individuals, but only limited information on their offspring. The residency decision thus has been modeled most often as determined by parental characteristics and by broad summary measures of the availability of children, such as the number of children in age/sex categories (see, for example, DaVanzo and Chan 1994). As a result, more detailed characteristics of the children and differences across children have been largely ignored.

In the residency decision, a parent normally chooses between living alone (or with a spouse only) and living with one or more children. Thus the characteristics of the children may play an important role in determining the residency outcome. Changing characteristics of younger generations may be important to forecasts of changing residency patterns. For example, increased educational attainment and the increasing income levels of the younger generation may have important implications for the future of coresidency. At the very least, it is important to investigate the significance, or otherwise, of the impact of children's characteristics on residency outcomes.

A unique feature of the Indonesian Family Life Survey (IFLS) is that it provides data on all non-coresident children of a sample of elderly individuals. The decision is modeled as a choice among children; the parent has the additional option of not living with any children. Thus it is possible to analyze the residency decision of the elderly while paying due respect to the role of children's characteristics.

The first methodological contribution of this paper is the use of a nested logit to model the residency decision. The nested logit is a less restrictive version of the multinomial logit: It selectively relaxes the assumption of the independence of irrelevant alternatives. Below I discuss the implications of this property.

The second methodological contribution is the inclusion of a measure of children's earnings capacity as an explanatory variable in the decision process. Although earnings figures are not provided for non-coresident children of the elderly individuals in this sample, the IFLS data supply enough information on coresident and non-coresident children to allow earnings figures to be generated. The estimation procedure consists of two stages. First, earnings equations are estimated from a random sample of working individuals from the IFLS; the parameter estimates then are used to construct predicted earnings figures. Second, these

*Lisa Cameron, Department of Economics, University of Melbourne, Parkville, 3052, Vic., Australia; E-mail: l.cameron@ccomfac.unimelb.edu.au. I am thankful to Deborah Cobb-Clark, Tom Crossley, Guay Lim, Chris Worswick, and attendees at the 1998 Labour Econometrics Workshop at the Australian National University for helpful comments on this paper. I also gratefully acknowledge funding from Australian Research Council Grant S79813009. All errors are my own.

predicted earnings figures and other explanatory variables are related to the residency decision via the nested logit. In addition to permitting the construction of earnings figures for children for whom earnings were not reported, the use of estimated earnings figures also circumvents the likely endogeneity of actual earnings.

The results from the nested logit indicate that children's and parents' demographic characteristics play an important role in the residency decision. Parents who are not part of a couple and parents who have a physical disability are more likely to live with a child. Unmarried and younger children are more likely to live in the same household as a parent. Parents' incomes have no effect on the probability of coresidency. Parents with children who, on average, have higher incomes are less likely, however, to live with a child, but this effect is quantitatively small. Coresidency rates, other things being equal, are higher in urban than in rural areas.

INDONESIAN BACKGROUND AND PREVIOUS LITERATURE

In Indonesia in 1980 there were approximately 5,047,000 persons (3.3% of the population) over age 65. This figure is forecast to more than quadruple in absolute terms to 23,663,000 (8.7% of the population) by 2025. Apart from the fact that only very few Indonesians have access to pension income (a small proportion of those who work as employees in the formal sector), very little is known about elderly Indonesians and their means of support. I know of no studies of the determinants of coresidency in Indonesia. Studies of financial support have been based almost entirely on small-scale field research (see, for example, Evans 1990). Rudkin (1993) is an exception: She used data from a sample of elderly individuals in Java to examine gender differences in economic well-being of the elderly. She found that elderly women generally have fewer financial resources than men and that household structure plays an important role in determining economic well-being. In another paper, she examined the relationship between dependency and happiness among elderly Indonesians (Rudkin 1994). Residential dependency appeared to be a desirable state. Neither paper explicitly modeled household structure.

Determinants of coresidency in neighboring Asian countries have been studied, however. DaVanzo and Chan (1994) examined the living arrangements of the elderly in Malaysia. They estimated logistic regressions and were unable to control for the characteristics of children beyond the number of offspring in specific age/sex categories. They found that coresidence is a positive function of housing costs and a negative function of elderly individuals' incomes.

Martin (1989) examined the residency decision of elderly Fijians, Koreans, Malaysians, and Filipinos. In contrast to DaVanzo and Chan, she found that modernization theory and the economic hypothesis of increased ability to purchase privacy received only weak support. She was unable, however, to control directly for either the parents' or the children's income; she could control only for whether or not the elderly person was "self-supporting."

Both Martin (1989) and DaVanzo and Chan (1994) mentioned the need for more extensive data on the younger generation.

The work most closely related to this study is Wolf and Soldo (1988). They used data on all surviving children of a sample of elderly women in the United States to model the residency decision within a multinomial logit framework. As mentioned above, the multinomial logit imposes the assumption of the irrelevance of independent alternatives. This constrains the response elasticities to be equal across choices. If this assumption is applied inappropriately, the resultant estimates will be biased; I discuss the assumption in greater detail below. The nested logit gives the researcher the opportunity to test the appropriateness of the assumption. In contrast to this study, Wolf and Soldo were unable to control for the children's earnings potential. The observable children's characteristics were limited to the age/sex composition of the siblings and to whether or not daughters are active in the workforce.

