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Living-arrangement and university decisions of Dutch young adults[1]

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Abstract

This paper analyses the nature of university and living-arrangement decisions at the example of Dutch students with a secondary education academic diploma. A random utility maximization nested logit model of living-arrangement and university decisions is estimated, allowing for distance and rent effects to vary according to the decision on whether to stay at parental home. Estimation results show that distance deters both at-homers and out-homers. Dutch youngsters are guided by consumption motives, rather than investment motives. They appear to attend university where their high school mates do. Tight housing markets lower the probability of choosing a given university. Male and low income students stay longer with parents, as do those with non-Dutch parents

Keywords: living arrangements, university choice, random utility maximization, nested logit

JEL: C25; D85; I2; J24; R00

1 Introduction

In industrialized countries of the West, a wide range of trends indicate a decline in family support and commitment, as the increasing desire for privacy and autonomy overcome the role of family and community. In a time where individualism prevails over traditional values, we observe a remarkable tendency for the age at which young people leave home to increase. This trend, which seems to run counter to the other trends by reducing the young adults' independence and privacy, has appeared throughout Europe and North America, although it is more pronounced in southern Europe. During the 1980s, home-leaving patterns in the Netherlands were characterized by high, increasing probabilities of leaving home at younger ages, but lately the country has been moving towards a different model. Transitions out of the parental home at the high school leaving age have become less common than they used to be; Dutch young adults are leaving home ever later: girls on average at 21, and boys at 23 (SCP, 2000: 210, 224).

This fact has several implications for the lives of these young people. It impedes, or at least postpones, the process of gaining independence, including participating in the housing market. Leaving the parental home is one of the most important signs that transition into completely independent living is taking place. "The move away from home is related to changing opinions and the creation of new ways of viewing the world" (Mulder and Clark, 2002: 981). Although many of those living away, for instance at a college location, are not truly independent, as they depend on their parents' money transfers, we expect the act of leaving home to contribute to speed up the timing of independence, by creating what Mulder and Clark (2002) call a 'taste for independence'. But the late home leaving also has important implications for individuals' educational career. Namely, the higher education institution choice of those students living with parents is more likely to be geographically constrained than the choices of the other students.

The economics of household behaviour has emphasized the interrelation between human capital investments, labour supply, and family status decisions of household members, but in most studies human capital decisions and family arrangements are treated separately, or, at most, family status is taken as exogenous. There are only a few recent studies that jointly model these decisions. Giannelli and Monfardini (2000, 2003) model the joint decision of working, studying, and living arrangements of Italian youth, by means of a multinomial probit model, with work and living with parents, work and not living with parents, and study and living with parents as the choices under analysis. Martinez-Granado and Ruiz-Castillo (2002) simultaneously analyse, by means of a trivariate probit model, three important decisions that Spanish youth make in their transition into adulthood: whether to work, whether to study, and whether to live at the parental home. All these analyses, however, take the studying decision as dichotomous, with students deciding between studying and not studying, and ignore the role of school characteristics.

The present study is an attempt to bring together the literature on university choice and the literature on the decision on whether or not to leave the parental home. Our primary focus is to investigate the effect of individual and university characteristics on student living-arrangement and university choices, with reference to the Dutch higher education setting, where access is free and tuition fees are low and similar for all institutions. The perspective of a potential student is approximated using a nested logit model, where special attention is given to university location attractiveness (including housing costs and the local supply of leisure amenities), perceived university quality, and peer effects.

Our analysis departs from the existing literature, as we pose some questions not (fully) dealt with in previous studies. First, are there differences in university choice behaviour between those who live at the parental home and those who do not? A number of previous studies address the determinants of university choices, but just a small number of studies model the choice of a higher education institution from a discrete set of alternatives. Some exceptions to note are Kohn et al. (1976) and Oosterbeek et al. (1992), who, however, do not consider the living-arrangement decision and do control for a small set of higher education institution characteristics. Recently, Avery and Hoxby (2003) and Long (2004) have analysed the determinants of college choice in the US by exploiting the advantages of conditional logit models in dealing with a large number of alternatives. Montgomery (2002) employs nested logit techniques to the study of the determinants of the choice of a graduate school. Again, the living-arrangement choice is not explored, and the analysis is confined to the particular set of business schools. Furthermore, the nested logit formulation he uses is not compatible with a random utility maximization approach. In view of that, our study makes two improvements to the previous literature regarding the model formulation. On the one hand, we jointly model decisions on living arrangements and higher education institution, within a nested logit framework, which enables us to look at factors that might explain the fact that Dutch young adults are leaving the parental home later than ever, and analyse the university attributes they take into account when choosing a university. On the other hand, we estimate the model by re-scaling utilities in such a way that the random utility maximization framework applies, that is, we estimate a nested logit model compatible with a random utility maximization formulation.

Second, what are the determinants of students' decisions? What is the role of distance in university choice, in a small country like the Netherlands with short commuting distances, and an extensive transportation network connecting the whole country? Are investment motives at work in the Dutch higher education market, in line with human capital theory? Do students look at quality when choosing a university? As referred to by Long (2004), studies on higher education-related choices tend to focus too much on price and its impact on higher education enrolment and college choice (see, for instance, Moore et al., 1991), while other relevant university/college characteristics are often neglected. Kohn et al. (1976) and Manski and Wise (1983) point out the positive impact of quality and the negative impact of distance to the likelihood of choosing a college. Long (2004) extends those results and finds that, over time, distance to college has become a less important aspect, while quality has turned into a more important factor in university choice. Avery and Hoxby (2003) study the effect of financial aid packages on college choices of high aptitude students and show that they respond to aid in a manner that is consistent with rational investment. The survey, designed specifically for their study, provides quite a complete set of university attributes. Oosterbeek et al. (1992) show that distance from home and good academic reputation are among the determinants that Dutch students consider important in choosing an economics department. Our analysis extends their study by considering all university departments, rather than just economics departments; it is in line with these other studies by considering several university-related attributes like, for instance, quality and diversity of study programmes. We also analyse the impact of distance to university on students' choices.

Third, what is the relevance of university location for university choice? Are students guided by consumption motives when choosing a university? Just a couple of studies on the demand for higher education have focussed on the (un)attractiveness of institutions' location. Sá et al. (2004) introduce university localization aspects in the analysis of students' mobility decisions, but at an aggregate level. Oosterbeek et al. (1992) include a dummy variable for the attractiveness of the city in which the five university economics departments in their study are located. The present study disentangles the impact of location on university choice by distinguishing the effects of several pull factors to the universities, like the local supply of leisure activities, housing costs, and local labour market factors.

Finally, are Dutch high school graduates influenced by their peers? Under uncertainty, it might be reasonable to use the knowledge acquired from interactions with other decision makers, such as colleagues, friends, or neighbours, who had to decide in comparable situations. Furthermore, from a sociological point of view, individuals tend to try to make sure that they are thinking in a reasonable way. Recent research has highlighted the existence of peer effects in higher education, but most studies take peer academic ability as the observed peer characteristic that might influence the others' behaviour (Winston and Zimmerman, 2004). Therefore, peer choices are included in our model, where individuals who attend the same high school form groups of interacting agents.

The remainder of this paper is organized into four sections. Section 2 sets up the framework of analysis: namely, it presents the theoretical and empirical models that put together the university choice and the living-arrangement decision. Section 3 explains the Dutch institutional context, the variables, and the data. The empirical strategy is discussed there as well. Section 4 presents and discusses the nested logit model results. Section 5 concludes.

2 Modelling living-arrangement and university decisions

2.1 Theoretical framework

In this section we present a simple model of university choice and living-arrangement decision, adapted from Giannelli and Monfardini (2003), from whom we borrow the main structure and notation. Assume that at $t = 0$, individual i is in the last year of secondary education and he has already decided to go to university at $t = 1$. He faces $J/2$ university options, as well as having to choose between living and not living with his parents, making a total of J combinations/alternatives. Each student stays at university until $t = t^*$. While at university, that is, for $t \in [1, t^*]$, students might accumulate human capital by studying and by working. After t^*, only working might contribute to human capital accumulation. Individuals are assumed to work until the end of their active life which occurs at t^{end}.

