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Maja Mihaljević Kosor

**Examining the Determinants of Student Non-
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Examining the Determinants of Student Non-completion in Higher Education: An Application to Croatia

MAJA MIHALJEVIĆ KOSOR

University of Split, Faculty of Economics

Matice hrvatske 31, 21000 Split, CROATIA

Phone: ++385 21 430 722 Fax: ++385 21 430 701

E-mail: majam@efst.hr

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ABSTRACT: *Similar to other European higher education (HE) systems, the Croatian HE framework has experienced some remarkable changes since the 1990s. The number of students enrolled increased by more than 80 percent in the last 15 years, while, at the same time, the number of students repeating their first year tripled. This indicates serious problems in non-completion, especially in the first year of studies. To gain more insight, this paper presents the theoretical background for examining student non-completion and identifies the main determinants. A model of student non-completion is developed and adjusted to Croatian context. Using a rich dataset on 8 cohorts of one large Croatian HEI, the empirical work in this paper analyses the effects of student's personal characteristics, his/her peers, student's effort level, parental qualifications, previous and current schooling characteristics on the probability of non-completion of the first year of studies. This research is also relevant and applicable in other countries experiencing these inefficiencies in student non-completion.*

1. Introduction

The goal of this paper is to increase knowledge on the determinants of students' failure to progress, focusing on Croatian higher education institutions (HEIs) with students as the key actors, and taking account of the educational environment in which they find themselves. Analysis in this area is of significant policy interest as non-completion may have an adverse effect on the efficiency and effectiveness of a higher education (HE) system. Any type of wastage is generally considered economically inefficient since it usually indicates a loss of private and social investment in HE. For the individual there are considerable monetary, work-related and other societal benefits stemming from completing HE and, inversely, potentially high pecuniary and non-pecuniary costs stemming from non-completion. In the labour market especially, the costs associated to non-completion can be considerable for leavers. Johnes and Taylor (1991) found that UK early leavers earn less than graduates and experience a longer duration of unemployment. Feirman (2005) finds that psychological distress namely, anxiety, depression, and self harm, increased dramatically for undergraduate student leavers in the US. Regarding the HEI, Ramsey et al. (1996) found some additional negative aspects of non-completion where student non-completion damages the reputation of the HEI and may lead to a loss of institutional resources.

However, not every withdrawal from HE is a negative experience for an individual. For some students leaving HE is a step towards discovering their true goals and occupations fitting their interest and ability. Also for the HEI, non-completion does not necessarily need to be negative; as Smith and Naylor (2004) argue, although there are costs associated with non-completion, it is doubtful that the optimal rate of non-completion is zero and “a successful matching between degree courses and students is likely to require that some withdrawal is desirable on efficiency grounds” (p. 447). What is recognized as important is that the HEI distinguishes between those forms of non-completion that are regrettably unavoidable and those where the institution can still instigate some actions to promote completion (Tinto, 1993). In a similar vein, government policy needs to be based on a clear understanding of non-completion and its extent as a potential problem in an economy.

There are four main motives for investigating the issue of student non-completion in Croatian HE. A primary motive for examining the determinants of non-completion is related to the situation in Croatian HE. Although the number of students enrolled in Croatian HE increased by 92 percent from 1990/91-2007/08 (Central Bureau of Statistics, 2008), only about two thirds of the enrolled students eventually, over a longer period of time, completed their studies and obtained degrees (Šošić, 2004). A problem is also the increasing share of students repeating their first year of studies which expanded from 14.8 percent of the total students enrolled in the first year (in 1991/92) to 26 percent in 2003/04. In the same time period, the number of students repeating the first year tripled while the number of students enrolled in the first year increased by 1.7 times (MSES, 2005). This indicates serious problems in non-completion, especially in the first year of studies, and warrants a more detailed analysis.

Furthermore, changes occurred in the pattern of financing of HE studies. In 1993/94 the cost of the tuition fees for 88.2 percent of the students was borne by the Ministry. However, by 2004/05 the Ministry covered the tuition fees for only 43.3 percent of students. In the same period, the number of students self-financing their studies increased nine-fold for full-time students and seven-fold for part-time students (Babić et al., 2006). This indicates a change from a predominantly public pattern of financing the costs of tuition to the mixed model with an increasing share of students bearing the costs. This seems to be a common trend in the developed economies (Adnett, 2006). OECD report (2001) links some of the problems of Croatian HE to centralised and ineffective funding mechanisms with highly autonomous Faculties in relation to universities. The income from tuition fees represents a large part of an HEI's budget (e.g. according to the OECD-2001 nearly 50 percent of the annual budget of the University of Zagreb comes from this source). Hence, an overview of the theory of non-completion and an analysis of the main determinants and how they apply to the Croatian context may improve the understanding of the issues related to non-completion in the country's HE sector. Furthermore, this type of research may provide a valuable comparison of the situation in Croatian HE before and after the implementation of the Bologna process guidelines when more data becomes available for empirical analysis. In addition, this is also the first empirical assessment of non-completion for Croatian HE.

A second motive for focusing the research on non-completion is that due to the greater access into HE there is already a widespread concern over rising rates of non-completion identified in European and US education systems. In many OECD countries enrolment rates to HE more than doubled during the last thirty years. Following this expansion there has been in many countries an increase in non-completion rates. This led some of the recent reports on the future of the European HE systems to stress the need for its reform and to specifically highlight student non-completion as problematic (in Aghion et al., 2008; van der Ploeg and Veugelers, 2008a).

A third motive is related to financial issues. In Croatia, due to the undeveloped financial markets and student loan schemes, students bear considerable costs of education (Šošić, 2004) and income from tuition fees forms a large part of the HEI's budget. Hence, in the empirical work an objective is to examine the effects of the former costs on student (non)completion, since the bulk of empirical studies suggest that financial considerations are an important predictor of student (non)completion.

A fourth motive is related to the use of non-completion as a performance indicator. This practice is relatively common in US HE and is also being applied in the UK HE system. Intentions exist to develop performance indicators for Croatian HE (MSES, 2005), however no research so far has been undertaken on this topic. Although the empirical work presented in this paper cannot directly provide answers to this issue, it may be useful in identifying some limitations of performance indicators based on non-completion data. In general, several problems appear in using the non-completion rate as a performance indicator and as a measure of the quality of an HEI. Some institutions, according to their institutional mission may seek to attract 'second chance' students and hence, be at risk of high non-completion rates given that this student population may not be able to fulfil the demands of the HE system. In a similar vein, while the government may pursue the goal of widening participation, high non-completion rates may cause some HEIs to limit the type of students they admit, as the goal of widening participation may conflict with a better HEI ranking (Yorke, 1999).

This paper is organised as follows. Some of the problems encountered when defining and measuring non-completion in HE are highlighted in section 2. Section 3 presents

an overview of the development of the theory of student non-completion, highlighting central features of the models pertinent to non-completion research, and indicating some of the limitations of those models. A critical examination of previous empirical work follows in section 4, with a focus on the more widely used variables contributing to an increased probability of non-completion. In section 5 a model is developed and used in estimating the probability of non-completion of the first year of studies for one large Croatian HEI. The dataset is analysed, multiple imputation is applied and the main empirical findings are discussed. A discussion of the wider policy context and general conclusions then follow in section 6.

2. Defining and Measuring Non-completion in HE

The major theoretical and empirical contributions on non-completion for the HE sector have come from authors in the United States and UK. Nevertheless, there is still no general consensus on the terminology used to describe and model non-completion in education. Frequently used terms referring to non-completion are student non-retention, non-persistence¹, departure, failure, discontinuance, withdrawal, wastage, attrition, and dropping-out and the students leaving the HE system are often referred to as dropouts. However, it is the opinion of this author that the term dropout is inappropriate since it may attach negative connotation to students leaving the HEI and label them as (academic) failures where for some individuals leaving the HEI presents a positive experience, i.e. these individuals may have gained knowledge about their real occupational interests, about the match between course requirements and their abilities, established and remain in contact with other students and in some cases even continued their HE at the same or at a different HEI². Furthermore, the term 'dropout' itself does not offer an insight to why the student discontinued his/her education; hence students leaving due to illness or to academic failure are in both cases labelled as dropouts. In addition, the review of the literature on student non-completion in the US presented by Kalsner (1992) revealed that students typically withdraw from HE due to personal, social and financial

¹ This term does not refer to student effort, determination or diligence but is widely used in the literature on HE and refers to students proceeding from one year to the next.