THE EMPIRICAL MODEL

The aim of this paper is to estimate a reduced-form model of residency choice that may be useful in forecasting future patterns of household formation. In the discussion below I consider the residency choice as being made by the elderly parent. In Indonesia, where a substantial social penalty is incurred by children who are regarded as neglecting their elderly parents, this assumption is likely to be close to the truth. This formulation allows for the parent's taking into account the impact of his or her decision on the children's welfare by permitting the children's utility to be a variable in the parent's utility function. There is nothing, however, to distinguish the empirical formulation of this model from the reduced form of the joint decision-making model, in which parents and children make the decision together. The assumption that the parent makes the choice is used here to simplify the discussion.[1]

Consider an elderly individual who must decide whether she will live on her own or with one of her n children: child^1, child^2,..., child^n. Allow V_{ij} to denote the utility associated with the jth choice, where j ranges from 0 for living alone to n. The utility obtained from living alone will depend on the characteristics of the elderly individual. Hence we can write

$$V_{i0} = \alpha_0 + \alpha_1 \mathbf{Y}_i + \varepsilon_i, \quad (1)$$

where V_{i0} is the indirect utility obtained from living alone, $\mathbf{Y}_i$ is a vector of parental characteristics, and ε_i is a random error term.

The utility associated with living with each of the children will be a function of the children's characteristics. Hence

1. To formally model the residency decision, one must make an assumption as to how the decision is made. However, whether the decision is made by the elderly individual, by the child, or by bargaining between the two is largely beyond the scope of this paper. In further work I plan to assess the residency decision concurrently with the provision of intergenerational transfers. At that point it may be appropriate to formally acknowledge the two parties to the decision-making process.

$$V_{ij} = \beta_0 + \beta_1 X_{ij} + \varepsilon_i, \quad (2)$$

where V_{ij} represents the indirect utility obtained from living with child j and X_{ij} is a vector of characteristics of the jth child of parent i.

Because the children are defined arbitrarily as child[1], child[2], ... , child[n], the β coefficients are constrained to be equal across all children. The nested logit formulation can accommodate variables that reflect the characteristics of the "chooser" only if their impact is allowed to vary across options. Hence it is not possible to include the parent's characteristics in Eq. (2). The coefficient α_1 in Eq. (1) thus should be interpreted as the contribution of parental characteristics to the utility obtained from living alone *relative* to that obtained from living with children. Interactions of children's characteristics with those of the parent can be included, however. For example, one could include a dummy variable that equals 1 if the child is male and the parent is male. I included various interaction terms and found them to be insignificant; so they are not included in the results reported here.

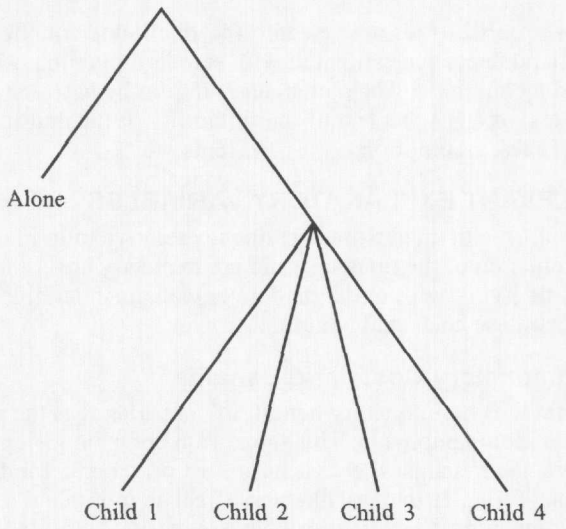
The residency decision involves a comparison of the utility obtained from each option. Hence

$$P_{ij} = \text{pr}(V_{ij} > V_{ik}) \text{ for all } j \neq k, \quad (3)$$

where P_{ij} is the probability of parent i making choice j. If we assume that the ε_i values are distributed according to the extreme value distribution, then the model can be estimated with a nested logit framework. The nested logit is a less restrictive version of the multinomial logit model: It selectively relaxes the restrictive assumption of the independence of irrelevant alternatives (IIA). The IIA assumption imposes equal response elasticities across choices. This means that the introduction of an additional choice will decrease the predicted proportion of the sample that chooses each of the original alternatives in proportion to their size before the introduction (Hoffman and Duncan 1988). One might, however, expect a greater impact on more similar alternatives. In regard to the residency choice, for instance, one might expect that having an extra child might decrease the predicted probability of living with each of the other children more than it would decrease the probability of living alone. This possibility is ruled out in a multinomial framework; for this reason I estimated a nested logit. The advantage of estimating the nested logit is that it allows one to test the appropriateness of this restriction.

The nested logit groups similar choices and (as stated above) selectively relaxes the IIA assumption. The natural hierarchical structure in the case of the residency decision is to group the choice of children, as shown in Figure 1. Note that the nested logit does not impose a sequential decision-making process. That is, it does not impose the unrealistic condition than an elderly individual first decides whether or not to live alone and only then, having decided to live with a child, looks at the traits of his or her children. The only structure imposed is the grouping of the error terms in such a way that the IIA assumption is relaxed selectively. (For a longer discussion of nested logit models, see McFadden 1984.)

FIGURE 1. HIERARCHICAL FRAMEWORK FOR RESIDENCY DECISION



In theory, estimating a multinomial probit is another methodological option. Multinomial probits are less restrictive than multinomial logits and even less restrictive than nested logits because they completely relax the IIA assumption. These models, however, are computationally very intensive and become quite difficult to estimate when there are more than four choices and if the number of choices varies across individuals, as they do in this data set.