At $t = 0$, each student is assumed to consider a feasible choice set of J alternative combinations of universities and living arrangements: namely, he chooses an alternative $j : j \in \Omega_i = \{1, ..., J\}$. He first evaluates the indirect utility conditional on each alternative considered and selects the alternative with the highest indirect utility: that is, each student chooses consumption level (C_t) and leisure (L_t) that maximize his expected lifetime utility:

$$\max E\left[\sum_{t=0}^{\infty} (1+\delta)^{t-1} U\left(C_t, L_t, P_j^e\right)\right], \tag{1}$$

where preferences are assumed to be inter-temporally separable; δ is the rate of time preference; and P_j^e are the subjective beliefs that individual i possesses about behaviour in the group, measured as a probability over that behaviour.[1] We assume that an individual ordering of university alternatives relies on what he thinks his schoolmates facing

[1] According to Manski (2000), decision makers interact through their chosen actions. In practice, they can affect each others actions through constraints, expectations and preferences. For a detailed discussion on the inclusion of peer effects in multinomial models, see Brock and Durlauf (2002, 2003).

the same decision are doing. These are called endogenous effects as their decisions are contemporaneous: namely, an individual is influenced by his colleagues' decisions, but he himself influences the others' choices.[2] Peer effects-related issues are extensively discussed in Section 3.2.

The expected lifetime utility in (1) is maximized subject to a budget constraint defined as:

$$\sum_{t=0}^{\infty} (1+r)^{t-1} \left[W_{jt} + F_t + TR_t - C_t - E_{jt}\right], \tag{2}$$

where r is the interest rate. Students who work have positive labour income (W_{jt}); they might also receive scholarships (F_t). Parental transfers (TR_t) can be either monetary (MTR_t), and so depend on parental income, or non-monetary ($NMTR_t$), as the implicit value of housing services when students live at home. Thus,

$$TR_t = MTR_t + \alpha_t NMTR_t, \tag{3}$$

where $\alpha_t = 1$ if the young adult lives with his parents, and $\alpha_t = 0$ if he lives away from the parental home. The total education price, E_{jt}, is formed by two components: the monetary, and the non-monetary price. The monetary price, M_{jt}, includes the direct costs of education, such as tuition and books (T_{jt}), and indirect costs, such as housing rent (R_t). The non-monetary price measures the opportunity cost of travelling to, and gathering information on, each university, $I(d_j)$, and is an increasing function in distance between home and university. That is,

$$E_{jt} = M_{jt} + I(d_j) = (T_{jt} + R_t) + I(d_j). \tag{4}$$

Replacing (3) and (4) in (2), the budget constraint becomes:

$$\sum_{t=0}^{\infty} (1+r)^{t-1} \left[W_{jt} + F_t + MTR_t + \alpha_t NMTR_t - C_t - (T_{jt} + R_t) - I(d_j)\right]. \tag{5}$$

While he is studying, the wage depends on the region where the student works, which is largely determined by the university location (r_j, region where university j is located).

[2] Durlauf (2004) distinguishes between peer group influences, which refer to contemporaneous behavioural influences that can be reciprocal, and role model effects which refer to situations in which the behaviour of one individual is influenced by the characteristics and earlier behaviour of older members of his social group.

After t^*, the wage depends on the quality of the university attended (q_j):

$$W_{jt} = \begin{cases} w(r_j) K_t H_t, & t = 1, ..., t^* \\ w(q_j) K_t H_t, & t = t^* + 1, ..., t^{end}, \end{cases} \quad (6)$$

where $w(\cdot)$ is the hourly wage rate per unit of human capital stock; K_t is the human capital stock; and H_t is the number of hours devoted to work. The time endowment T is divided between hours of work (H_t), leisure (L_t), and study (S_t):

$$T = \beta_t H_t + L_t + (1 - \beta_t) S_t, \quad (7)$$

where β_t is the proportion of non-leisure time devoted to work. The human capital accumulation rule varies over the life cycle*:*

$$K_t = \begin{cases} K_{t-1} + F[(1 - \beta_t) S_t + \beta_t H_t], & t = 1, ..., t^* \\ K_{t-1} + G_j[H_t], & t = t^* + 1, ..., t^{end}, \end{cases} \quad (8)$$

where K_0 is the human capital at the end of high school; $F(\cdot)$ and $G(\cdot)$ are functions of the human capital accumulated till moment t; and G_j depends on the university attended.

The indirect utility function conditional on combination j of living arrangements and university is then obtained by replacing the optimal consumption level in every period, C_t^*, and the optimal level of leisure, L_t^*, in the expected individual lifetime utility, and is given by:[3]

$$V_{ij} = V_{ij}(X_i, Y_j), \;\; j = 1, ..., J, \quad (9)$$

where X_i is a vector of individual and parental characteristics (e.g. human capital stock at $t = 0$, income) that determine the choices; and Y_j is a set of university-specific and location attributes (e.g. quality, housing, and labour market conditions). From these characteristics, prospective students can attach to each university its additional value for human capital investment and the consumption goods it offers. Having evaluated the indirect utilities associated with all combinations, the student chooses the one that provides him with the highest value added, that is,

$$\omega_i = \arg \max_{J \in \Omega_i} V_{ij}, \quad (10)$$

where ω_i is the university-living arrangement pair chosen by individual i.

[3] So far, we have suppressed the subscript i for the individual, in order to keep the model formulation simpler.

2.2 Econometric approach: nested logit model

The theoretical model presented in Section 2.1 suggests random utility maximization (RUM) as the appropriate formulation for analysing student decision-making processes. A random utility model consists of deterministic and stochastic elements, reflecting the observable and unobservable attributes of individual choice. Let the non-random part of the utility in (9) be a linear function of individual characteristics and university attributes, all represented by Z_{ij}. The utility function is then specified as:

$$v_{ij} = v_{ij}\left(X_i, Y_j\right) = \beta_1 X_i + \beta_2 Y_j + \varepsilon_{ij} = \beta Z_{ij} + \varepsilon_{ij}, \tag{11}$$

where ε_{ij} captures variations in individual preferences due to unobservables; $i = 1, ..., N$ represents the individual; and $j = 1, ..., J$ stands for each choice available in the choice set. An individual i chooses alternative j if and only if it gives him the highest utility, that is, if $v_{ij} > v_{ik}$, $\forall k \neq j$.

Different assumptions on the distribution of ε_{ij} lead to a variety of discrete choice models. Our empirical approach uses the nested multinomial logit model, one of the most widely used in the class of the generalized extreme value models. Its use can be justified with two main arguments. First, it offers a method of linking the university choice with the decision on living arrangements, and of capturing any feedback between the two simultaneously determined decisions. Second, we suspect that unobserved utilities associated with the at-home university choices are correlated, as are the unobserved utilities associated with the out-home choices, violating the Independence of Irrelevant Alternatives (IIA) assumption.

Let all combinations of living arrangements-university be grouped into two nests (or branches), represented by B_m, one for at-home alternatives ($m = 1$) and the other for out-home options ($m = 0$), such that each alternative j belongs to only one nest. The probability of choosing alternative j given a particular type of living arrangement is the one of a conditional logit model for nest m alternatives, and is given by:

$$\Pr\left(\omega = j | \omega \in B_m\right) = \frac{\exp\left(\frac{v_{ij}}{\tau_m}\right)}{\sum_{k=1}^{J} \exp\left(\frac{v_{ik}}{\tau_m}\right)}, \tag{12}$$

where $\tau_m = \sqrt{1 - \rho_m}$; and ρ_m is the correlation coefficient for all choices within nest m. The coefficient τ_m represents the dissimilarity between all alternatives in nest m.[4]

[4] This parameterization is suggested by Heiss (2002). Hensher and Greene (2002) propose different, but equivalent parameterizations.

Probabilities given by Eq. (12) differ from the non-normalized nested logit model because the utilities are re-scaled by $1/\tau_m$.[5] Without this normalization, utilities in each nest would be scaled by a different factor and not comparable across nests. Unlike the non-normalized nested logit model, the formulation presented and estimated here is based on a RUM approach.[6] Hereafter, following Heiss (2002), we refer to our model as a random utility maximization nested logit (RUMNL) model.