² Some students leave one HEI to later transfer to another HEI. Hence, these students are not dropouts in the HE system but should be referred to as stopouts. However, due to difficulties in monitoring individual students who transfer to a different HEI they are in most cases labelled as dropouts.

considerations whilst academic dismissal is characteristic of only a relatively small number of withdrawals. In Europe, the situation is similar and non academic problems are also found to be more likely to contribute to student's withdrawal (e.g. Davies and Elias, 2003; Boero et al., 2005; Hovdhaugen, 2009). Given the above, the term 'student leavers' will be used instead of dropouts³.

The issue of student non-completion in Europe has received little attention in comparison to the research carried out in the United States. In a large part this was because the non-completion rates were quite low in some countries e.g. in the United Kingdom they were about 8 percent in the pre-1992 universities; reported in Johnes and Johnes (2004), while in contrast in the US only around 50 percent of those who enter tertiary level education successfully complete their programmes (OECD, 2007). To avoid differences between definitions of dropout rates used in various countries and between various authors, the survival rate estimated in the OECD 2007 report is used. This measure is calculated as the ratio of the number of students who graduated from an initial degree during the reference year (for the OECD 2007 report the reference academic year was 2004/2005) to the number of new entrants into that degree n years before, where n is the minimum number of years of full-time study required to complete the programme. However, this measure is a relatively simple indicator and takes no account of stopouts, students transferring between different programmes at the same HEI and students taking longer to complete. Nevertheless, using the OECD survival rate allows more appropriate cross country comparison to be made than relying solely on estimates in various studies for different education systems.

Given the vast differences in education systems across the OECD countries some simple information based on the survival rates is presented next. The average survival rate for 23 OECD countries is around 71 percent, i.e. around 29 percent of students fail to successfully complete the HE programmes they undertake within the n years (OECD, 2007). However, there is wide variation in survival rates among the countries considered. In the US, as previously mentioned, just above 50 percent of those who

³ Additionally, in the literature on non-completion the distinction between students who had withdrawn and students who had failed can also be found, although some authors use them as synonyms. Given the general lack of information on the reasons why students did not complete their HE the term 'student leavers' is again preferred.

enter tertiary programmes successfully graduate while in the UK and Japan over 80 percent complete their tertiary programmes, and in Austria 65 percent. In Croatia, according to this author's personal calculations of the number of those who completed in 2005 compared to the ones enrolled four years previously for the first time to the first year of studies, the survival rate in the academic year is around 54 percent. In comparison to the OECD countries (OECD, 2007) this would be at the lower end suggesting that this is an important issue to analyse. In terms of the increasing participation, a similar situation may be observed in the EU-25 region where the number of students increased steadily at a rate of over 2 percent from 1998-2002 (OECD, 2006). There were also large variations among countries and in Latvia, Lithuania and Romania the number of students in HE increased by over 50 percent. With increasing participation in HE throughout Europe it can be expected that non-completion rates will likely increase which then presents a considerable educational and national policy concern. As previously noted, these concerns are already expressed in some of the recent reports on the situation in European HE (Aghion et al., 2008 and van der Ploeg and Veugelers, 2008a).

Given the lack of reliable national data on non-completion a comprehensive picture of the situation in Croatian HE cannot be made. This limitation is partly related to the issue of defining non-completion across the Croatian HE system and its HEIs. For example, students from one Croatian HEI who discontinue their education in the first year may be classified in three groups: as students who are intermitting (taking a lapse year), leaving (both voluntarily and involuntarily) or transferring (between the programmes at the same institution or leaving to some other). In general, each HEI is unrestrained in classifying/defining non-completion.

3. The Theory of Student Non-completion and Its Application

In this section theoretical studies and conceptual frameworks dealing with non-completion are considered. An overview is provided focusing on two strands: Tinto's (1975) theory and model of non-completion from the education literature, which is the most widely used model, and Becker's (1974) and Stratton et al.'s (2004) model from the human capital theory. These conceptual frameworks help in identifying variables likely to influence student non-completion for the empirical part of this paper.

One of the most extensive theoretical studies of non-completion in tertiary education is that by Tinto who developed a Student Integration Model (1975) which was further extended in 1988 and 1993. The origin of Tinto's theory of non-completion may be linked to Durkheim's (1897) groundbreaking theory of suicide and Spady's (1970, 1971) initial work on student non-completion. On a simplified basis, the underlying logic in the theory of suicide is that people who are not well integrated in the society are more likely to commit suicide. Whereas most of the contemporary studies of suicide before Durkheim's focused on individual characteristics, Durkheim argued that suicide is primarily caused by a lack of integration of the individual into society, i.e. suicide is defined as a cutting off of social bonds. However, Durkheim's theory was also criticised on the grounds that it focuses on social integration of the individuals while disregarding psychiatric impairments (which had been nearly always found to be a significant determinant of suicide) and the finding that the majority of people suffering from weak social integration do not commit suicide. Spady (1970, 1971) was the first to attempt to apply the theory of suicide and explain the importance of social integration to non-completion. Spady's (1970, 1971) initial model of non-completion included five independent variables, namely, grade performance, intellectual development, normative congruence and friends' support all of which influenced the fifth variable, social integration. However, it was Tinto's work (1975, 1988, 1993) that laid the foundations for the study of student persistence/non-completion.

Comparable to Durkheim, Tinto (1975) relates dropout to a student failing to socially and academically integrate at university, i.e. "*... the process of dropout from college can be viewed as a longitudinal process of interactions between the individual and the academic and social systems of the college during which a person's experiences in those systems (as measured by his normative and structural integration) continually modify his goal and institutional commitments in ways which lead to persistence and/or to varying forms of dropout*" (Tinto, 1975, p. 94, in Woodley, 2003). Therefore, the explanation in Tinto's (1975) Student Integration Model (SIM) of non-completion or persistence depends on the quality of the match between the student and the institution. In the model, students are viewed as entering the HEI with certain personal characteristics and with their goals, commitments and intentions. Attributes such as age, gender, family characteristics, student ability and prior schooling

contribute to student's goals and commitments. Moreover, goals and commitments are continually modified as a student progresses through his/her studies leading to persistence or to non-completion where student's academic and social experiences will either help the student to integrate into the HEI and to persist, or the opposite may happen and the student will not complete the programme. Integration in the SIM depends on two factors: the match between the student and the HEI and the social interactions between the student and others at the institution (other students and the HEI staff). In the SIM model, academic integration is primarily determined by student's academic performance and his/her level of intellectual development, whereas social integration is primarily a function of the extent and quality of peer group interactions and student's interaction with the HEI's staff (Tinto, 1975). According to Tinto (1975), the higher the level of integration the more likely is the student to persist.

Tinto (1993) also identifies eight reasons for student non-completion: isolation, finances, obligations, poor student-university match, problems in adjustment, commitment and intentions (other aspirations). The application of the SIM model was central to a number of studies (Aitken, 1982; Pascarella and Terenzini, 1991; Johnes and McNabb, 2004) and most of these studies supported the validity of the major variables in the model. However, none of the research papers employed the whole range of explanatory variables that Tinto (1993) hypothesised about, nor did they examine their salient features. The main critique directed at the Student Integration Model is that it is putting too strong an emphasis on social integration with only a modest stress on the personal characteristics of students. Also, it is mostly focusing on full-time residential students in the United States who have just recently graduated from school thus making it complicated to apply the model to e.g. adult learners, foreign students and distant learners, or to education systems in other countries since the variables and functional relationships may require a somewhat different specification (Towles and Spencer, 1993; Yorke, 1999, Braxton, 2000). Woodley (2003) argues that there is a problem of obtaining suitable data, especially on personal characteristics and testing the model. Moreover, as McCubbin (2003) argues, basing the model of student attrition on the theory of suicide attaches a negative connotation to non-completion where for many students it can represent not a failure but a positive experience as argued in section 5.1.

The next major model of student non-completion was developed by Bean and Metzner (1985). These authors argue that the above models relied too heavily on the socialisation aspect to explain non-completion. A supplementary theory was necessary to explain non-completion for non-traditional students (i.e. married, parents, older, working and part time students) who did not have the occasion to become socially integrated in the HE community. The model was developed from Bean's (1980) initial work on student non-completion, i.e. from his Student Attrition Model (1980, 1983) that supports the idea that student's withdrawal from a HEI is like employee turnover where behavioural intentions and financial factors influence non-completion. Bean emphasises the role of intentions (i.e. factors external to the HEI), while Tinto's model is mostly focused on the match between the student and the institution. Bean and Metzner (1985) assume that non-traditional students are affected more by environmental factors that are outside the academic environment (e.g. working hours, family obligations, finances, opportunity to transfer), than by integration into the academic environment. In their model variables that are assumed to have the greatest effect on non-completion for non-traditional students were academic performance, intent to leave⁴, personal characteristics, secondary school attainment, educational goals and environmental variables (in Summers, 2003). A similar model from the education literature is by Cabrera et al. (1993) who combine Tinto's (1980) Student Integration Model with Bean's (1980) Student Attrition Model into a Model of Student Retention. In the Model of Student Retention the most important factors influencing persistence in HE are student's intention to persist, student's grade point average at the HEI and the institutional commitment to the student (Cabrera et al., 1993).