When a nested logit is used, as in the multinomial logit framework, the probability of the elderly individual living with child j, given that she is living with one of the children, is calculated according to the following equation:

$$P_i(\text{child } j \mid \text{with}) = \frac{\exp(V_{ij})}{\sum_{k=1}^{n} \exp(V_{ik})}. \quad (4)$$

Yet the way in which the probability of living alone is calculated, as opposed to living with one of the children, differs under the nested logit method, as follows:

$$P_i(\text{alone}) = \frac{\exp(V_{i0})}{\exp(V_{i0}) + \exp(\lambda * I_i)}, \quad (5)$$

where

$$I_i = \ln\left(\sum_{k=1}^{n} \exp(V_{ik})\right). \quad (6)$$

I_i is termed the "inclusive utility value." If $\lambda = 1$, then the model collapses to the standard multinomial logit. When λ is allowed to differ from 1, the nested logit relaxes the IIA assumption across nodes of the decision tree. The IIA assumption is imposed within the nested choices but is relaxed across them.

The probability of living with each child is thus calculated as follows:

$$P(\text{child } j) = P(\text{child } j|\text{with})(\ (1-P(\text{alone})). \quad (7)$$

These probabilities are fed into the likelihood function and the parameters are estimated with standard maximum-likelihood techniques.[2] The parameter λ should lie between 0 and 1; a test of $\lambda = 1$ is a test of the suitability of the multinomial logit's IIA assumption.

RELEVANT EXPLANATORY VARIABLES

The utility obtained from coresidency relative to living alone is a function of the monetary and nonmonetary costs and benefits of living with children. The explanatory variables will reflect these costs and benefits.

Nonmonetary Costs and Benefits

An obvious nonmonetary benefit of coresidency is the provision of companionship. The gains from companionship must be weighed against the cost in loss of privacy and independence. Variables that are likely to affect an individual's tastes for companionship versus privacy are marital status, age, and educational attainment. One might expect the benefits of coresidency to be higher among widowed or separated parents and lower among couples. Older parents may have more traditional values that place a higher weight on coresidency. Better-educated parents may have been exposed to a more modern lifestyle and may be less likely to coreside.[3]

The child's characteristics also will affect the attractiveness of coresidency. Although some of the relevant characteristics are unobservable, others, such as the child's age, education and marital status, are observed. Unmarried children may be a more attractive residency option because of the absence of a son- or daughter-in-law. Better-educated children, like better-educated parents, may have been exposed to a more modern lifestyle and may be less inclined to coreside. The preference for an older or a younger child may be determined by societal norms: For example, it may be customary to reside with the youngest daughter. Hence the child's ordinal birth number and age are possible determinants of coresidency. As mentioned above, children's preferences can affect the outcome indirectly even if the parent makes the decision, if the parent takes the child's wishes into account. Alternatively, they may affect the outcome directly if children do not merely accommodate parents' wishes.

Monetary Costs and Benefits

In addition to companionship, coresidency provides the elderly with financial support. This support may take the form of the consumption of semipublic goods such as housing as well as economies of scale within the household, or it may involve direct financial transfers to the elderly individual. Although it is difficult to learn how resources are shared within households, one expects that in many extended-family households, direct financial transfers also are made to the elderly individuals. Such transfers may be made regardless of the residency decision, but it may be that the proximity of the elderly parent increases the probability of such transfers.

The financial benefits of coresidence are less important to better-off parents. Hence elderly individuals with higher earnings potential may be less likely to coreside because they can afford to pay for their own consumption and are more able to buy "privacy." The extent of the financial benefits that are offered by the child will be a function of the child's earnings; earnings also will reflect the degree of financial hardship imposed on the child as a result of coresidency. This latter point may feed into the elderly person's utility function via the utility of the child. Children's incomes also reflect the extent to which children can afford to support parents through financial transfers rather than by relying on the economies of scale of the household. Hence it is not clear in which direction children's incomes will affect coresidency. The possibility that higher incomes enable children to establish their parents outside the family home may entail a welfare cost if the parent is being made to live alone against his or her wishes.

Children's incomes will enter the nested logit in two ways: as individual children's predicted earnings and as the average earnings of the children of a given parent. The first figure enables one to determine whether the parent chooses (for instance) to live with the wealthiest child. The second figure may reflect the availability of intergenerational transfers from all children if the elderly parent is not to coreside.

The financial benefits of coresidency also might take the form of domestic care that otherwise might need to be purchased. This is especially likely to be the case for elderly individuals with physical disabilities. The IFLS data allow one to construct a variable reflecting the elderly individual's capacity to perform daily tasks without help. In the analysis below, I use a variable that equals 1 if the elderly person has difficulty in one or more of the following tasks: getting dressed, standing from a sitting position, and going to the bathroom. The variable equals 0 otherwise. One would expect coresidency to be correlated positively with this variable. The need for care also may be a function of the elderly

2. It is possible to estimate the nested logit sequentially by obtaining estimates of the βs from Eq. (4), calculating the inclusive value from Eq. (6), and then calculating the αs using Eq. (5) (Maddala 1983). The sequential method, however, involves an efficiency loss and is undesirable in cases where the number of choices differs across individuals, as in this study (Hensher 1986). Differing numbers of choices were allowed by programming the likelihood in blocks reflecting the number of children of the elderly individuals.