The denominator in Eq. (12) is a (re-scaled) measure of the attractiveness of each branch m. In this literature, the log of that expression is called 'inclusive value', IV_m:

$$IV_m = \ln \sum_{k=1}^{J} \exp\left(\frac{v_{ik}}{\tau_m}\right). \tag{13}$$

If all τ_m lie in the unit interval, the model is compatible with a RUM formulation.[7,8]

The probability of staying at home is also a conditional logit probability for the choice between living and not living with parents, and is given by:

$$\Pr(\omega \in B_m) = \frac{\exp(\tau_m IV_m)}{\sum_{m=1}^{2} \exp(\tau_m IV_m)}. \tag{14}$$

The probability that a student chooses a combination j of living arrangements-university is equal to the product of probabilities in Eqs. (12) and (14):

$$\Pr(\omega = j) = \Pr(\omega = j | \omega \in B_m) \times \Pr(\omega \in B_m) = \frac{\exp\left(\frac{v_{ij}}{\tau_m}\right)}{\exp(IV_m)} \times \frac{\exp(\tau_m IV_m)}{\sum_{m=1}^{2} \exp(\tau_m IV_m)}. \tag{15}$$

The package NLOGITRUM developed by Heiss (2002) for STATA is used to estimate the model by full information maximum likelihood. It only allows explanatory variables to directly enter the conditional probabilities of the (elemental) alternatives (Eq. (12)). This way we avoid the difficulty of selecting nest-specific and alternative-specific vari-

[5] Following Heiss (2002), we use the designation non-normalized nested logit (NNNL) model to refer to the nested logit formulation that might not be compatible with a RUM formulation. This formulation is the most frequently presented in the literature (see, for instance, Greene, 2003), and the default in most econometric packages.

[6] See, for instance, Heiss (2002), Hensher and Greene (2002), Koppleman and Wen (1998), for a detailed discussion on the RUM formulation of the nested logit model.

[7] Börsch-Supan (1990) argues, however, that this condition, pointed out by McFadden, may be unnecessarily restrictive.

[8] The conditional logit model can be seen as a special case of the nested logit model, when $\tau_m = 1$, $\forall m = 0, 1$. It can easily be tested against the nested logit model by means of a likelihood ratio test.

ables, which several applications solve in an ad hoc, artificial way. Furthermore, "for the RUMNL model it does not make a difference at all if a nest-specific variable is specified for a nest or for all alternatives within that nest" (Heiss, 2002: 248).[9]

The estimated coefficients are not directly interpretable, as in most discrete choice models, and so the computation of marginal effects and/or elasticities is required. The derivative that describes the direct effect of a (quantitative) variable y_j on the probability of choosing university j given the living arrangement m is:

$$\frac{\partial \Pr(\omega = j|\omega \in B_m)}{\partial y_j} = \frac{\beta_{y,m}}{\tau_m} \Pr(\omega = j|\omega \in B_m)\left[1 - \Pr(\omega = j|\omega \in B_m)\right], \quad \forall j \in B_m, \;\; m = 0, 1, \tag{16}$$

where $\beta_{y,m}$ is the coefficient of variable y_j in branch m. For coefficients that do not vary with living arrangements, $\beta_{y,1} = \beta_{y,0} = \beta_y$, and β_y applies to both branches. The corresponding elasticity is obtained when multiplying the marginal effect in Eq. (16) by the ratio $y_j / \Pr(\omega = j|\omega \in B_m)$.

Instead, if we are interested in estimating the direct impact of a variable (y_j) on the probability of choosing a certain living arrangement type, then the expression is:

$$\frac{\partial \Pr(\omega \in B_m)}{\partial y_j} = \beta_{y,m} \Pr(\omega = j|\omega \in B_m) \Pr(\omega \in B_m)\left[1 - \Pr(\omega \in B_m)\right], \tag{17}$$

where $\beta_{y,m}$ is the coefficient for variable y_j associated with branch m. Once again, if the coefficient of a given variable is equal in both branches, then $\beta_{y,1} = \beta_{y,0} = \beta_y$. In order to obtain the elasticity, the marginal effect in Eq. (17) has to be multiplied by the quotient $y_j / \Pr(\omega \in B_m)$.

For individual-level variables included as the cross-product with a dummy for one of the branches, marginal effects as given in Eq. (16) are 0. Marginal effects for dummy variables are computed as differences in predicted probabilities, that is, the value of the predicted probability at 1 minus its value at 0, rather than using Eq. (17).

[9] An extra reason pointed out by Heiss (2002) has to do with the simplicity of command syntax.

3 Empirical issues

3.1 Institutional background

The Dutch higher educational system is a dual system with universities and professional colleges as the main education providers. Since the present study is confined to the university sector, we highlight its main features. In principle, students from the secondary education academic track (VWO, *Voorbereidend Wetenschappelijk Onderwijs*) have free access to any of the 13 publicly funded universities, and only they can apply for university education right after they get the high school diploma.[10] Only for some university study programmes, such as for instance medicine, dentistry and veterinary science, the number of admissions is limited at the national level and/or at the institutional level in order to assure that the number of people with a qualification do not exceed the number of jobs available in the labour market, and due to capacity constraints, respectively. In order to help universities in the following school year preparation, during their last year in high school, students report to the Central Office for Higher Education Application and Student Financial Support (IBG, *Informatie Beheer Groep*), what are the two universities and the two studies they like best. These are intentions, which might differ from students' actual choices. The choice of the study programme depends on the profile the student chooses in secondary education. That is, each one of the four possible profiles — science and technology, science and health, economics and culture, language and culture — prepares students for different sets of higher education programmes. As a result of the policy of geographical decentralization of the university system up to the 1970s, the average geographical accessibility of the university system is relatively high, as there are about three universities per 100 by 100 km grid cell. The city of Amsterdam has two universities, the Free university and the University of Amsterdam, while all the remaining university cities have just one institution.

Students have to pay fees, which are not very high and do not vary according to the study programme or the institution. Regular full-time students are eligible for student support. All university students are entitled for a basic grant, which amount depends on whether they live with their parents or on their own. As an example, in 2003, students living with their parents received 71.70 euros, while those who lived away from the parental home got 220.78 euros. Students from low-income families can apply for a supplementary grant. Irrespective of parental income, students can take out loans, to be repaid within fifteen years of the end of the period of study, if they can afford so. Part-time jobs up to

[10] Despite all universities are publicly funded and eligible for the same public support, three of them have private, religious denominations. These are the Free University, the Tilburg University, and the University of Groningen.

a certain amount of yearly earnings are compatible with scholarships.

Two types of free transportation passes are provided to Dutch students. One type is intended for students living away from home; it gives free access to public transport from Friday evening through Sunday, and discount for travelling over the workdays. The other type of pass is intended for commuting students; free travelling is valid only on weekdays, but over the weekend students get discounts.

3.2 Data and variables

The nested logit model presented in Section 2.2 is based on a tree structure consisting of two branches, one for each type of living arrangement; under each branch there are 13 university (elemental) alternatives, that is, all publicly funded universities. We discuss below the appropriateness of this nested structure. Variables, and data sources are presented in this section. The exogenous variables in Eq. (11) can be grouped into three categories: university-specific and location attributes; matched high school-university characteristics determining the university choice; and individual characteristics determining the living-arrangement choice. Table 1 summarizes the variable definitions.

Dependent variable. The Central Office for Higher Education Application and Student Financial Support provides background and actual decision information on the 2003 cohort of high school graduates. These are administrative data on first-time entrants; students who transfer to another higher education institution or change study programme are kept out of the analysis. Just the students who graduate from the academic track in secondary education (VWO) take part in the sample, as only they can directly apply for university education.

After eliminating missing data on all the independent variables presented below, there are 17,973 students remaining in the sample. This represents about 46% of the Dutch university applicants for 2003, and 79% of the university applicants with a VWO diploma.[11] To get the final sample, we deleted from the data all observations referring to students following study programmes with *numerus clausus*, as for them university is more a matter of chance, rather than a matter of choice.[12] Estimations presented below are then performed with a sample of 16,006 students.

[11] According to CBS (2005), there were 38,890 university applicants in the school year 2003/2004, of whom 22,770 had a VWO diploma.