Next the human capital literature is discussed and additional explanation of student non-completion is presented. The major contribution in applying human capital framework to non-completion comes from Stratton et al. (2004, 2008). Stratton et al. (2008) refer to their model as the 'human capital model of non-completion' (p. 5). However, as will be emphasized in section 4, the variables used in Stratton et al. (2008) are already pertinent to the research carried out in the education literature, and found in Tinto (1975, 1993), Bean and Metzner (1985) and Cabrera et al. (1993) along

⁴ It may be argued that this variable is non-explanatory, i.e. it cannot be used in predictions as it is almost an outcome of the process and not an explanatory variable.

with the empirical studies stemming from these models. Hence, this model is not completely distinguishable from other models in practice.

According to the model of non-completion based on the human capital theory, students will persist in the HEI as long as the present value of expected benefits exceeds the present value of expected costs. The cost and benefits in pursuing a degree can be both pecuniary and non-pecuniary. The major financial benefits may be higher future earnings after completing the programme. Non-financial benefits may include better working conditions and a more satisfying job. Furthermore, education institutions impart good standards of behaviour, socialise people and enable them to become better informed members of the society. Financial costs include tuition fees and forgone earnings and non-financial costs may be linked to psychological costs of studying, i.e. stress, anxiety, alienation, more effort, less leisure.

The human capital theory suggests that an individual's investment in years of education depends on his/her comparison of marginal costs and benefits. With higher share of public expenditures a student's private marginal costs of education are reduced leading to a longer than necessary duration of studies, assuming all net social benefits are internalised into the student's decision. In the 'human capital model of non-completion' applied by Stratton et al. (2008), although the authors stress income and constraints rather than sociological reasons, their analysis does not seem to lead to a model specification that would employ different variables than the ones previously known in the non-completion theory and practice. More on this model is presented in section 5.1.

4. A Critical Examination of Previous Empirical Work

This section introduces and analyses different types of studies examining the subject of non-completion and student persistence. Some of their advantages and disadvantages are discussed. In section 4.1 the focus is on the variables that were found important in the theoretical overview and have also been employed in the empirical research on non-completion in HE. The characteristics of these variables are briefly discussed and the results of some of the major studies are presented.

In examining student non-completion four broad types of studies can be distinguished. Firstly, there are wide, national (or state-based), quantitative studies which mostly provide indications of the groups of students that are mostly at risk of not completing their HE. However, given the extensiveness of this type of research, and a general lack of reliable national databases on HE system, in Europe especially, these studies are rare. Furthermore, the available data fails to discriminate between stopouts, transfer students and other types of non-standard student behaviour (Barefoot, 2003). In most cases the information in the database may not be up to date (i.e. the database only covers some academic years) or tailored to the needs of non-completion models (i.e. often the data on the reasons of student non-completion are missing). The above mentioned issues may lead to overestimation of non-completion. A recent study is by Hovdhaugen (2009) of undergraduate students in Norway and by Di Pietro and Cutillo (2009) for Italian HE. For Norwegian HE, Hovdhaugen (2009) finds that more than 50 percent of all students left the initial institution before degree completion, but that the majority transferred to another HEI and completed the degree. There is no similar type of information on the numbers of Croatian students who swap HEIs and this presents a limitation of the following empirical work. However, this type of data is rarely available even for the HE systems with more developed student databases such as UK. Furthermore, as indicated in section 1, this may not represent a major problem for the empirical work.

Secondly, there are institutional level studies that usually examine student attainment and non-completion and are rather narrow in scope but may provide rich information for the individual HEI and its students (e.g. Johnes, 1990; Davies and Elias, 2003; Johnes and McNabb, 2004; Arulampalam et al., 2005; Boero et al., 2005; Stinebrickner and Stinebrickner, 2009). However, in terms of the estimated coefficients and their signs, the results of these studies cannot be easily extended to other HEIs in the country or to the HE system in general. Nevertheless, some broad determinants of student non-completion can be identified and applied, to a larger or smaller extent, in other HEIs.

The third type of study is the ones using questionnaires and/or interviews on usually small samples of students who left programmes. A recent example is a study by Stinebrickner and Stinebrickner (2008) and Vandamme et al. (2007). The aim of these

studies, in most cases, is to determine the reasons for student non-completion (i.e. determining whether the departure was voluntary or non-voluntary). However, these studies are usually rather limited in scope, may suffer from a small number of respondents and sample selection bias. This leads to an underestimation of HEI related problems.

The fourth type of study is focusing on 'potential student leavers', a category of students that were found discontented (in questionnaires or interviews, mostly at enrolment to their second semester of study or to the second year) or are exhibiting poor academic progress (e.g. Ramsay et al., 1996; Meyer, 2000; Shanahan and Meyer, 2003). This type of research is important as it may allow an early identification of potential student leavers so that the HEI can adjust faster and take steps to improve the situation by developing/applying retention programmes and encouraging persistence. The disadvantage of the approach is that it is limited to the institution level and its results cannot be extended to reflect the situation in the whole HE system.

As previously noted, major contributions in theory and estimation of non-completion come from the US and, to a smaller extent, the UK. These education systems are atypical and this may limit the applicability of the major findings to other HE systems. However, it may be argued that there is sufficient commonality in the major influences on non-completion that can be extended to HE systems in other countries. Such a framework is developed in section 5.1, taking into account the characteristics of the Croatian HE system.

Some clarification is also necessary at this point to distinguish between three broad categories of students that can be labelled as first-year leavers. These students may be the ones who withdrew from the HEI before the end of the first year of study; who failed the first year at the HEI or those who successfully completed their assessments but do not return for the second year. However, the reasons for their withdrawal largely remain unknown due to problems in obtaining data of this type, i.e. the reasons for withdrawal are usually not collected by HEI's administrative staff. However, one exception is the study of Johnes and McNabb (2004) for the UK HE system who benefit from individual records of all students included in the application process at

UK HEIs in 1993. The data contains reasons for withdrawal allowing Johnes and McNabb to distinguish between 'voluntary' and 'involuntary' non-completion. These are also the two most common types of non-completion referred to in the relevant literature. However there is a problem with this classification. It may be argued that these two types of non-completion may become blurred as involuntary withdrawal (i.e. often considered as academic failure) may oftentimes be the result of personal and financial problems. Thus, there is interrelatedness between the two categories and student non-completion may often be an outcome of the above mentioned factors rather than a lack of ability.

As mentioned above, most of the empirical work on HE identifies non-academic reasons as the main ones influencing student non-completion. However, this leads to another concern. Most of this empirical work is carried out via interviews or questionnaires of students who left the HEI. This type of research is usually problematic given the small number of respondents which may introduce bias in the research. To illustrate this issue, in the study by Davies and Elias (2003) of early leavers in UK HE, the conclusions on student non-completion were based on a 10 percent response rate to a postal enquiry, and although responders had higher level entry qualification than non-responders, the authors nevertheless generalised their findings to a whole population of early leavers disregarding the potential bias in their research. An additional source of bias may be that the students themselves are reluctant to report that the coursework was too complex or demanding for them, i.e. that they failed due to academic reasons hence, they report non-academic problems as being dominant. Furthermore, as Stinebrickner and Stinebrickner (2009) find, students keep updating their beliefs/expectations during the HE studies taking into account both their beliefs at the beginning of the semester and the information they receive during the semester in the form of semester grades.

From the discussion above it may be concluded that although the theoretical bases of the models above are very different there is, nevertheless a significant overlap between the empirical formulation of Tinto (1975, 1988, 1993), Bean and Metzner (1985), Cabrera et al. (1993) and Stratton et al. (2008) in explaining student (non)completion. Furthermore, in the empirical work, there is a collection of variables which are commonly considered as relevant. These are related primarily to the

institutional, personal and external characteristics. However, although there is wide research into the problems of student non-completion and other related issues, there are significant gaps in understanding the process. As indicated by van der Ploeg and Veugelers (2008b), the empirical research in this area is surprisingly limited and is only beginning to emerge.