3. Cultural differences across different ethnic groups also may affect preferences for coresidency. Indonesia contains many different ethnic groups. Although the sample size of the IFLS is relatively large, it is not large enough to facilitate division into the number of geographic regions that are necessary for differentiation on cultural grounds. In addition, people can be linked only to geographic regions; their ethnic background is not specifically identified. Initially I estimated the equations separately for Java and for the outer islands. The Javanese results did not differ markedly from those for the other islands. In addition, dummy variables reflecting the householders' religion were allowed in the initial estimations. Coresidence differs significantly across religious groups: Catholics are the most likely to coreside, but this effect is statistically insignificant once the additional explanatory variables are included.

person's age and gender: Wolf and Soldo (1988) suggested that elderly males may have a greater need for domestic services, whereas elderly females may be in greater need of financial services. Financial services can be provided more easily from outside the home than domestic services and care. Hence, in addition to tastes for companionship, gender may affect coresidency via the demand for domestic services. On this basis one would expect to see more single males than single females coresiding.

The affordability of living alone will also be a function of living costs. These costs are significantly higher in cities, and a number of studies have found that coresidence is more common in urban areas than in rural areas (Kim and Choe 1992; Martin 1988). This finding contrasts with the prediction that households in rural areas will reflect a more traditional lifestyle in which coresidence is more prevalent. DaVanzo and Chan (1994) explicitly included a measure of housing costs in their analysis and found that it is related positively to coresidence; inclusion of this measure reduced the positive effect of urban residence on coresidency. In this study I make no attempt to control for housing costs; thus rural/urban designation will serve as a proxy for these costs.

Earnings are potentially endogenous to the residency decision: Coresiding parents may be less likely to work than if they lived alone. Children with coresiding parents may either increase their working hours to be able to support their parent or decrease them to spend more time with the parent in the home. In the analysis below, I take the endogeneity of earnings into account by the calculation of predicted earnings figures.

Number of Children

Previous studies included a measure of the number of children as an explanatory variable: This reflects the maximum number of opportunities for coresidency. As I explain below, the nested logit approach implicitly incorporates the number of children in the likelihood function.

The above discussions can be summarized in the following list of conjectures:

1. Elderly couples may be less likely to coreside than elderly individuals who are single, because of a lesser need for companionship.
2. Single elderly men may be more likely to coreside than single elderly females because of a greater need for domestic services that can be provided by children.
3. Parents with a disability may be more likely to coreside.
4. Older parents may be more likely to coreside because of (a) a greater need for care in the home and (b) more traditional tastes.
5. Less highly educated parents may be more likely to coreside because of more traditional tastes.
6. Parents with a higher income may be less likely to coreside because of the increased ability to purchase "privacy."
7. Coresidency may be higher in urban areas because of higher living costs.
8. Children's earnings potential may affect the coresidency decision in the following ways: (a) Positively: Children with higher earnings can offer a higher level of financial benefits; (b) Negatively: children with higher earnings can afford to support their parents outside the family home.
9. Married and better-educated children may be less likely to coreside.
10. Social norms may dictate parents' preference for coresiding with younger children and for living with daughters.
11. The more children an elderly individual has, the greater the probability that he or she will live with a child.

Timing of the Residency Decision

A difficulty encountered in modeling the residency decision with cross-sectional data is the lack of information on the timing of the decision. Such timing is relevant in trying to assess who is living with whom. For instance, it is difficult to interpret a finding that parents are more likely to live with younger children. Do elderly parents move in with younger children, or are younger children still living with their parents but may move out later? We may not want to classify the latter situation as true "coresidence." Information on the ownership of the household home cannot clarify this issue entirely. Some children will remain in the parental home until and beyond their parents' death; thus at some stage they will be "coresiding" in the sense that their parents are dependent on them, even though the home officially belongs to the parents.

Another way of approaching this issue is to use the information on the household head. In the IFLS, however, the household head is defined as the person "who is responsible for satisfying the daily necessities of the household or a person who is assigned/regarded as the head of the household." Custom most likely dictates that the oldest male be accorded the position of household head regardless of earnings. The great majority of the elderly in the IFLS sample are named as household head.

In interpreting the results reported below, one must bear in mind the lack of information on the dynamics of household formation.

DATA

The IFLS, a general household survey, provides data on a random sample of 7,224 households across the Indonesian provinces in Java, Sumatra, Bali, West Nusa Tenggara, Kalimantan, and Sulawesi.[4] In this study I focus on Indonesians age 60 or over (average life expectancy in Indonesia is 63; World Bank 1995). These 7,224 households contain 2,625 individuals in this age category, or 7.94% of all household members surveyed. This figure translates to 7.03% when weighted by the appropriate sampling weights.

Information was gathered on all household members; more detailed information was gathered on selected house-

4. Sampling weights are provided to weight the data so that it is representative of the population in the 13 provinces and to correct for the within-household sampling of respondents.

holders. Those who were selected for more detailed questioning are called *respondents*. Each household contains a maximum of four respondents. These individuals were chosen specifically so that a relatively large number of elderly persons were surveyed; there are approximately 1,900 elderly IFLS respondents. The age, gender, marital status, and educational attainment of all living children of these elderly individuals are known.

In the preceding discussion I considered the coresidency decision of an elderly individual. Many elderly persons, however, are part of a couple; it is necessary to find some way of dealing with this fact in the analysis. Here I treat couples as a decision-making unit, much like individuals. Their residency decision, however, is allowed to differ from that of individuals by the inclusion of dummy variables that reflect whether an elderly decision-making unit is a couple, an elderly male, or an elderly female.