[12] In the school year 2003/04 the studies/universities with rationed places were veterinary science (*Diergeneeskunde*, in Utrecht University); medicine (*Geneskunde*, in Leiden University, the University of Groningen, Utrecht University, Erasmus University Rotterdam, Maastricht University, Nijmegen, the University of Amsterdam, and the Free University Amsterdam); dentistry (*Tandheelkunde*, in the University

Table 1: Definitions of the explanatory variables

Variables	**Definition**
University-specific and location attributes	
Quality	University overall quality
Student-teacher	Student-teacher ratio
Diversity	Diversity of the study programmes offered
Religious (D)	= 1 if the university has a religious denomination
Centrality	Centrality index
Ho-Rent	Average housing price by m^2 X (D) = 1 for at-home options
Out-Rent	Average housing price by m^2 X (D) = 1 for out-home options
Leisure	% of higher education students in the municipality total population
Unemployment	Unemployment rate in the university municipality
Matched high school-university characteristics determining university choice	
Ho-Distance	Distance between HS and university X (D) = 1 for at-home options
Out-Distance	Distance between HS and university X (D) = 1 for out-home options
Peers	% of students from each high school choosing each university in the pre-application phase
Individual characteristics determining living arrangement choice	
Male (D)	= 1 if the student is male X (D) = 1 for at-home options
Age	Student age (in years) X (D) = 1 for at-home options
Dparent (D)	= 1 if at least one parent is Dutch X (D) = 1 for at-home options
GPA	Student GPA in final exams X (D) = 1 for at-home options
Supplem (D)	= 1 if the student gets supplementary grant X (D) = 1 for at-home options
Priv-Insurance (D)	= 1 if the student is privately insured X (D) = 1 for at-home options

Note: (D) stands for dummy variable; HS is the abbreviation for High School; and GPA means Grade Point Average.

Table 2: Observed choices (sample frequencies)

University		At-homers
LEI	Leiden University	62.68%
RUG	University of Groningen	33.85%
UU	Utrecht University	57.46%
EUR	Erasmus University Rotterdam	73.46%
TUD	Delft University of Technology	51.22%
TUE	Eindhoven University of Technology	70.57%
UT	University of Twente	31.21%
WU	Wageningen University	16.89%
UM	Maastricht University	38.95%
UvA	University of Amsterdam	61.63%
VU	Free University Amsterdam	76.47%
RUN	Radboud University Nijmegen	56.22%
UvT	Tilburg University	64.69%
	Sample size	16,006

Source: IBG (2003).
Note: The values represent the proportion of students staying at home, by university. The out-home corresponding percentage is the remainder.

Information on each student's actual choices comprises university and living-arrangement decisions. Combining the 13 available university alternatives with two living arrangement types, students end up choosing among a set of 26 pairs of options. Table 2 displays the sample frequencies of all at-home outcomes; the out-home corresponding percentage is the remainder. The Free University shows the biggest share of students still staying with their parents: about 76% of the sampled cases. It is immediately followed by Erasmus University Rotterdam, Tilburg University, Leiden University, and University of Amsterdam, where at-homers represent more than 60% of the first-time entrants.

University-specific and location attributes. Table 3 summarizes the main university (-related) characteristics that are assumed relevant in students' university choice.

The literature on the empirical testing of the motives for student choice has highlighted investment and consumption motives. In order to test for investment motives, we include a measure of the overall university quality. Measures of university attributes needed to construct such a quality index are taken from the annual survey conducted by the weekly magazine Elsevier (2003). In 2003, 23 study programmes were evaluated for the Elsevier ranking by interviewing a stratified sample of 3,071 university students.[13] We combine

of Groningen, the University of Amsterdam, and the Free University Amsterdam); international business (Maastricht University); public administration (*Bestuurskunde*, in Utrecht University); bio-medical sciences (*Bio-medische wetenschappen*, in Utrecht University and Leiden University); international business administration (Erasmus University Rotterdam); Psychology (*Psychologie*, in Erasmus University Rotterdam); and clinic technology (*Klinische technologie*, in the University of Twente).

[13]The respondents are asked to give points from 1 (for extremely poor) to 10 (for extremely good)

Table 3: University-specific and location attributes: summary statistics

Characteristics	Mean	St deviation
Quality	1.1507	0.6913
Student-teacher	12.6523	3.1808
Diversity	0.6189	0.2157
Religious (D)	0.2343	–
Centrality	2999.9270	1224.1580
Rent	19.1250	4.9225
Leisure	4.1171	2.2505
Unemployment	0.0527	0.0171

Sources: VSNU (2000), CFI (2005), LSVb (2003), and Elsevier (2003).

the scores on the six attributes in a composite overall index for educational quality of the university, such as:

$$quality\ index_j = \prod_{k=1}^{K} \left(0.5 + \frac{\exp\left(\frac{y_{kj}-\mu_k}{\sigma_k}\right)}{1+\exp\left(\frac{y_{kj}-\mu_k}{\sigma_k}\right)} \right), \tag{18}$$

where y_k are different university attributes, μ_k and σ_k are the mean and the standard deviation of each attribute, respectively, and $K = 6$.[14,15]

In an attempt to control for consumption motives, that is, to account for the fact that students consume cultural and recreational products, our analysis includes a proxy for

to the quality of their academic studies with respect to teaching facilities (computer rooms, seat availability), curriculum (topics in the programme and its relevance), tutors and lectures (supervision, office hours, lectures and syllabus quality), teaching quality (research skills, lectures), examination (connection between lectures, study materials and exams), and communication between the higher education institution and the student. For each university, a limited number of study programmes is evaluated, as a rule those with many students. For each university and attribute we compute the average score over the different study programmes, weighted by the number of students in that specific programme in the total number of students of the programmes evaluated at a specific university.

[14]The quality index is strictly positive, and varies between 0.5 and 1.5 per attribute (for more details, see Portela, 2001).

[15]Literature on returns to college quality on labour market outcomes suggests several other measures for quality. Behrman et al. (1996), Brewer et al. (1999) and Long (2004), among others, refer to the median SAT score of the college student body, instructional expenditures, student-faculty ratio, and percentage of the faculty with a PhD. The student-teacher ratio is available for all Dutch universities, but not usable, as it is highly correlated with the diversity index we use to measure the university scope and to distinguish between specialized and 'general' universities. In fact, because of the nature of the study programmes offered by universities that show low diversity in their study offer (specialized universities), the use of labs is often required and students are grouped in smaller classes. On the other hand, the percentage of the faculty with a PhD does not by itself fully capture institutional quality in all its dimensions. However, we estimate the model with the student-teacher ratio, and in Section 4 we discuss how those results compare with those for the model with the quality index.

the supply of leisure activities in each municipality which has a university. As: "Facilities like sport halls, university theatres, music ensembles, multimedia workshops and cinemas, depend crucially on the students' demand" (Van den Berg and Russo, 2004: 5), leisure is proxied by the proportion of higher education students in the municipality. It could be argued that in bigger cities, like for instance Amsterdam, the number of students represents a small proportion of the total population, although it is a leisure-type city. This is not, however, what emerges from the data. In fact, the higher education sector comprises not only the 13 universities dealt with in our study, but also 54 professional colleges attended, in 2003, by 338,830 other students (HBO-raad, 2005), several of which are located in university cities.

University location determines not only the leisure activities to which students have access, but also the housing market and the labour market constraints they face. Martinez-Granado and Ruiz-Castillo (2002: 319) show that: "housing conditions significantly affect the living arrangements of the young in a direct way, while unemployment exerts its influence indirectly through its negative effect on the propensities to work and to study." The price of student housing is, however, an ambiguous concept when some students stay in university accommodation, not available for all institutions, while other students share apartments or live in sub-let rooms, often without a legal rental agreement. Furthermore, house rents as provided by, for instance, Statistics Netherlands refer to apartments, not to student-type accommodation. For the present study, we obtained data from a survey on room prices, conducted in 2003, by the Dutch National Union of Students (LSVb, 2003). Room adverts were randomly picked from www.kamernet.nl: namely, the first ten advertisements on a certain number of days were taken and both the rent and the surface area of the room were registered.[16] The survey covers 253 offers in all 12 university cities in the Netherlands. Our model specification includes rents as the average housing price per square metre in euros, and allows it to have two coefficients, one for at-home and another one for out-home alternatives. This means that at-homers' and out-homers' choices are both influenced by housing rents, but their impact may be different between groups. While for students not living with their parents room rents refer to the housing costs they actually pay, for the other students they represent how much they will have to pay, if later they decide to leave the parental home.