4.1. Main Variables

In this section the focus is on the variables that might prove useful in understanding and modelling student non-completion, especially for Croatian HE. The introduction of a certain variable in the models of non-completion is mostly justified by Tinto's (1975, 1993) student integration approach which is the most widely used theoretical background for modelling student non-completion. On a simplified basis, drawing from all the models outlined above, a student's decision to persist or to leave depends on his/her academic and social integration along with many 'input' factors such as student's personal characteristics (gender, age, ethnicity), ability, socio-economic background, course characteristics and non-cognitive factors (i.e. career aspirations, motivation, commitment to the goal of completing). The following section presents an overview of recent empirical work focusing on the main findings for several categories of variables that are also used in the empirical part of this paper. The effects of these variables on the probability of non-completion are also discussed.

Student's Personal Characteristics

Age. When 4-year HE programmes are analysed most empirical work finds that mature student have a higher probability of non-completion due to financial difficulties, high demands of employment whilst studying and responsibility for dependants. In this scenario, mature students have already spent an amount of time outside the education system and may be more likely to experience academic difficulties, hence a positive effect of age on student non-completion is found (e.g. Smith and Naylor, 2001). However, student's age may contribute to the likelihood of non-completion in a different respect: older, mature students may have a better idea about what they expect from HE, some of them may have given up their work to pursue HE, and thus, for these students a negative relationship is expected between

age and the probability of non-completion (found in e.g. Johnes and McNabb, 2004). Also in a study by Yorke (1999), older entrants were about half as likely as their younger peers to make the 'wrong' choice of field of study, and were less likely to be dissatisfied with accommodation. Consistent results can be found in Davies and Elias' (2003) study of full-time and part-time students who dropped out of university.

Gender. The evidence on the effects of gender on the probability of non-completion is more extensive, but the direction of this effect is again uncertain. It has been found that men and women typically leave HE due to different reasons. For men, the reasons for non-completion are more likely to be related to course requirements, work obligations or financial issues. Women are more likely to leave HE due to a mistaken choice of course, family commitments and illness (Davies and Elias, 2003).

Marital status. Married students are likely to have more time-consuming family obligations and financial strains than single students, thus increasing their probability of non-completion. This argument is supported by evidence from studies (Bean, 1983; Johnes, 1990; Johnes and McNabb, 2004).

Socioeconomic status. Lower socioeconomic status is often associated with non-completion. An often used proxy for student's socioeconomic background is parental education or occupation and previous empirical work indicates that students whose parents are more highly educated are less likely to leave HE (Ermish and Francesconi, 2001; Johnes and McNabb, 2004; Black et al., 2005; Ishitani, 2006; Ortiz and Dehon, 2008; Stratton et al, 2008). The examination of relevant literature for the US reveals that students from disadvantaged socio-economic backgrounds leave HE prematurely more frequently than rich students, i.e. only 54 percent of students with a family income of less than \$25,000 complete their education in comparison to 77 percent of students with incomes higher than \$70,000 (Jacobs and van der Ploeg, 2006). Recent examples on relationship between parental background and non-completion can be found in Johnes and McNabb (2004) and Stratton et al. (2008).

Ability and Previous Schooling

Ability. Academic ability is potentially a highly important determinant of non-completion and may enter a model of non-completion in two ways, through secondary

school performance which is an indicator of student's prior ability or via grades obtained at the HEI. Firstly, students enrol in the HEI with some prior ability which is mostly proxied by their secondary school grades or results at standardised tests at the end of secondary school. Many studies have established a negative relationship between secondary school attainment and the probability of non-completion (Arulampalam et al. 2005, Johnes and McNabb, 2004; Stratton et al., 2008). A-levels in the UK and SAT scores in the US are often used as a predictor of student's prior ability. However, there is a concern whether the results from standardised tests are a good predictor of student ability as they may incorporate grade inflation. As recorded by Jacobs and van der Ploeg (2006), in the UK the A-levels pass rate has increased from 68 percent in 1982 to 97 percent in 2004 and the fraction obtaining an A-grade has doubled in the last 20 years to almost a quarter. It is doubtful that this indicates brighter students or improvements in teaching practices. This is more of a concern when analysing non-completion over time. In Croatia, there are no standardised test scores at the end of secondary education; hence, that type of data is not available. However, as measures of prior ability, secondary school grades will be used in the empirical work (measured through the complete length of the secondary education, i.e. three or four years) and student's entrance examination score at the admissions to the HEI, thus potentially avoiding the problem of grade inflation as suggested in current literature. It may be assumed that the latter variable is a useful proxy for the ability required to do well in the HEI as it likely highlights student's motivation, as students have to prepare for it separately.

Nevertheless, not all HEIs in Croatia select at entry (i.e. have entry examinations) and selection is to some extent bound to be subjective. Hence, HEIs commit type I errors when they enrol weak students and type II errors when they reject good students. The lack of selective entries in Croatian HEIs and also in the majority of European ones may serve as an additional explanation why many students fail in their first year, i.e. why the 'real' selection takes place after one year or even later (Jacobs and van der Ploeg, 2006).

Peer effects. Peer-group effects are perceived as a group of influences arising largely from 'social interactions' where the behaviour of one individual is affected by the behaviour or characteristics of other individuals in the same group. In terms of student

attainment, studies such as Henderson et al. (1976), Hoxby (2000), Zimmer and Toma (2000), Checchi and Zollino (2001), Hanushek et al. (2003), Robertson and Symons (2003) and McEwan (2003) have found positive peer effects operating at the classroom level i.e. having more able peers can improve the student's own attainment. The impact of peer effects on non-completion has been examined by Light and Strayer (2000) and Johnes and McNabb (2004) where it is hypothesised that students whose ability is similar to the ability of their peers are less likely to leave the HEI. Many issues related to peer effects require a model that is either non-linear in peers' mean achievement or in which other moments of the peer distribution matter. To address the issue of non-linearities in peer effects (recognized by Winston and Zimmerman, 2004; Hoel et al., 2005) Johnes and McNabb (2004) use a squared term of peer effects which is expected to have a negative sign so that the positive peer effect becomes smaller with high group mean ability. In the study by Smith and Naylor (2001), peer effects arise as a result of social and economic interaction of students, hence, they may present a proxy for student integration within the HEI. Their research suggests that students who live at the parental home develop, and are influenced by different social networks when compared to student who leave home and are more integrated in student life. Some authors suggest that peer effects might even be more significant determinants of higher education outcomes than institutional quality (Sacerdote, 2001).

Type of secondary school attended. In empirical studies on non-completion the type of secondary school is an often used as a proxy for educational background and an important determinant of non-completion. As Johnes (1990) argues, academic difficulties experienced at the HEI are sometimes not due to a student's lack of ability but emerge from his/her educational background, i.e. in the UK HE it is more likely that grammar and independent schools offer education which is more fitting to the requirements of HE than some other types of schools. This can be extended to the Croatian framework where students from gymnasiums and technical secondary schools often outperform students from vocational schools, ceteris paribus (OECD, 2001). It may also be argued that the type of secondary school attended is a proxy for student's socioeconomic background, however, a rather limited one. Given that data on parental occupation is included in the empirical model developed in this paper, this is not its role here.

Student Status at the HEI

Enrolment status. In previous research on the effects of enrolment status on the probability of non-completion there is evidence that suggests that full-time students have a higher propensity to persist in HE. A related issue is examined by Bean and Metzner (1985) who find that mature and part-time students have higher non-completion rates due to problems linked with family, finance and work requirements. Stratton et al. (2008) find substantial evidence that factors associated with non-completion differ by initial enrolment status, i.e. that student attainment, parental education and household characteristics have a greater effect on students initially enrolled full-time, whilst ethnic and racial characteristics had a greater impact on those initially enrolled part-time. The authors used a two-stage sequential decision model to analyse the initial enrolment intensity jointly with non-completion. This approach is also followed by recent research in the US (Horn and Berger, 2004) that shows that a large number of students in HE (about 20-30 percent of all undergraduates) enrol part time. In the Croatian HE system, prior to the implementation of the Bologna process guidelines, part-time students were a considerable segment of the student population and although previous research found that there are differences between full-time and part-time students these two populations are rarely directly compared. This is taken into account in the empirical part in this paper with a dummy variable indicating student's enrolment status is used.

Financial considerations. A review of studies examining the relationship between HE costs and student (non)completion is presented by Leslie and Brinkman (1988) and some of the more relevant studies include Cabrera et al. (1992); Tinto (1993); Yorke (1999) and Dynarski (2003). In most of these studies it is found that financial hardship has a positive effect on non-completion. Furthermore, Callendar (1999) finds that, for England, those who had the most financial difficulties are full-time students, students over 19 years at the start of their studies, single parents and couples with children. The focus below is more on the effects of tuition fees at the HEI since in Croatia there is little diversity in types of financial aid available to students and student loan schemes are generally undeveloped. Since the effects of the tuition fee may be linked to financial considerations however, the sign of this effect is uncertain. For some students paying the tuition fee may increase their motivation and their commitment to the goal of completing HE and thus limiting the duration and costs of

their education. On the other hand, having to pay a tuition fee may imply that student will seek funding elsewhere or start working, i.e. they may experience financial difficulties that are likely to increase the probability of non-completion. This issue will also be analysed in the model of student non-completion developed in the next section.