Treating couples as a unit also necessitates decisions about how to characterize a couple in terms of age, earnings, and level of disability. Below I define couples' educational attainment to be the husband's educational attainment because this is judged to reflect the couple's social status more accurately than the wife's. I calculate earnings potential as per capita predicted earnings, or the average of the husband's and the wife's potential earnings. I experimented with treating the couple as disabled if either the wife or the husband was categorized as disabled. The greatest predictive power, however, was obtained by treating the couple as disabled only if the wife was disabled: It seems that a husband's disability can be ameliorated by an able wife. For similar reasons, the couple's age is the age of the wife, who tends to be younger; this more accurately reflects the couple's ability to live alone.

Because I am interested in examining whether or not an elderly parent decides to live with his or her adult children, I focus only on those individuals who have at least one living child over age 18. Dropping individuals with no living adult children, condensing the sample to one observation per elderly couple, and omitting a small number of observations that have missing values for one or more of the explanatory variables results in a sample size of 1,348. The final data set includes one observation per residency option; the 1,348 parents have 5,254 adult children; hence the final sample size is 5,254 + 1,348 (one observation for the possibility of living alone per elderly unit) = 6,602. The variables used in the analysis are described in the appendix. Summary statistics of these variables are shown in Appendix Table A1.

RESULTS

Overview of Coresidency in Indonesia

Table 1 provides a summary of the living arrangements of all elderly Indonesians surveyed in the IFLS. It shows that 62.51% of elderly individuals live with their adult children. Of all persons age 60 or over, only 20.67% live either with their spouse only or alone. Others live with siblings, friends, or other family members.[5] Of the 37.49% who do not live with children, only 4.5% have no children. Hence, approximately 33% of elderly Indonesians have children but do not live with them.

TABLE 1. LIVING ARRANGEMENTS OF THE INDONESIAN ELDERLY

Living Arrangement ($N = 2,625$)	Percentage of Elderly
Living With Adult Children	62.51
Living With Spouse and Others (Not Children)	7.60
Living With Others (Not Spouse or Children)	9.02
Living With Spouse Only	13.67
Living Alone	7.03

Estimating Earnings Potential

In the first stage of the estimation procedure I estimate an earnings equation. Even though the data provide actual earnings figures for the elderly individuals and for the coresident children, I calculate predicted earnings for all children and parents. This results in an identical method of calculating earnings for coresiding and non-coresiding children, and addresses the possible endogeneity of earnings. It is likely that labor supply decisions are affected by residency status and therefore that actual earnings are endogenous. I avoid this endogeneity by estimating the income that could have been earned if the individual had supplied labor to the market.

I estimate earnings equations over a subsample of IFLS respondents (this is a random sample of the population and includes individuals regardless of their residency status)[6] who are over age 18 and who report that work is their main activity. I control for selectivity into the workforce by estimating a Heckman selectivity model. Separate earnings equations are estimated for men and for women to allow for the possibility of differing returns to education and also for a different process of selection into the workforce. Eq. (8) is the earnings equation:

$$\begin{aligned}\log(Y_i) = {} & \beta_0 + \beta_1 AGE_i + \beta_2 AGE^2{}_i \\ & + \beta_3 EDUCATION_i + \beta_4 RURAL_i \\ & + \beta_5 PROVINCE_i + \beta_7 GROSSINC_i \\ & + \theta\lambda_i + \varepsilon_i \end{aligned} \quad (8)$$

5. Wolf and Soldo (1988) explicitly took these other living arrangements into account by modeling them as one of the choices. It is questionable whether this is desirable because information on the availability of such options is needed to be consistent with the modeling of the child's choice. In this paper I concentrate on the decision whether or not to live with adult children. This is the same approach as taken by DaVanzo and Chan (1994) and Martin (1989).

6. The IFLS is a survey of a random sample of households. Hence it provides data (including income figures) for all types of households: those in which parents live with children, those with parents not living with children, and those with children living apart from their parents. The IFLS, however, does not provide income figures for the non-coresiding children of the elderly respondents; thus I use my income data on the random sample of respondents to generate them. As explained above, I also use similarly constructed predicted earnings figures for the elderly individuals and their coresiding children.

$$WORK = \alpha_0 + \alpha_1 MARRIED + \alpha_2 UNDER10 + \alpha_3 X_i + e_i, \quad (9)$$

where $\log(Y_i)$ is the log of annual individual earnings in millions of rupiah (defined to include wage income and business income), *AGE* is the individual's age, *EDUCATION* is a vector of dummy variables reflecting educational attainment, *PROVINCE* is a vector of dummy variables for province, *RURAL* reflects the household's rural/urban status, *GROSSINC* equals 1 for the small proportion of self-employed individuals who reported their gross income instead of their net profit, and $\lambda_i = \varphi(\alpha' w_i) / \Phi(\phi' w_i)$ is the inverse mills ratio.

Estimates of the vector of coefficients α are derived from a probit of labor-force participation on the vector of characteristics, w_i, shown in Eq. (9). The system of equations is identified by the inclusion of the variables *UNDER10* and *MARRIED*. The former is the number of children the individual has who are under age 10; the latter is a dummy variable that equals 1 if the individual is married. (Regression results are reported in Appendix Table A2.) Married men were more likely to be in the workforce than single men, and the presence of children under age 10 also increased the probability that the male was working. Married women were less likely to be in the workforce than single women. Workforce selectivity, however, was found to be significant only in the earnings equation for males. The inverse mills ratio was insignificant in the earnings equation for females.