The above-mentioned characteristics of the Dutch higher education system, indicating that it is rather inexpensive, spatially balanced and easy access to higher education, makes it less likely that price and supply considerations play a major role in the choice behaviour

[16] As it says in the site, "kamernet.nl is a service for people who wish to find a budget-conscious place to live in the Netherlands. The rooms offered on this site are particularly well-suited for students [... namely,] rooms in a rooming house, small apartments and studios, often times in downtown locations near the universities or colleges."

of students. In spite of focussing on demand issues, the analysis takes into account supply constraints that may be important in the university matching process. An attempt to control for supply-side influences is the inclusion of the diversity of study programmes in each university. The Central Funding of Institutions Agency (CFI, *Centrale Financien Instellingen*) supplies data on the total number of students by institution and field of study (CFI, 2005), which is used to compute a Shannon-Wiener diversity index of the study programme areas[17]

$$Diversity_s = -\sum_{m=1}^{M} p_m \log p_m, \tag{19}$$

where $M = 9$ is the number of areas of study offered by Dutch universities; and p_m is the proportion of study programme type m in a given university.[18]

The peculiarities of some universities make them more attractive to certain groups of students, and they tend to have national recruitment markets (Sá et al., 2004). As mentioned in Section 3.1, although all Dutch universities dealt with in our study are eligible for public funding, some of them have private denominations as their creation was supported by a religious group. Furthermore, the results by Sá et al. (2006) suggested that the proportion of universities with a religious base might play a role in the choice between university, professional college, and no higher education. The religious origin of some universities: namely, the University of Nijmegen, Tilburg University, and the Free University, is then controlled for by means of a dummy variable. There is also some variety in terms of university spatial location, with some regions being strongly oriented towards a university, whereas, in other regions, the universities face the competition of other institutions nearby. We control for the competition that each university faces by means of a centrality index, that is:

$$Centrality_j = \sum_{\substack{m=1 \\ m \neq j}}^{M} \frac{P_m}{d_{jm}}, \tag{20}$$

where m represents a destination rather than j; P_m is the total number of students in

[17]This index is used in Brose (2003), who took it from Magurran, in his work of 1988 on ecological diversity measurement.

[18]The Dutch Ministry of Education, Culture and Science groups all university study programmes into nine main areas: namely, Behaviour and Society, Economics, Education, Health Care, Land and Natural Environment, Language and Culture, Law, Nature, Technical. For areas which are not present in a given university, $p_m \log p_m = 0$. This follows from the L'Hôpital rule, according to which $\lim_{p_m \to 0} (p_m \log p_m) = 1/(1/p_m) = p_m = 0$.

university m; and d_{jm} is the distance between university j and university m.[19] Large values of the centrality measure are associated with universities in proximity to many other universities, and small values are associated with isolated universities. A positive sign for the coefficient of this variable implies that agglomeration forces are present, whereas a negative sign indicates the presence of competition effects and means that universities in close proximity to other universities are less attractive. That coefficient is 0 whenever there is no hierarchical destination choice and the location of a university relative to the other universities is not important. The relevance of centrality to the individual decision-making process might have something to do with students' forward-looking behaviour. This implies that students might choose more central universities, which are located in more urbanized areas, because they intend to settle there after graduation, and more central locations are associated with higher probabilities of finding a job within commuting distance.

Concerning labour market conditions, Ermisch (1999) concludes that a young person's own unemployment increases the chances that a student lives apart from his parents. Holdsworth et al. (2002) identify high regional levels of unemployment as possibly causing young adults to look for a job outside the locality of the parental home. Lower unemployment rates in some university cities might then be a reason for leaving the parental home and for choosing certain institutions. But unemployment is also suggestive of limited economic resources; and therefore it can also be associated with a reduced probability of leaving home and can be seen as an additional constraint in university choice. In order to test which of these two forces is at work in the Netherlands, individual utilities take into account the unemployment rate in the university municipality.

Matched high school-university characteristics determining the university choice. The individual-level data includes information on students' previous education, namely, on the high school attended and its address. We computed two variables based on the postcode of the high school and its name. Table 4 shows the descriptive statistics for these variables.

Geographical distance is computed as the straight line distance (in km) between the postcodes for each high school/university pair.[20] In general, the longer the distance to the university, the higher the costs students experience, and thus the lower the chance they

[19]The general formulation for this measure is $C_j = \sum_{m=1,m\neq j}^{M} P_m/d_{jm}^{\delta}$. We use the special case when $\delta = 1$, which is standard in the literature of hierarchical destination choice (see, for instance, Fotheringham et al., 2001).

[20]In order to avoid scale problems, we define the intrazonal distance, which is relevant when a high school and a university location coincide in the same region, as $d_i = ((\pi - 1)/\pi) \times \sqrt{s_i/\pi}$, where s_i is the area of region i measured in square metres (see Rietveld and Bruinsma, 1998). The formula assumes that regions are circular, and all zones are equally intensively used.

Table 4: Matched high school-university characteristics: summary statistics (N = 16,006)

		Mean	St deviation
Distance (in km)			
	At-home	29.9727	24.0902
	Out-home	82.6570	51.0197
Peers		21.2867	16.5085

Source: CBS (2005), IBG (2003).

select that university. Leppel (1993) discusses several explanations for this negative effect. For both at-homers and out-homers, distance captures the cost of gathering information about each university in the choice set. High school peers and teachers are a privileged source in this regard, and they have better knowledge on universities nearby. Furthermore, distance means costs: namely, the monetary costs associated with travelling.[21] Those still living with parents have the cost of everyday commuting, while those who move out of their parents' house have to pay for weekend travelling. There is also a psychic cost associated with distance, as individuals may feel less comfortable in places with which they are less familiar. Furthermore, distance necessarily involves establishing new social and interpersonal relationships. For these reasons, we expect a negative impact of distance on university choice, although distance perceptions might differ between at-homers and out-homers. To allow for differences between the two groups of students, we consider two coefficients, one for at-home options and another one for out-home alternatives.

Individuals, especially those with little information or experience, obtain information from the decisions of others, which points to the existence of social interactions. Social interactions refer to a type of externalities in which the decisions/actions of a reference group affect an individual's preferences or choices. These may develop along several dimensions, such as distance, race or ethnicity, religious affiliation, education. The reference group depends on the context, but neighbourhoods, friends and school peers are among the most used sources of information. In our study, social interactions result from peer choices, which are operationalized as the proportion of students in the same high school who intended, over the last year of secondary education, to choose one of the universities concerned, with the high school as the reference group (for its main summary statistics, see Table 4). The individual student is left out of the computations, and proportions are computed based on intentions, rather than actual choices.

Gaviria and Raphael (2001), in their study of juvenile behaviour, provide some arguments in favour of the choice of the school as the reference unit of analysis. The school is

[21] In the particular case of Dutch students, the monetary costs of travelling are not relevant, as they are all entitled to a transportation permit, allowing them to travel for free.

a 'neighbourhood' where youths are forced to interact with a fixed, well-defined (in terms of school, grade, track) set of peers. It could be argued that neighbourhoods should be used instead. However, as schools offer a larger pool of potential friends for a student than do neighbourhoods, students will establish, on average, more durable friendships with schoolmates than with neighbours. Because students interact mainly during school hours, estimated social interaction effects are more likely to reflect endogenous effects than contextual effects, because they reflect the influence of the behaviour of peers rather than the influence of peer background factors.[22] Using the argument of Gaviria and Raphael (2001: 257), "observable social interaction effects at the school level are more likely to be driven by bidirectional peer influences (rather than contextual effects) than are social interaction effects estimated at the neighbourhood level." Therefore, the peers variable we use reflects endogenous interactions, while we assume that contextual interactions do not exist. Following Brock and Durlauf (2003), we consider that the group choice probabilities are not constant across schools, but each individual within a group is modelled as possessing identical beliefs about the percentage of choices within the group.