Student Commitment, Motivation and Integration

According to Tinto (1975), the extent of student's social and academic integration in the student community is a major determinant of his/her educational outcomes. Hence, a lack of motivation and commitment to the HEI, courses or to HE in general may be expected to positively influence the probability of non-completion. A recent analysis focusing on student experiences during the first year of studies can be found in Palmer et al. (2009).

A summary of studies dealing with commitment variables (in Summers, 2003) identified that if the student is able to recognise his/her goals clearly, indicate a high level of commitment to that goal and report a positive outlook on his/her educational experiences, then that student is more likely to persist in his/her HE studies. In the research by Pascarella and Terenzini (1983) the variable on goal commitment consisted of two items: highest expected academic degree and perceived importance of completing the programme at the HEI. The variable on institutional commitment was the sum of two items: the rank of the selected HEI as a student's initial choice and his/her confidence that choosing to attend the selected HEI is the right choice. Since there is no data from questionnaires, or interviews available in our Croatian dataset another determinant of non-completion is proposed that was not considered in the above mentioned studies. This is the proxy for student effort available in the dataset and defined as the number of times student took an exam (where the maximum number of exam attempts at an HEI is 8). This measure may be considered as an indicator of student's commitment to completion of HE studies and thus, has a potentially important (positive) effect on non-completion indicating that students with more exam attempts are more likely to drop out.

A lack of motivation is assumed to increase the probability of non-completion where it may be assumed that motivation is one reason for student commitment. A proxy for

motivation may be student's previous employment experience. According to Johnes (1990), a student who was employed is more likely to perceive the benefits of completing HE studies on his/her career opportunities. In her research (1990), the dummy variable indicating a student who had full-time work experience, and is thus assumed to be more motivated, was statistically significant and had a negative effect on non-completion.

Other variables used in measuring student integration are the location of student's home where some research showed that living at a parental home is positively related to non-completion, taking into account social class (Johnes and Taylor, 1998) since for these students it might be more difficult to integrate with the social and academic life on campus.

5. Developing a Model of Student Non-completion

The extensive body of literature on student non-completion indicates that the probability of non-completion for an individual student depends on a large number of factors examined in the previous section. As noted in section 4.1 analysis is frequently restricted to quantitative measures that can be developed from available datasets.

One important aspect of student non-completion that is examined in this paper is the timing of student departure, i.e. the year of study when the student leaves HE. The reasons for focusing on student leaving before completing their first level of studies are twofold. Firstly, relevant research in the US and UK on non-completion revealed that most of the student non-completion occurs during the first year (level) of study (e.g. Tinto, 1982, 1993 for the US; and Smith and Naylor, 2001 and Arulampalam et al., 2005 for UK). This seems consistent with the situation in Croatian HE where the highest non-completion rate is also during the first academic year/level (MSES, 2005). Furthermore, it is necessary to distinguish between non-completion of the first year and at a different time in the programme, as the determinants for first year non-completion may differ from those on later non-completion (Arulampalam et al., 2005). From here, a model of student non-completion in the first year of studies is developed in the next section.

5.1. Modelling the Probability of Student Non-completion of the First Year of Studies

In this section a variety of approaches to examining the probability of non-completion are presented, some of the main features of the models are outlined and the limitations of previous research are identified. The focus is on the more recent studies in this area given that additional studies were already presented in sections 3 and 4 and some of the main variables and key findings were discussed in section 4.1. The first study analysed in this section is an assessment of non-completion of the first year of study for the US HE where Stratton et al. (2008) use a two stage sequential decision logit model, i.e. a switching regression, to determine whether the factors associated with non-completion differ according to initial enrolment intensity (i.e. part time and full time status). The authors specify three equations, where the first equation models the decision to enrol part-time and it is a function of variables known prior to enrolment. The second equation models the decision to leave HE studies conditional upon having enrolled full-time and the third equation models the decision to leave conditional upon having enrolled part-time. Equations one and two are then estimated simultaneously to explore non-completion among full-time students and then equation one and three are estimated simultaneously to explore non-completion among part-time students. This specification allows part-time students to react to different factors or to react differently to the same factors as compared to full-time students when deciding whether to continue their studies. Students who are not enrolled one calendar year after their initial enrolment are defined as non-completers, i.e. the focus of the empirical work is on non-completion of the first year of studies.

The model is estimated using data on a stratified random sample of 4,655 students of whom 349 were initially enrolled part-time. The variables used in the model are related to personal, household, academic, institutional and economic characteristics. The authors find that academic performance, socioeconomic background, parental education and economic factors (living in an area with high unemployment rate) had a significant effect on students who were initially enrolled full-time, whilst racial and ethnic characteristics had a significant effect on part time students. However, the variables the authors use does not include peer effects or characteristics of prior schooling which, as seen above, are well established determinants of student non-

completion in the economics of education literature. A variable capturing prior ability is also missing. It may be argued that the lack of the above mentioned variables seriously impairs the validity of the estimates. Furthermore, as a measure of student's ability the authors are using the first year grades at the HEI which are self-reported by the students in cases where that data was not available. It may be argued there may be a bias when combining the HEI awarded grades and the self reported ones as the latter may not be accurately reported. Another concern is the size of the sample of part-time students, i.e. only about 7.5 percent of the students were initially enrolled part-time. However, Stratton et al. (2008) do not report if any tests were made to check for example, for the existence of outliers that might bias the results.

For UK HE, Smith and Naylor (2001) examine the probability of non-completion for the entire 1989/90 entry cohort of full-time students in the 'old' universities. In their dataset these students had either completed their studies at the end of 3 or 4 years of study or left the programme prior to completion. The last data is available for 1993 and the model is estimated using a probit model. Smith and Naylor (2001) find that the probability of non-completion is influenced significantly by prior schooling, personal characteristics and the characteristics of the department and the university. Another limitation of the model is again the lack of a variable for peer effects. This variable is usually constructed as student's individual ability (proxied by A-levels in the UK HE system) relative to the ability of student's peers at the same university or course (also A-levels). In Smith and Naylor (2001) the authors only examine the effects of student's A-levels relative to the average scored by all A-level candidates in the previous (i.e. secondary) school attended. Hence, such specification neglects the impact that the peers at the HEI have on a student and his/her decision to persist/leave HE.

Using the same dataset, Arulampalam et al. (2005) investigate the probability of student non-completion of the first year of study using the data for nine cohorts (1984/85-1992/93) of full-time undergraduate students in the 'old' universities in the UK. The authors use the logit model to analyse the determinants of non-completion probabilities during the first year of studies only and focus on the results for the 1992/93 entry cohort which is also the last one for which the data is available. The variables included are related to student's personal characteristics, prior schooling,

socio-economic background, enrolment status, course and university characteristics and peer effects. Their results show that students with lower prior attainment (also based on A-level score) are more likely not to complete their first year. The probability of non-completion for students with higher and lower prior attainment increases with the extent of in-class heterogeneity (determined also by prior performance), where the median ranked students are less at risk of non-completion.

Another related study for UK HE is that by Johnes and McNabb (2004) who investigate student non-completion in 1993. Disaggregating the data to the level of the individual full-time student and matching it with institutional information the authors were able to distinguish between the two types of non-completion, voluntary and involuntary, and include it in their model. The estimation technique used is the multinomial logit where the dependent variable captures one of three outcomes: completion of studies, voluntary withdrawal and involuntary withdrawal. Other variables used are student's personal characteristics (age, marital status, nationality, residency), type of secondary school attended, prior attainment (A-levels or Scottish Highers), a variable capturing peer effects and gender specific peer effects, degree subject and the characteristics of the university attended (university income from research grants, library expenditures per student, staff-student ratio, teaching and research quality assessment). In terms of peer effects, this variable is constructed as student's individual ability (proxied by student's A-level score) relative to the mean ability of students at the same university and on the same course. Also a squared term of the peer effects is included to address the issue of non-linearities. The authors find that peer effects have a significant effect on non-completion and a student is more likely to leave HE studies if his/her prior grades are better relative to those of other students at his/her university or degree course. This is a surprising finding and at odds with the theoretical basis. The squared peer effects term was however insignificant. Furthermore, the probability of non-completion (both voluntary and involuntary) is negatively related to the performance prior to university entry (A-levels or Scottish Highers), i.e. prior attainment.