I then use the coefficients from Eq. (8) to construct measures of predicted earnings for the elderly individuals as follows:

$$\log(\hat{Y})_i = \hat{\beta}_0 + \hat{\beta}_1 AGE_i + \hat{\beta}_2 AGE^2{}_i + \hat{\beta}_3 EDUCATION_i + \hat{\beta}_4 RURAL_i + \hat{\beta}_5 PROVINCE_i. \quad (10)$$

By omitting the inverse mills ratio in Eq. (10), I obtain an estimate of earnings that is not conditional on work being the individual's main activity. Unfortunately it is not known where non-coresident children live; thus I calculate predicted earnings for *all* children (not only non-coresiding children) as follows:

$$\log(\hat{Y})_i = \hat{\beta}_0 + \hat{\beta}_1 AGE_i + \hat{\beta}_2 AGE^2{}_i + \hat{\beta}_3 EDUCATION_i. \quad (11)$$

This step arbitrarily assigns everyone to the reference category (urban Jakarta).

The Nested Logit

Table 2 presents the results of the nested logit. The first item to note is that the estimate of the inclusive value is 0.83 and that the null hypothesis (that it equals 1) is strongly rejected ($p = 0.005$). As explained above, estimating a multinomial logit would constrain the point estimate to equal 1. Hence the nested logit is a more appropriate estimation tool in this setting.

The parental coefficients are interpreted as the marginal effect of a one-unit increase in each variable on the utility of living alone relative to living with a child. I interpret the coefficients on the children's characteristics as the marginal effect on the utility associated with living with that child. Because utility is an ordinal measure, the absolute magnitudes of the coefficients do not have an intuitive interpretation. Comparisons of the magnitudes of the coefficients on different variables signify the relative importance of the variable; in some instances discussed below, I ran simulations to further clarify the interpretation.

In previous studies that estimated simple logits, the number of the elderly individual's offspring was found to be a significant determinant of coresidency. It is appropriate to include the number of the elderly individual's offspring when one estimates a simple logit because that number reflects the availability of coresidency opportunities. It is inappropriate, however, to include the number of children in a nested logit equation because that number is implicitly taken into account in the likelihood function. The parent is modeled as choosing the residency option that provides her with the highest level of utility. Having more children, other things being equal, increases the probability of finding a child who offers a higher level of utility than does living alone. The inclusion

TABLE 2. NESTED LOGIT RESULTS

Variable	Coefficient	*t* Statistic
Constant	–3.51	–1.05
Elderly Individual's Characteristics		
Age	0.0001	0.00
Log predicted earnings	–0.117	–0.61
Average of children's predicted earnings	0.132	2.97
Couple	0.486	3.02
Male	0.393	1.33
Disability	–0.506	–2.20
Primary education	0.003	0.02
High school education	–0.179	–0.62
Tertiary education	–1.423	–1.66
Rural abode	0.717	5.65
Child's Characteristics		
Age	–0.667	–7.00
Ordinal birth number	–0.024	–0.80
Log predicted earnings	0.025	0.13
Male	–0.089	–0.47
Married	–1.814	–19.40
Primary education	–0.218	–1.26
High school education	–0.230	–0.86
Tertiary education	–0.485	–1.21
Inclusive Value	0.83	13.77
t-test: Inclusive Value = 1		–2.84
Pseudo-R^2:	0.253	
Maximized Log-Likelihood:	2,164.833	
N = 6,602 (1,348 Elderly Parents)		

Note: Dependent variable = 1 for chosen residency option, 0 otherwise.

of an extra living arrangement option in the likelihood function thus implicitly incorporates the effect of an additional child on the probability of living alone.

Earnings variables. The nested logit results show that parents' earnings capacities are not a significant determinant of coresidency. The coefficient on parents' income is negative; this suggests that, on average, higher earnings capacity decreases the probability of living alone. Its effect, however, is statistically insignificant ($p = 0.54$). This finding is at odds with DaVanzo and Chan's finding for Malaysia, whereby coresidency was a positive function of a parent's ability to afford to live alone. The result reported here, however, is consistent with Rudkin's (1994) finding that coresidency is a desirable state for elderly Indonesians. If this is the case, then one would not expect higher income to be correlated with lower coresidency rates. This finding is also consistent with the work of Martin (1988), who found only weak evidence that coresidency rates were affected by increased ability to purchase privacy. Martin also found that the determinants of coresidency in Malaysia differed from those in the other countries she examined (Fiji, Korea, and the Philippines).

One might be concerned that this finding—that earnings potential is not systematically related to coresidency rates–could indicate that my measure does not accurately capture the elderly individuals' earnings capacities. Yet this seems unlikely to be the cause of the result reported here, for two reasons. First, as I discuss below, I calculate children's earnings potential using the same method as for parents' earnings potential, and find that it is systematically and significantly correlated with coresidency.[7]

Second, the raw data show that individual income is actually higher for elderly individuals who live as part of an extended family in Indonesia. Of course earned income may be endogenous to the residency decision, but both earned *and* nonearned income (which is normally treated as exogenous) are lower for those who live alone. Hence the IFLS data show that actual individual income is lower for those who live alone in Indonesia; once I have controlled for the demographic characteristics of children and parents and for the possible endogeneity of earned income, I find no statistically significant relationship between parents' income and coresidency decisions. As mentioned above, this suggests that the elderly in Indonesia may view coresidency as desirable.

I find, however, that coresidency is much higher in urban than in rural areas. I had hypothesized that the rural dummy variable might capture the effect of lower housing costs in rural areas and hence the parents' ability to purchase privacy. Therefore this result is slightly at odds with the insignificance of parental income. It is possible, although unlikely, that the rural dummy variable proxies so well for housing costs that income has no further explanatory power in rural and urban areas.

7. As shown in Eqs. (10) and (11), parents' earnings potential varies by province and by rural/urban status, whereas children's does not. Calculating parents' earnings potential in exactly the same way as children's does not affect the results.