Individual characteristics determining living-arrangement choice. As explained above, the nested logit model can be seen as a modification of the stochastic specification in the conditional logit model, and, like the conditional logit specification, it is the variation in college attributes that drives the estimates. In fact, the student's own characteristics are the same regardless of the alternative he chooses, and they cannot be a reason for choosing one university over another. However, individual student attributes may affect the way he responds to a university or a match-specific attribute. Thus, interactions of individual characteristics and a dummy for at-home alternatives enter the utility specification. Variables referring to individual characteristics included in the IBG data contain both demographic and family background aspects. Table 5 shows the summary statistics of individual characteristics for our sample.

Our empirical specification considers individual demographic variables such as gender, age, and parents' nationality. Although all students are similar in terms of years of schooling, they differ in the human capital stock at university entrance that can be measured by the GPA in high school final exams.

Several studies have explored the effect of family socio-economic background on young adults' co-residence decisions (see, for instance, Ermisch and Di Salvo, 1997; Ermisch, 1999). Whether the student gets a supplementary grant, and the type of health insurance

[22] Manski (1996) distinguishes between contextual interactions, which happen when a youth's behaviour is influenced by the exogenous characteristics of those in his reference group, and endogenous interactions that occur when a youth's behaviour is influenced by the incidence of that behaviour in the group.

Table 5: Individual characteristics: summary statistics (N = 16,006)

Variable	**Mean**	**St deviation**
Male (D)	0.4960	–
Age	18.3109	0.6980
Dparent (D)	0.1266	–
GPA	6.9032	0.5414
Supplem (D)	0.2380	–
Priv-Insurance (D)	0.5512	–

Source: IBG (2003).

are controls for socio-economic background. As explained in Section 3.1, only low-income students can get a supplementary grant. We generate a dummy equal to 1 if the student gets a supplementary grant, and 0 otherwise, and use it as a proxy for family income.

There are four health insurance types in the data set: public funds; public administration insurance; private insurance; and not insured. In principle, private insurance is indicative of better-off economic condition than public health insurance, as the government only takes care of those with low income or those who are refused insurance by a private company. Non-insured individuals are usually those not employed and not eligible for unemployment benefits, and so are in a worse economic condition when compared with those who are privately insured. We then use a dummy variable equal to 1 if the student is privately insured, and 0 otherwise, which acts as a crude measure for economic background.

3.3 Research strategy

Our empirical strategy is as follows. We first perform some tests on the IIA property and on the choice of a nested logit model against other available alternative models.

We continue estimating the model specified in Section 2.2 with the explanatory variables presented in Section 3.2. All results are obtained with STATA 9.0: namely, the package NLOGITRUM prepared by Heiss (2002). As STATA reports coefficients for τ_m, not ρ_m, inclusive value parameters in the regression tables should be interpreted in the following way: $\tau_m < 1$ means that alternatives within nest m are perceived as more *similar* than alternatives outside the nest; $\tau_m > 1$ means that alternatives within nest m are perceived as more *dissimilar* than alternatives outside the nest, and suggests that the nesting structure is not appropriate; $\tau_m = 1$ means that alternatives are independent, and the nested logit collapses into the conditional logit model.[23] Using model estimates, we compute marginal effects and elasticities for some relevant variables, and estimates of

[23] Each ρ_m can be obtained using the expression $\rho_m = 1 - \tau_m^2$.

the probability of choosing each university-living arrangement combination.

Finally, we perform some additional robustness tests on our model specification: namely, we estimate the model with alternative quality variables and under alternative tree structures.

4 Results

4.1 Nested logit: the preferred model

To start with, we perform the Hausman test of the IIA assumption based on the idea that if a subset of the choice set is truly irrelevant with respect to other alternatives, then removing it from the model will not lead to inconsistent estimates. The null hypothesis is that there is no systematic difference in coefficients between the model estimated for the full choice set and the model estimated for a subset of that choice set. Table 6(a) shows the results for such test when we take a university out of the choice set. In practice, two combinations are taken out each time, that is, each university combined with both at-home and out-home options. The results show that the null hypothesis is rejected at any ordinary significance level in all tests.

A similar test was performed by omitting each of the combinations one by one, and the null hypothesis is rejected at the 1% significance level in all 26 tests. These tests suggest that the IIA assumption between choices does not hold, suggesting that the more complex nested logit model should be used.

In order to show the advantages of using the nested logit over its conditional logit equivalent, we estimated a conditional logit model for all living arrangement-university combinations, and performed a Likelihood-ratio test on the null hypothesis that all inclusive value parameters are equal to 1. As shown in Table 6(b), the null hypothesis is rejected at any ordinary significance level, and so we reject the hypothesis of equal to unit inclusive values. That is, the test results are in favour of the nested logit model, when compared with the conditional logit model.

4.2 Main results

We therefore concentrate on the estimation results of the nested logit model (see Table 7, Model (1)). The inclusive value parameters are both within the unit interval, showing that the model is consistent with the RUM approach. The model includes two separate coefficients for distance and for rent, one for at-home options and the other for out-home alternatives. When we perform a Likelihood Ratio test for the equity of those coefficients,

Table 6: The preferred model: statistical tests

(a) Hausman test of the IIA assumption		
Removal of both at- and out-home	test statistic	(significance level)
Leiden U	250.93	(0.00)
U Groningen	431.53	(0.00)
Utrecht U	435.95	(0.00)
E U Rotterdam	660.25	(0.00)
T U Delft	365.23	(0.00)
T U Eindhoven	388.38	(0.00)
U Twente	247.02	(0.00)
Wageningen U	477.79	(0.00)
Maastricht U	148.59	(0.00)
U Amsterdam	171.80	(0.00)
Free U Amsterdam	257.28	(0.00)
R U Nijmegen	324.64	(0.00)
U Tilburg	493.77	(0.00)

The hypothesis was tested that there is a non-systematic difference in coefficients between the model estimated for the full choice set and the model estimated for a subset of that choice set. The test was performed 13 times by removing each time the combination of a university and both living arrangements. The table shows the test statistic and the lowest level of significance (in parenthesis) at which the null hypothesis can be rejected. These results show that the null hypothesis is rejected at any ordinary significance level in all tests.

(b) Likelihood ratio test on nested logit versus conditional logit models			
Log-likelihood Nested logit model		-38,814.52	
Log-likelihood Conditional logit		-38,852.78	
LR test statistic	76.52		(0.00)

The hypothesis was tested that both IV parameters are equal to 1, and so the nested logit collapses into the conditional logit model. The log-likelihood at convergence for both models, the test statistic, and the lowest level of significance (in parenthesis) at which the null hypothesis can be rejected are given in the table. The null hypothesis is rejected at any ordinary level of significance.

the null hypothesis is rejected, giving reason for such distinction. As it can be seen in Table 7, Model (1), university quality and diversity, and student's age, are not statistically different from zero. All the remaining parameter estimates are significantly, statistically different from zero, at a significance level of at least 5%.