Regarding the time frame used in the analysis, the authors do not provide information/discussion on the years of initial enrolment of these students who in 1993 completed or left the HE studies. For example, students on a 3 year (4 year)

programmes and completing in the specified timescale may have entered at the earliest in 1990 (1989) however, those taking a longer time to complete may have entered prior to that. Given the increased participation rate of students in the UK HE during the 1980s and 1990s (Yorke, 1999) there might have been some differences between the different cohorts that are not discussed in the paper. However, as noted above, given the UK regulations in most cases students cannot take a longer time to complete, although there was a small movement to less stringent regulations in the 90s. The only brief explanation the authors offer is that by conditioning on A-levels and some other personal characteristics of the students any bias resulting from sampling across mixed cohorts should be small. Furthermore, the distinction made in this study between the voluntary and involuntary withdrawal from the theoretical point of view may be unclear. Involuntary withdrawal (i.e. often considered as academic failure) may sometimes be the result of personal and financial problems. In this case student non-completion may be an outcome of the above mentioned factors rather than a lack of ability. However, as noted above, the authors have not addressed this concern or the issue of transfers to other courses/HEIs.

Overall, from this review of recent models of non-completion in HE it may be concluded that there are a number of different approaches in estimating this probability. This particularly refers to the time-frame used in the empirical work where, due to data limitations, there is often a defined cut-off point (usually coinciding with the last data available) after which a student is considered as a non-completer although he/she may be continuing the studies but taking a longer time to complete (the programme). This is an important issue in the Croatian context. Another related remark is about the cohorts examined in the empirical work. In general, assessing non-completion requires that a certain time passes between student enrolments and (non)completion before any empirical work can follow. As a result, there might be a considerable difference between the actual/current situation in the HE and the one that was examined, and from which policy proposals have been developed. This limitation can be addressed to some extent by using the most recent cohorts and examining the first year non-completion. It appears that most of these problems emerge due to limited (national) databases.

In conclusion, the models and the explanatory variables used seem to be dependent on the datasets available, rather than being based fully on theory. This is particularly evident in the lack of certain variables (e.g. effort, part-time and full-time status) or inadequate representation of others (e.g. peer effects). Taking into consideration the limitations addressed in the above presented review of the empirical work the next step is to develop a model that will attempt to address these limitations while taking into consideration the specific situation in Croatian HE. Subsequently, a model of student non-completion of the first year of studies is developed given the specific characteristics of the Croatian HE system.

Model Specification

As discussed in section 3, there is a collection of variables generally considered as relevant. Here the focus is on the basic model of non-completion developed by Tinto, which is extended given the Croatian context. The main independent variables are the academic and social integration of the student. As argued by Tinto (1975), the higher the level of integration, the more likely is the student to complete his/her HE studies. Academic integration captures the match between the student and the HEI and is assumed to be primarily determined by student's prior performance and his/her level of academic attainment and ability. In the empirical work in this paper academic integration is represented by several variables namely, the student's prior schooling characteristics including the type of secondary school attended, secondary school grades and the score at the entry examination for admission to the HEI. A dummy variable, whether the student studied a related subject in the secondary school is included to proxy whether there is a good match between the student and the HEI course. The social integration component is primarily captured by the quality and the extent of the peer effects operating between the student and others at the institution. This peer effects variable is constructed as the mean ability of students in the same group of lectures as student i and with the same enrolment status (i.e. part time and full time students are considered separately since, in general, these groups have separate lectures). In constructing peer effects, the total score at admission to the HEI is used as a proxy for ability. This score consists of the secondary school grades and the score in the entry examination. Students are selected by the HEI based on this score, hence, this should be a good proxy for peer influences and aims to address some of the limitations of measures used in the previously presented empirical work.

Along with academic and social integration which are important in modelling non-completion, students enter the HEI with certain personal characteristics, goals and commitments. Therefore, the model also includes a vector of personal characteristics such as age at enrolment, marital status and the place of birth (urban or rural). The characteristics of the first two variables and their expected signs were discussed in section 4.1. The rationale for including the dummy variable indicating whether the student comes from an urban or rural area is that for students from the latter might find it more difficult to adjust to the new environment. To some extent this variable is capturing the degree of social integration of the student. Also included is a proxy for socio-economic status: the level of educational qualifications of student's parents. It is expected that more educated parents have a positive effect on student persistence in HE. In terms of student's commitment also used is a variable indicating student's effort. This variable is proxied by the number of exam attempts where it is assumed that students with a smaller number of attempts, other things being equal, are actually the ones more committed to the goal of completion. Furthermore, the variable is incorporated in students' grades obtained during the first level of studies, assuming that students obtaining good grades are more committed to their HE studies. Additionally, there are variables on other current schooling characteristics such as the enrolment status and a dummy variable indicating if the student is paying the tuition fee or is exempt. The importance of these variables for Croatian HE was discussed above in section 4.1.

Given the above, the model of student non-completion of the first level of HE studies has the following specification:

$$NC = f(X, F, S, P, E, C) \quad (1)$$

The dependant variable (NC) is the probability of non-completion. Explanatory variables capture student's personal characteristics (X), socio-economic i.e. family background (F), previous schooling (S), peer effects (P), effort (E) and several other characteristics related to current schooling (C). These variables and their importance were already discussed in section 4.1 along with their expected signs.

Student (non)completion is analysed for 8 consecutive cohorts starting with the 1995/96 entry cohort up to the 2002/03 cohort. This makes it possible to follow

students' progress through HE studies until 2005 (the last available year in the dataset), since in Croatia it may take some time to progress through level one and this time frame allows students from the last cohort (2002/03) three years to complete the first level/year of studies. The advantage of examining first-year non-completion is that more cohorts may be used and more information may be exploited than would otherwise be feasible, although as noted above there may be problems if the situation is not stable.

Operationalising equation (1) the model of student non-completion has the following form:

$$NC_1_{ij} = \beta_0 + X_i\phi + F_i\varphi + S_i\gamma + \beta_1P_i + \beta_2P_i^2 + \beta_3E_i + C_i\psi + T_i\lambda + \varepsilon_i \quad (2)$$

In the dataset the variable NC_1 is the dependant variable equal to one if student did not complete his/her first level of studies at the HEI, and zero otherwise. *Student's personal characteristics* (X) include age at enrolment, marital status, and a place of birth (urban or rural). *Family characteristics* (F) include parents' educational qualifications where this variable serves as a proxy for socio-economic background. A set of variables for *previous schooling characteristics* (S) includes the type of secondary school that student attended and if the student studied subjects that were related to his/her present subject area. Students' prior ability and to some extent also his/her commitment to the goal of studying at the HEI is proxied by the score at the admission exam (max. value 600) to the HEI. Furthermore, also used is a score based on secondary school grades (max value 400) as a measure of student prior ability. The academic *peer effects* (P) are captured by the mean ability of students in the same group of lectures j as student i , where this ability is proxied by the obtained total score at the admission exam. A squared measure of academic peer effects variable is used to allow for the non-linear nature of academic peer effects. It is expected that a greater disparity between the academic ability of the student and those of his/her peers increases the likelihood of non-completion. *Effort* (E) is measured as the average number of exam attempts. In Croatian HE, at the time period considered in the dataset, the number of possible exam attempts for the each course the student had at the HEI was from one up to eight. It may be argued that students who are more committed to their studies at the HEI, *ceteris paribus*, pass their exams with fewer

attempts and are more likely to complete their first level. Given cross-country differences in the regulatory framework in HE, this author does not suggest that the number of exam attempts is the only possible proxy for effort, especially given that the earlier literature could not include such a variable as in most institutions in those studies students can only resit once and that is during (usually at the end of) the year of study. However, it may be emphasized that including a variable indicating student effort is important otherwise models may be misspecified. This may then create additional problems when developing policy proposals based on poorly specified models.

Several dummy variables are used to indicate student's *current* schooling characteristics (*C*) i.e. if the student is enrolled full-time or part-time, and is he/she paying tuition fees or is exempt. Also included are the dummies for the *year of student's enrolment* (*T*), equal to one if a student enrolled in the HEI in that year and zero otherwise. The years of enrolment, as previously noted, are from 1995-2002 where the omitted category is 2002 as the last year of enrolment in the dataset. The characteristics of the dataset and the results of estimation without imputation are presented next.

Characteristics of the Dataset

The dataset used in estimating the probability of student non-completion is discussed in this section. The variable descriptions are presented in Table 1 and descriptive statistics are presented in Table 2.