The literature contains another, alternative reason for the higher rates of coresidency in urban areas in many Asian countries: congestion and the shortage of housing in urban centers. In rural areas, housing is not in short supply; hence it is easier to find housing. and living separately but close enough to maintain regular contact is a viable option. In cities this is much more difficult. People's lives also are generally busier, and traffic congestion makes it more difficult to move around. As a result, people may opt to live together in cities as the only way to ensure regular contact and the exchange of domestic services between family members. Young people's out-migration from rural areas is another possible explanation for lower rural coresidency rates (Andrews et al. 1986).

As mentioned above, the average of children's earnings potential has a significant impact on coresidency. The higher the children's incomes on average, the more likely that an elderly parent will live alone. If (as suggested above) coresidency is desirable, this result may be troubling because it could indicate that children who can afford to finance their parents outside their own home are more likely to do so, and possibly against the elderly individual's wishes. This effect, however, is quantitatively small: A doubling of the income of all children results in only a 1.7 percentage-point increase in the probability that the elderly individual lives alone.[8] In addition, the earnings potential of individual children is statistically insignificant; this finding indicates that the amount of income earned by a child does not make him or her more likely than the siblings to have a coresiding parent (when the averages of the incomes of all children in the family are held constant).

The results for children's income hence do not support the hypothesis that increases in children's incomes and in their ability to support their parents through interhousehold transfers cause a large movement away from the traditional family structure. Parents with children who can afford to support them outside the home are only very slightly more likely to live alone. Also rejected is the hypothesis that more affluent children can offer a higher level of financial support and so may be an attractive target for coresidence.

Demographic variables. The demographic characteristics of the elderly individuals and their offspring appear to be the most important variables in determining their residency status. For the elderly parents, whether they are part of a couple and whether they have a disability are important. As hypothesized, couples are most likely not to be living with their children: They are 5.4 percentage points more likely than single women to be living alone. On average, single males are more likely than single females to be living alone, but this difference is not statistically significant.

8. I arrived at this figure in the following way. First I calculated the predicted probabilities of coresidency. Then I doubled the children's average incomes and calculated the new predicted probability of coresidency for each individual. The figure 1.7 is the difference between the average of the original predicted probabilities and the average of the new predicted probabilities.

DaVanzo and Chan (1994) similarly found no gender differences in Malaysia.

Having a disability was hypothesized to increase one's demand for domestic care. Accordingly a disability (measured by difficulty in standing from a sitting position, going to the bathroom, and/or dressing oneself) significantly increases the likelihood of coresidency. A parent who reports difficulty in any of the above tasks is 9.0 percentage points more likely to live with his or her adult children than a parent without such a disability. One also would expect older parents to have a greater need for domestic care. I hypothesized that this point, combined with their "traditional" values, would make them more likely to coreside. The parent's age, however, is statistically insignificant.

I also conjectured that a parent with higher educational attainment might have been more exposed to a modern lifestyle and thus would be less likely to coreside. The parent's educational attainment, however, has no systematic relationship with coresidency. The children's education is similarly insignificant.

Demographic characteristics of children that are important in the residency decision are the child's marital status and age. Married children are much less likely to live in the same house as their parents. Younger children are more likely to be coresiding. This may be due to societal norms, as stated in Hypothesis 9, but also is most likely due to the difficulty of establishing who is living with whom. It may be that these children are actually living with their parents and will move out later. Also, the nonsignificance of ordinal birth number suggests that it is not the case that parents often choose to live with the "youngest child," but that the child's absolute age determines household formation.

The coefficient on the child's gender (male) is negative, an indication that sons, on average, are less likely than daughters to live with their parents. The effect, however, is statistically insignificant ($p = 0.47$).

CONCLUSION

In this paper I have examined elderly individuals' coresidency decision, using a nested logit framework. A multinomial logit framework was too restrictive in this setting. The IFLS data have enabled me to focus on the characteristics of the children of elderly individuals, including their earnings potential. I had hypothesized that elderly individuals might opt to purchase privacy in the form of their own household as their financial ability to do so increased; the hypothesized effect of children's earnings was indeterminate. Yet I found no evidence of any relationship between parents' earnings potential and coresidency in Indonesia, although parents are more likely to live with their adult children in cities than in rural areas. This may reflect economic considerations because housing costs are lower in rural areas, but I cannot be certain of this explanation. Instead it may reflect other differences between the areas, such as urban congestion and young people's out-migration to cities.

In contrast to parents' earnings, children's earnings are negatively related to coresidency. Parents with children who, on average, have high earnings are more likely to live by themselves, but this effect is quantitatively small. Therefore, in regard to forecasting future patterns of coresidency in Indonesia, I find very little evidence to suggest that increases in parents' and children's incomes would cause a large movement away from the traditional family structure.

Income is the most obvious indicator that changes with development. Other variables also change, however. Health improvements, for instance, may have consequences for coresidency. The results reported here suggest that increased survival of spouses, and hence a greater proportion of couples over age 60, will lead to lower coresidency rates. Health improvements also may result in a lower level of disability, which corresponds to less coresidency, but one might expect the health effects to be offset at least partially by the effect of increased life expectancy.

Caution is always needed in forecasting, especially when one attempts to extrapolate over time using results obtained from cross-sectional data. It may be that the wealthier elderly individuals in society today differ from the poorer in their unobserved propensity to live alone, and that as the poorer gain in wealth, their residency behavior may differ significantly from that of the currently wealthy. Also, the IFLS sample of elderly individuals is selected on survival to 1993. As survival rates increase in the future, so the composition of the portion of the population that is over any given age may differ significantly from the composition today. This change may affect residency patterns.