Let us start with statistically non-significant coefficients. We found a correctly signed, but not significantly different from zero effect of institutional quality on the attractiveness of a university. It appears that Dutch students do not believe that a high academic standard brings them better credentials and hence better job opportunities after graduation. The indication that investment motives might not be at work in the Dutch higher education context was already found by Oosterbeek et al. (1992), more than ten years ago. Furthermore, it confirms the results achieved by Sá et al. (2004) in their regional level

Table 7: Nested logit model: estimation results

	(1)		(2)	
Variables	Coeff	St Error	Coeff	St Error
University-specific and location attributes				
Quality	0.0029	(0.0137)	–	–
Student-teacher	–	–	−0.0006	(0.0033)
Diversity	−0.0548	(0.0495)	−0.0448	(0.0584)
Religious (D)	0.0789 ∗ ∗∗	(0.0237)	0.0780 ∗ ∗∗	(0.0224)
Centrality	0.0001 ∗ ∗∗	(0.0000)	0.0001 ∗ ∗∗	(0.0000)
Ho-Rent	−0.0387 ∗ ∗∗	(0.0038)	−0.0388 ∗ ∗∗	(0.0038)
Out-Rent	−0.0610 ∗ ∗∗	(0.0038)	−0.0611 ∗ ∗∗	(0.0038)
Leisure	0.1575 ∗ ∗∗	(0.0091)	0.1571 ∗ ∗∗	(0.0091)
Unemployment	−1.3238 ∗ ∗	(0.6026)	−1.4094 ∗ ∗∗	(0.4787)
Matched high school-university charact. determining univ. choice				
Ho-Distance	−0.0314 ∗ ∗∗	(0.0010)	−0.0315 ∗ ∗∗	(0.0010)
Out-Distance	−0.0005 ∗ ∗	(0.0002)	−0.0005 ∗ ∗	(0.0002)
Peers	0.0326 ∗ ∗∗	(0.0015)	0.0326 ∗ ∗∗	(0.0015)
Individual characteristics determining living-arrangement choice				
Male (D)	0.4600 ∗ ∗∗	(0.0335)	0.4600 ∗ ∗∗	(0.0335)
Age	0.0141	(0.0104)	0.0141	(0.0104)
Dparent (D)	−0.2257 ∗ ∗∗	(0.0515)	−0.2256 ∗ ∗∗	(0.0515)
GPA	0.0997 ∗ ∗∗	(0.0261)	0.0996 ∗ ∗∗	(0.0261)
Supplem (D)	0.1934 ∗ ∗∗	(0.0403)	0.1935 ∗ ∗∗	(0.0403)
Priv-Insurance (D)	−0.3668 ∗ ∗∗	(0.0339)	−0.3668 ∗ ∗∗	(0.0339)
Inclusive Values				
At-home	0.8640 ∗ ∗∗	(0.0295)	0.8641 ∗ ∗∗	(0.0295)
Out-home	0.7137 ∗ ∗∗	(0.0310)	0.7134 ∗ ∗∗	(0.0311)
Log-likelihood	-38,814.52		-38,814.53	
Nr Observations	16,006			

Note: 1. Significance at the 1, 5 and 10% level is indicated with ***, ** and *, respectively.
2. These are the estimation results for the nested logit model with either the composite index (Specification (1)) or the student-teacher ratio (Specification (2)) for the university quality.

analysis; they argue that this might be an inevitable outcome of the egalitarian tradition in university funding, which has contributed for non-discernible differences in quality between the Dutch universities. The diversity of the study programmes appears to be not relevant in student university choice. Age is unimportant for the home-leaving decision. This result has probably to do with the fact that there is not very much variation in age among the individuals in our sample: namely, about 90% of the students are either 18 or 19 years old.

As explained in Section 2.2, the magnitude of coefficient estimates are not directly interpretable, and computation of marginal effects and elasticities is required. Table 8 shows the marginal effects on the probability of choosing a university conditional on living

Table 8: Selected (direct) marginal effects and elasticities on the probability of choosing an university, given the living arrangements

	Elasticities		Marginal effects	
	Prob univ j given at-home	Prob univ j given out-home	Prob univ j given at-home	Prob univ j given out-home
University-specific and location attributes				
Religious (D)				
RUN			−0.0048	−0.0075
UvT			−0.0045	−0.0072
VU			−0.0052	−0.0056
Centrality	0.0000	0.0000		
Rent	−0.6481	−1.1976		
Leisure	0.5716	0.6617		
Unemployment	−0.0617	−0.0711		
Matched high school-university characteristics determining university choice				
Distance	−0.8191	−0.0388		
Peers	0.6050	0.7109		

Note: 1. Elasticities and marginal effects are computed using the expressions presented in the text. Marginal effects for the religious universities' dummy are computed as the difference between the probability of choosing a given religious university if that university is no longer religious and that same probability if it continues to be religious. Both marginal effects and elasticities in this table refer to Model (1), in Table 7.
2. See Table 2 for the names of the universities.

at home and conditional on not living at home for the religious variable, for Model (1). These are direct effects, computed as changes in the probability of choosing each religious university if it was to change into a non-religious university. For the remaining variables, to help interpret the results, we report elasticities, but only for parameter estimates that are statistically, significantly different from zero.

Table 8 shows that all religious-denominated universities would be chosen less if they were to become not religious, and such impact would be stronger for out-homer's choices than for at-homers' decisions. Considering this scenario might seem a merely academic exercise, as it is not very likely or even real that a university would give up its religious denomination. However, these results clearly show that the religious denomination of some universities might be a relevant attribute in student choice. This has possibly to do with the central role of denomination within the Dutch primary and secondary sectors of education. Although church attendance in the Netherlands has decreased dramatically, "the denominational educational system has remained largely intact" (Driessen and Van der Slik, 2001: 562). Students attending a religious-denominated high school are then more likely to choose a religious-denominated university. Another potential source of explanation is the one that establishes a link between religious denomination and the ethnic mix of students. In this regard, our data do not provide very conclusive insights.

Although 25% of students with a non-Dutch background (that is, both parents are non-Dutch) attend religious universities, the share of non-Dutch students in some non-religious universities is still also quite high.

The estimate for the coefficient of the centrality index is positive and statistically significant, suggesting that more centrally-located universities attract more students. A university is more centrally-located than another university if is it closer to a good number of big institutions. Higher values for the centrality index are then found in the highly urbanized Randstad area, which has 6 out of the 13 universities, and where there are plenty of job opportunities for university graduates. It is then possible that students are forward-looking in that they take into account to what extent a university has a central location in the country, so that after having finished their studies it may be relatively easy to find a job within commuting distance. The effect of this variable is, however, very small, as its marginal effect (Table 8) is very close to zero. Despite the statistical significance, it appears that its economic impact is nearly null, and so virtually no hierarchical choice is at work in higher education students' decisions.

As we anticipated above, rents play a major role in student university choice. The probabilities of choosing a given university conditional on any of the living-arrangement alternatives are negatively influenced by housing prices. The effect is, however, stronger when students opt to live away from their parents' home, which is understandable as for them rents mean an actual cost, while for at-homers rents are just a potential (future) cost.

Although investment motives do not seem to be at work in the Dutch higher education market, there are consumption reasons behind the decision to attend a given university. Students living apart from their parents appear to be more concerned with the leisure supply in the university location than those staying at home. Our finding of the positive effect of city attractiveness on students' choices reinforces and extends what Oosterbeek et al. (1992) found for economics students.

The effect of distance works in the same direction as that of rents, as distance deters students from choosing a given university that is far from home. We confirm in the present setting those results of Oosterbeek et al. (1992), using individual-level data, and Sá et al. (2004), employing aggregate-level data, that distance is associated with a disutility and the probability of choosing any university decreases as distance increases. Another sensible result is that at-homers are more deterred by distance than out-homers, as follows from the comparison in size of both elasticities.

The unemployment rate at the university location has a negative impact on university choice, suggesting that labour market conditions are relevant for student decisions. Elasticities, as shown in Table 8, reveal that out-homers are more affected by changes in the unemployment rate than at-homers. At-homers have the option of working in the region where they live, which is often different from the one where they attend university, and then conditions in the labour market of the residence area might overcome potentially worse employment prospects at the university location.

Unlike Oosterbeek et al. (1992), our results suggest that students copy their high school peers' choice. This is to say that their decisions rely on student-to-student meetings that create information flows within each high school about the best university environments and the benefits and costs of studying in a given higher education institution. Out-homers' decisions are more influenced by their peers than are the choices of those staying at home.

Table 9 shows the (direct) marginal effects of individual characteristics on the probability of staying at the parental home. Our model estimates reveal that women leave home earlier than men, a finding consistent in all models of leaving home throughout Europe and North America (Holdsworth et al., 2002). The tendency to leave the parental home is less frequent among students with very good high school performance, when compared with their low-ability counterparts.[24] Having a Dutch background appears to make young adults more likely to leave home, pointing to cultural differences as a possible explanation for such resolution. We confirm the relevance of socio-economic background, measured here by the right to a supplementary grant and the type of health insurance, on young peoples' decision to live on their own. Such low residential mobility among poorer students limits their university choice, and should concern policymakers, usually engaged in assuring equal opportunities to all individuals. Furthermore, helping poor students in moving out parental home will have a direct impact on their university choices and potentially on their performance.