Table.1: Variable Descriptions

VARIABLE	DESCRIPTION
Personal characteristics (X)	
Age	Age of the student at enrolment
Gender	1 if female; 0 otherwise
Married	1 if the student was married; 0 otherwise
Urban	1 if student is from an urban place of living ⁵ ; 0 otherwise
Previous schooling characteristics (S)	
Secondary school type	
Gymnasium-technical	1 if the student attended a gymnasium or a technical school; 0 otherwise
Vocational (omitted)	1 if the student attended a vocational school; 0 otherwise
Studied a related subject	1 if the student attended a secondary school offering related subjects; 0 otherwise
Secondary school grades	Average secondary school grades (max. 340 points)
Admission exam	Score at the admission exam (max. 600 points)
Family characteristics (F)	
Parental educational attainment	
Father	
F_Uni. or non-university degree	1 if the student's father obtained a university or non-university college degree; 0 otherwise
F_Secondary school (omitted)	1 if the student's father completed secondary education; 0 otherwise
F_Basic or no school completed	1 if the student's father completed basic school education or have no basic school completed; 0 otherwise
Mother	
M_Uni. or non-university degree	1 if the student's mother obtained a university or non-university college degree; 0 otherwise
M_Secondary school (omitted)	1 if the student's mother completed secondary education; 0 otherwise
M_Basic or no school completed	1 if the student's mother completed basic school education or have no basic school completed; 0 otherwise
Current schooling characteristics (C)	
Fee status	1 if the student is paying the fee; 0 otherwise
Full or part-time	1 if the student is enrolled full-time; 0 otherwise
Peer effects (P)	
Peers_1	Calculated as the mean total score at the enrolment at the HEI (consisting of secondary school grades and entry exam performance) of students on the same course group as student <i>i</i> and at the same level
Peers_1sq	Square of the peers variable
Effort (E)	
Exam attempts	Average number of times student took exams during the first level of study taking the value from 1 to 8
Year of enrolment dummies (T)	
Enrol_year	1 if the student enrolled in that year, 0 otherwise

⁵ The sorting was based on the list of towns and cities published online by Wikipedia at http://en.wikipedia.org/wiki/List_of_cities, accessed 23/11/05.

Table 2: Descriptive Statistics

VARIABLE	Obs.	Mean	Std. dev.
Non-completion_1	3310	0.332	0.471
Personal characteristics (X)			
Age	3308	19.956	3.235613
Gender	3310	0.609	0.488
Urban	3302	0.962	0.192
Married	3303	0.327	0.178
Previous schooling characteristics (S)			
Gymnasium-technical	3214	0.568	0.495
Vocational (OMITTED)	3214	0.393	0.488
Studied related subject	3213	0.307	0.461
Sec. school grades	2869	244.647	74.769
Admission exam	2805	375.253	56.441
Family characteristics (F)			
F_Uni. or non-university college degree	2749	0.419	0.493
F_Secondary school (OMITTED)	2749	0.562	0.500
F_Basic or no school completed	2780	0.079	0.344
M_Uni. or non-university college degree	2780	0.301	0.459
M_Secondary school education (OMITTED)	2780	0.562	0.496
M_Basic or no school completed	2780	0.137	0.344
Current schooling characteristics (C)			
Fee status	3310	0.728	0.445
Full time student	3310	0.879	0.326
Peer effects (P)			
Peers_1	3310	614.835	65.067
Peers_1sq	3310	382254.8	63497.52
Effort (E)			
Exam attempts	1621	2.239	0.881
Year dummies (T)			
Enrolled in 1995	3849	0.080	0.271
Enrolled in 1996	3849	0.102	0.302
Enrolled in 1997	3849	0.116	0.320
Enrolled in 1998	3849	0.098	0.298
Enrolled in 1999	3849	0.109	0.311
Enrolled in 2000	3849	0.109	0.311
Enrolled in 2001	3849	0.112	0.315
Enrolled in 2002 (OMITTED)	3849	0.135	0.342

The majority of students in the dataset enrolled as full-time students (around 88 percent), 73 percent of students were paying a tuition fee and the majority of students have parents who completed secondary school. Around 61 percent of students in the dataset are females. Furthermore, the average student in the dataset was 19.9 years old at enrolment in their first level of studies. This is above the standard entry age to HE which is from 18 to 19 years in Croatia. The age at enrolment was particularly high in the first four years from 1995-98 and the mean value is above 20. This may be related to economic and political circumstances in the country at that time. The war ended in 1995, youth unemployment rate was relatively high (29.8 percent in 1998 according

to World Development Indicators-2006) and the possibility of finding employment with only secondary school qualifications was relatively low. This may have led more mature individuals to enrol in HE programmes at that time.

In this type of analysis where the dependant variable is binary and where the interest is in assessing how each explanatory variable influences the probability of an outcome (completion/non-completion), the two most frequently used models are the binary logit and probit. From the empirical standpoint, logit and probit generally lead to similar conclusions for the same dataset (Long and Freese, 2005). For the empirical work the decision is to use logit.

Results

This section presents the results for the model of the probability of student non-completion, also addressed are limitations of the approach including problems related to missing data. The results of the logit estimation of the probability of student non-completion of the first level of studies are presented in Table 3. The reported log likelihood is -523.8 and the pseudo R-squared is 0.18. Furthermore, the null hypothesis that all of the effects of the independent variables are simultaneously equal to zero can be rejected at the 0.01 level ($LR\chi^2 = 237.41$, $df=23$, $p<0.01$). A graph of the residuals and the index plot of standardised Pearson residuals was examined in Stata, as suggested by Freese and Long (2005). There was no indication of heteroscedasticity. The results in Table 3 are discussed for each vector of variables separately.

Table 3: Regression Results for Logit Estimation of Non-completion of the First Level of Studies (N=1153)

VARIABLE	Coeff.	(z-statistic)
Constant	-2.684	(-1.13)
<i>Personal characteristics (X)</i>		
Age	0.156**	(4.50)
Urban	0.049	(0.11)
Married	0.022	(0.03)
<i>Previous schooling characteristics (S)</i>		
Gymnasium-technical	-1.345**	(-5.58)
Studied related subject	-0.624**	(-2.63)
Sec. school grades	-0.008**	(-5.57)
Admission exam	0.002	(0.96)
<i>Family characteristics (F)</i>		
F_Uni. or non-university college degree	-0.483**	(-2.71)
F_Basic or no school completed	-0.470	(-1.43)
M_Uni. or non-university college degree	-0.362	(-1.85)
M_Basic or no school completed	0.068	(0.25)
<i>Current schooling characteristics (C)</i>		
Fee status	0.569*	(2.24)
Full time student	-0.049	(-0.07)
<i>Peer effects (P)</i>		
Peers_1	0.008	(0.61)
Peers_1sq	-0.000	(-0.62)
<i>Effort (E)</i>		
Exam attempts	0.275**	(2.76)
<i>Year dummies (T)</i>		
Enrolled in 1995	-0.672	(-0.58)
Enrolled in 1996	-0.907	(-0.73)
Enrolled in 1997	-1.729**	(-2.78)
Enrolled in 1998	-2.411**	(-4.44)
Enrolled in 1999	-1.500**	(-5.24)
Enrolled in 2000	-0.600	(-0.83)
Enrolled in 2001	-0.447	(-1.67)

Notes: Significant at **1% and *5%.

From the vector of the variables capturing student's personal characteristics (X) only age at enrolment had a statistically significant effect on non-completion, the positive effect suggesting that more mature students have a higher probability of leaving the HE programme in the first level of study. A similar finding is also present in the studies by Johnston (1997), Smith and Naylor (2001) and McGivney (2003), to mention a few, where it is suggested that the reasons for higher non-completion rates of mature students are, in most cases, financial difficulties, responsibility for dependents or academic difficulties given that these individuals have spent some amount of time outside the full-time education system. In terms of the characteristics related to previous schooling (S), attending a gymnasium or a technical school has a

negative and statistically significant effect on non-completion in comparison to individuals who completed vocational secondary schooling (the omitted category). This corresponds to the initial hypothesis presented in section 4.1, and a similar result is also found in Italian HE (O'Higgins et al., 2008; Di Pietro and Cutillo, 2009). Also, studying a related subject decreases the probability of non-completion, as does having good secondary school grades. However, the score in the admission exam to the HEI is not found statistically significant, thus indicating that secondary school grades are a better predictor of student persistence in HE. Examining the proxies for socio-economic background (F), there is a negative and statistically significant effect of having a father who completed HE in comparison to a father who completed only secondary school. Mother's educational qualifications had no statistically significant effect on the dependent variable. Within the vector of current schooling characteristics (C), paying a tuition fee has a positive and significant effect on non-completion. The rationale for this may be that the tuition fee also increases the likelihood of financial problems, thus further affecting student non-completion. Being a full time student has the expected negative sign, as discussed in section 4.1. This may be linked to Tinto's model where the extent of student integration plays an important role in determining student completion. It may be argued that student integration is greater for full-time students and that this may also serve as an explanation of the negative sign of the variable. However, this variable is not statistically significant.