Certainly it is also possible that Indonesia will experience changes in coresidency rates even if all of the explanatory variables used here do not change over time. The process of modernization involves (for example) the development of more highly integrated labor markets. Such markets demand a more mobile workforce, which makes coresidency more difficult. Hence, although modernization results in higher incomes, a move away from coresidency may be motivated not by incomes but by fundamental changes in the country's production technology. This area deserves further research.

APPENDIX. DEFINITIONS OF VARIABLES

Omitted category variables are shown in italics.

Parental Characteristics

Couple = 1 if the elderly decision maker is a couple, 0 otherwise.

Male = 1 if the elderly decision maker is a single male, 0 otherwise.

Female = 1 if the elderly decision maker is a single female, 0 otherwise.

Age = age in years of the individual (of the wife if a couple).

Log(Predicted Earnings) = log of predicted rupiah earnings over the past 12 months.

Log(Average of Child's Predicted Earnings) = average of above.

Disability = 1 if the elderly person (wife if a couple) self-reported having difficulty in getting dressed, standing

from sitting position, or going to the bathroom.
Primary School = 1 if the highest educational institution attended was primary school, 0 otherwise (of husband if a couple)
High School is defined as above, but for high school.
Tertiary is defined as above, but for tertiary education.
No Schooling = 1 if the individual/husband had never received any formal schooling, 0 otherwise.
Rural = 1 if the elderly individual/couple lives in an urban area, 0 otherwise.

Children's Characteristics

Male = 1 if the child is male, 0 otherwise.
Female = 1 if the child is female, 0 otherwise.
Age = child's age in years.
Ordinal Birth Number = 1 if first-born child, 2 if second-born, and so on.
Log(Predicted Earnings) = log of predicted rupiah earnings over the past 12 months.
Married = 1 if the child is married, 0 otherwise.
Primary School, High School, Tertiary School, *No Schooling*: defined as above.

Additional Variables From the Earnings Equations

Gross Income = 1 if the individual reported gross income rather than net income, 0 otherwise.
Under10 = the number of children the individual has under age 10.
The educational categories correspond to the highest educational institution attended, and are self-explanatory (No Schooling was the omitted category).

TABLE A1. SUMMARY STATISTICS OF VARIABLES

Variable	Mean	*SD*	Min.	Max.
Residency Choice ($N = 6,602$)	0.260	0.439	0	1
Parental Characteristics ($N = 1,348$)				
Age	61.82	9.14	34	95
Log (predicted earnings)	12.30	0.56	10.03	14.52
Log (average of children's predicted earnings)	13.91	1.49	1.64	15.77
Couple	0.583	0.493	0	1
Male	0.065	0.247	0	1
Children	4.447	2.471	1	13
Disability	0.079	0.270	0	1
Primary school	0.433	0.496	0	1
High school	0.076	0.265	0	1
Tertiary education	0.012	0.108	0	1
Rural area	0.580	0.494	0	1
Child's Characteristics ($N = 5,254$)				
Age	33.1	8.55	19	70
Ordinal birth number	3.30	2.13	1	13
Log (predicted earnings)	14.2	0.758	12.6	16.2
Male	0.507	0.500	0	1
Married	0.773	0.419	0	1
Primary school	0.464	0.499	0	1
High school	0.352	0.478	0	1
Tertiary education	0.086	0.281	0	1

Note: All log earnings figures are annual measures.

TABLE A2. EARNINGS EQUATIONS

	Female		Male	
Variable	β	*t*	β	*t*
Constant	11.81	40.46	12.89	75.14
Age	0.064	5.55	0.062	8.43
Age Squared	–0.0007	–6.01	–0.007	–9.29
Primary Education (SD)	0.332	4.84	0.314	6.63
Junior High (SMP)	0.676	5.82	0.727	11.07
Vocational SMP	0.948	4.05	0.793	7.45
Senior High (SMA)	1.316	5.82	1.030	13.67
Vocational SMA	1.627	4.05	1.144	16.73
Junior College (D1, D2)	2.166	9.29	1.997	8.30
College (D3)	1.982	13.70	1.582	11.82
University	1.963	8.70	1.588	16.10
Gross Income	0.528	7.62	0.0578	1.82
Rural	–0.589	9.30	–0.498	–14.39
λ	–0.085	0.41	–0.990	110.0
Probit				
Constant	1.51	4.91	0.185	0.57
Married	–1.01	–11.20	0.638	9.77
Under10	0.017	0.60	0.129	5.05
Age	0.029	2.54	0.054	5.59
Age squared	–0.003	–2.79	–0.0006	–5.86
Primary education (SD)	–0.021	–0.30	0.110	1.74
Junior high (SMP)	0.078	0.65	–0.0186	–0.17
Vocational SMP	0.331	1.30	0.156	0.89
Senior high (SMA)	0.370	2.10	0.073	0.29
Vocational SMA	0.809	5.15	0.187	1.10
Junior college (D1, D2)	1.220	2.82	–0.498	–0.67
College (D3)	0.764	1.66	0.335	0.31
University	0.467	1.55	–0.330	–1.02
Rural	–0.747	–11.21	–0.358	–5.29
N	3,087		4,548	

Notes: Dependent variable is log(individual earnings). "No schooling" is the omitted educational dummy variable. Provincial dummy variables were also included in both stages of the estimation.

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