Estimated probabilities of the choice of each and every alternative are computed on the basis of the estimation results presented above. Table 10 shows the predicted probabilities for elemental alternatives, based on estimation results for Model (1), in Table 7. It emerges that about 55% of the first-year students stay at home. Utrecht University, located in the geographical midpoint of the Netherlands, appears as the most chosen one, by at-homers, whereas out-homers seem to prefer the University of Groningen.

[24]We believe there is no unique reason for this fact. It might have to do with personal preferences (e.g., better students want to concentrate on their study and give less priority to live independently); the fact that in the Netherlands there is no numerus clausus for most studies, and hence both low and high ability students have the same university opportunities; the parental residential location choice, which makes that better students are more likely to live close by the best schools, and they therefore do not need to move to attend university.

Table 9: (Direct) marginal effects on living-arrangement decision

	Probability of living at home
Individual characteristics determining living arrangement choice	
Male (D)	0.1041
Dparent (D)	−0.0509
GPA	0.0247
Supplem (D)	0.0432
Priv-Insurance (D)	−0.0826

Note: Marginal effects are computed using the expressions presented in the text, and refer to Model (1), in Table 7.

Table 10: Predicted choice probabilities

University	At home	Out home	Total
LEI	0.0474	0.0366	0.0840
RUG	0.0529	0.0766	0.1295
UU	0.0962	0.0651	0.1613
EUR	0.0534	0.0332	0.0866
TUD	0.0300	0.0285	0.0585
TUE	0.0260	0.0252	0.0512
UT	0.0181	0.0239	0.0420
WU	0.0137	0.0123	0.0260
UM	0.0232	0.0250	0.0482
UvA	0.0543	0.0274	0.0817
VU	0.0475	0.0257	0.0732
RUN	0.0464	0.0374	0.0838
UvT	0.0386	0.0354	0.0740
Total	0.5477	0.4523	1.0000

Note: 1. The probabilities in this table were computed based on the estimation results for Model (1), in Table 7. 2. For university names, see Table 2.

4.3 Additional checks

To test the robustness of our results, we tried out several alternative specifications. First, an alternative way of measuring institutional quality very much in use in the student choice literature is, as referred to above, the student-teacher ratio. Estimation results for the model with that variable instead of the quality index are in Table 7, Model (2), but show no big differences, when compared with those of Model (1) in the same table.

Second, similarly to what we did for other location-related variables like rent and distance, we estimated the model with two coefficients for leisure, one for at-home options and another one for out-home alternatives. In that case, however, one of the inclusive values exceeds 1, hinting that the model specification is not compatible with a random utility maximization approach.

Finally, we chose our 'preferred' tree structure after evaluating the results obtained from a number of potential candidate trees. While searching for the appropriate nested structure, we kept in mind that the main purpose of the nested logit model is to accommodate the violation of the IIA assumption. "It has nothing to do with any behavioural belief in the way that alternatives are assessed in the process of making a choice" (Hensher et al., 2005: 482). Thus, we were looking for a tree that is compatible with global utility maximization, and that results in the lowest log-likelihood. The necessary conditions for a nested structure to be consistent with global utility maximization are inclusive values lying between 0 and 1, and scale parameters declining in value as we move up the tree (Hensher et al., 2005).

In a first attempt to look for the 'best' model, we re-estimate the nested logit model based on a tree with 13 branches, for each and every university, and two-living arrangement alternatives within each branch. Most coefficients show the same sign and significance as those in the model presented above. Among other tree structures we tried out, we would like to refer one in particular, the one that explicitly incorporates the university city. Our model specification considers not only university attributes, but also some location aspects. While the former may be different among universities, the latter are common to universities sharing the same location. In the particular case of the Dutch higher education setting, this occurs for the University of Amsterdam and the Free University, which both happen to be located in the city of Amsterdam. We accommodate this location coincidence in our model by means of a three-level nested structure with the two living-arrangement limbs on the top level, two city branches within each limb (Amsterdam and non-Amsterdam location), and finally the universities at the bottom level. Although the main results in terms of sign and significance are the same as in the model presented earlier, again such a three-level nested logit model is not compatible with a RUM formulation as 1 out of the 6 inclusive value parameter estimates is above 1.

Thus, our conclusion is that our results are robust to the inclusion of alternative quality variables and to the tree structure behind the nested logit model. There are, however, some weaknesses of our study that we would like to discuss. First of all, there may be a statistical problem (selectivity bias) that does not allow us to generalize these results to all high-school leavers, as only students who can directly continue on to university education took part in our sample. Furthermore, we are missing some exogenous variables that are relevant for this decision process. The analysis of students' decisions: namely, concerning living-arrangement choice, would be enriched if some information on parents' money transfers to their adult children was available. Finally, we are missing part of the choice problem, by not accounting for the choice of the study programme. It might happen that the choice of a field of study may constrain the choice of an institution as well.

5 Conclusion

Universities are bundles of education, leisure and social networks. Furthermore, university attendance is often associated with the decision on whether to move out of the parental home. Data on individual student choices and characteristics were combined with university attributes and matched high school-university features in order to estimate a Random Utility Maximization Nested Logit model on the factors that influence university choice and living-arrangement decisions.

We did not find evidence of a quality pattern of choosing a university, which goes against human capital theory predictions. Quality turns out to be non-relevant for student university choices; this evidence appears to be in line with some previous studies, suggesting that no big changes have been in place in the Dutch higher education market, in that regard.

Another major result is that of the importance of leisure supply in the university location in influencing student university choice. It is very much in the interest of cities to attract and fix highly educated individuals, as they add to the city's human capital stock, which is highly relevant for local growth. Of course, students may not have to move in order to access leisure benefits, as they can simply stay at home and commute to obtain those benefits. Thus, the local leisure supply has to be coordinated with other policies that make students want to fix residence in the city where they attend university. The first step that can be taken towards that direction has to do with the housing offer and housing prices. There is evidence of different attitudes towards university choices of individuals who live with their parents and those who live apart. Our results confirm that housing rent is the most important factor for both at-homers and out-homers, and that the high housing costs in some university cities are deterring students from going there to attend university. Universities and local authorities should work together on these issues, by offering university students affordable housing and promoting their integration in the local community. Active, integrated strategies of housing and leisure can attract students in first place, and attach them to the city, in such a way that they fix residence there after the completion of their studies. As there are peer effects at work, these policies are expected to have a multiplier effect.

Distance is shown to have a negative impact on university choice. Universities cannot easily interfere in direct financial costs associated with distance, as these are not under their control. But distance also implies less reading and hearing about the university, and on this issue universities still have a word to say. More advertising would increase a university's visibility and possibly its enrolment rate.

Our results also give some indication of possible factors contributing to the recent trend for late home leaving. Low income, usually not enough to pay the high rents in most university cities, is among the reasons behind the decision to postpone the beginning of independent life. From an individual point of view, it is important to highlight that students from disadvantaged economic backgrounds appear to be more constrained in their choices than any other students. The hope of policy makers is that low-income students should have the same options as their counterparts in choosing where to attend higher education. In pursuing this objective, low-income students should be provided with sufficient financial help to enable them to freely choose whether to stay at home and where to attend university.

In closing, some higher education policy issues and implications of these results need to be considered and summarized. At the national level, in particular, the Ministry of Education, Culture and Science should ensure that poorer students are not restricted in their choices because of their low-income situation. This could be achieved by reforming the student aid scheme. Public student loans and their repayment conditions could be used to improve equity. Namely, if all students could easily get a loan, and loan amounts are sufficient to cover expenses of all kinds, then free fees and scholarships can be restricted to poor students. Furthermore, repayments should be income-contingent and low-income students should pay subsidized interest rates. At the local level, city councils and administrators should involve students and graduates in city life, as they are key actors in local development. In order to fix these highly educated workers in the city, the cultural and recreation environment, and the offer of good value housing are crucial factors that should be enhanced. Finally, at the institutional level, some work has to be done in conjunction with local authorities in providing a pleasant environment in which to study and to live after graduation. A direct and effective marketing strategy should then involve actual students who could play an important role in advertising the university and the city.

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