The variables on peer effects (P) were not found to be statistically significant in the model, though the variable on effort (E) is statistically significant at one percent level. This variable is a proxy for student commitment to the goal of completion. The effort variable has an expected positive sign indicating that with the greater number of exam attempts the probability of non-completion increases. This suggests that students exerting more effort are less likely not to complete their first level of studies. However, 321 students who withdrew right at the start of their studies are neglected as there is no information on their effort levels. Due to casewise deletion in Stata these individuals were dropped out from the estimation. However, in order to include these individuals in later estimation multiple imputation is performed allowing us to take advantage of the full dataset. More information on imputation is presented in the next section. From the above table it may be noted that the dummy variables for the level of enrolment are all negative in comparison to the omitted cohort of 2002 and these

are statistically significant for students enrolled in 1997, 1998 and 1999. This negative influence on non-completion is also found across all the cohorts considered and the coefficient is first increasing in absolute terms and decreasing after 1998. These findings suggest that students enrolling in 1997, 1998 and 1999 were significantly more likely to complete their first level of studies in comparison to the last cohort in the dataset of 2002.

Given that the above presented model was estimated using a nonlinear regression model - logit, the estimated parameters do not provide directly helpful information for understanding the relationship between the dependent and independent variables. Hence, to present the main findings more effectively predicted values are calculated for specific cases and selected issues are discussed. Predicted probabilities of non-completion of the first year of studies are computed for three different scenarios (i.e. types of students) and the results are presented in Table 4. The confidence interval for predicted probabilities is set at the 95 percent value. All other independent variables that are not specified in the table are set to their mean. A mature student is specified as one who is 25 years old at the time when he/she enrolls in the HEI; a young student is the one who is 19 years old and an “average” student is defined as having the mean of all variables.

Table 4: Predicted Probabilities

Type of students	Probability of first year non-completion
Mature, married, enrolled part-time, paying a tuition fee	0.42
Young, single, full time student, enrolled tuition-free	0.13
An “average” student	0.19

From the above it is found that the probability of non-completion for a mature, married, part-time enrolled student who is paying the tuition fee is quite high and equal to 42 percent. If only the effect of age on non-completion is examined and all other variables are set to their mean, the probability increases with an increase in age, and for students who are 21, 22, 23, 24 and 25 years old at enrolment the probability of non-completion is 0.23, 0.26, 0.29, 0.33 and 0.36 respectively. This is consistent with the empirical results presented above in Table 3 suggesting a positive relationship between enrolment age and non-completion. At the same time, a young,

single, full-time enrolled student admitted to tuition free places has a much lower risk of non-completion equal to only 13 percent. If we add to this specification that the student has highly educated parents than the probability of non-completion falls to 8 percent. The risk of non-completion for a student who is average on all characteristics is 19 percent.

Next, a discrete change in the predicted probability is presented for a given change in an independent variable (X). This measure captures the amount of change in the probability for a given finite change in one independent variable. The changes for specific variables of interest, which are found significant in the empirical work presented above, are presented next. The results are presented in Table 5 for discrete changes for three options: change in predicted probability of non-completion as X changes from its minimum to its maximum (column 1); change in predicted probability as X changes from 0 to 1 (column 2); and the change in predicted probability as X changes from 1/2 standard deviation below base to 1/2 standard deviations above (column 3).

Table 5: Changes in Predicted Probabilities

	(1)		(2)		(3)	
	X=min	X=max	X=0	X=1	X-1/2sd	X+1/2sd
Age at enrolment	0.161	0.867	0.012	0.014	0.169	0.223
Secondary school grades	0.654	0.094	0.654	0.653	0.237	0.158
Effort level	0.147	0.542	0.116	0.147	0.176	0.214
Tuition fee	0.141	0.224	0.141	0.224	0.174	0.216

It is found that varying the enrolment age from its minimum (17.7 years) to its maximum (53.2 years) increases the predicted probability of non-completion from 0.16 to 0.87, an increase of 0.71. Furthermore, a standard deviation change in enrolment age centred around the mean (column 3) increases the probability of non-completion by 0.05, holding other variables to their means. Change in secondary school grades from their minimum to their maximum decreases the probability of non-completion from 0.65 to 0.09, a change of 0.56. In terms of effort, changing the number of exam attempts from their minimum to their maximum increases the predicted probability of non-completion from 0.15 to 0.54. If the student pays the

tuition fee, the probability of non-completion is 0.08 greater than for a student who is exempt (column 2), holding other variables at their mean. These findings are consistent with the general results of our model of non-completion for the first year of studies. In order to take more advantage of the available dataset, given a large extent of missing variables, the issue of missing data is analysed in greater detail in the next subsection.

Missing Data and Imputation

From Table 3 it may be observed that regression results are based on only 1153 individuals, although there are 3310 individuals in the overall dataset (Table 2). Statistical software such as Stata ignores missing observations and uses only complete observations for a certain individual, therefore if any of the observations for the individual are missing the entire subject is omitted from the analysis. This then leads to a substantial decrease in sample size and may introduce bias in the results hence there is a need to investigate this issue further. The variable on student effort has the most missing data and is only 49 percent complete and this severely limits the dataset available for estimation.

To take advantage of the dataset for the purpose of multivariate analysis, a frequent approach is to impute the data for missing observations. The focus here is on multiple imputation (MI). A more detailed, technical discussion of MI is beyond the scope of this paper⁶, hence, only its application to this dataset is addressed. Multiple imputation (MI) produces unbiased parameter estimates which reflect the uncertainty associated with missing data if the underlying assumptions are met. The method is also robust to departures from normality assumptions and it is appropriate when there are high rates of missing data. For the dataset 20 imputations were used given the substantial lack of data on some of the variables. The results of the estimation of the probability of student non-completion of the first level of studies using multiple imputation are presented in Table 5.

Table 5: Regression results with MI(20) (N=3310)

⁶ It can be found in Rubin, D. (2004) and Little and Rubin (2002).

VARIABLE	Coeff.	(z-statistic)
Constant	0.815	(0.72)
<i>Personal characteristics (X)</i>		
Age	0.093**	(6.65)
Urban	0.256	(1.19)
Married	-0.337	(-1.31)
<i>Previous schooling characteristics (S)</i>		
Gymnasium-technical	-0.459**	(-3.45)
Studied related subject	-0.535**	(-3.83)
Sec. school grades	-0.007**	(-9.31)
Admission exam	-0.003*	(-2.49)
<i>Family characteristics (F)</i>		
F_Uni. or non-university college degree	-0.343**	(-3.26)
F_Basic or no school completed	0.205	(1.09)
M_Uni. or non-university college degree	-0.292**	(-2.57)
M_Basic or no school completed	-0.083	(-0.52)
<i>Current schooling characteristics (C)</i>		
Fee status	0.310*	(2.36)
Full time student	-1.058**	(-4.13)
<i>Peer effects (P)</i>		
Peers_1	-0.0002	(-0.05)
Peers_1sq	3.15e-06	(0.49)
<i>Effort (E)</i>		
Exam attempts	0.063	(0.93)
<i>Year dummies (T)</i>		
Enrolled in 1995	-2.357**	(-10.24)
Enrolled in 1996	-1.573**	(-7.71)
Enrolled in 1997	-1.263**	(-8.32)
Enrolled in 1998	-1.118**	(-6.19)
Enrolled in 1999	-0.948**	(-6.03)
Enrolled in 2000	-0.752**	(-2.70)
Enrolled in 2001	-0.754**	(-4.83)

Notes: Significant at **1% and *5%.

To gain more insight, the results from Table 5 are briefly compared with the results from Table 3 when missing observations and casewise deletion severely limited the dataset. The results are surprisingly similar however, the major advantage when using MI is in terms of more precise inference.

From the vector of the variables capturing student's personal characteristics (X) only age at enrolment had a positive and statistically significant effect on non-completion. The same result is found in the previous estimation, however, the coefficient was slightly higher. The next vector of variables captures the characteristics of the previous schooling (S). All of the variables have a negative sign and are statistically significant at the one percent (attending a gymnasium or a technical school, studying a related subject, secondary school grades) or five percent level (score at the admission

exam). The score at the admission exam was not significant in the previous estimation, however, here it has the expected negative sign suggesting that the likelihood of non-completion is lower for students with higher admission exam score.

Analysing parental education levels (F) the results suggest that having parents with a university or a college degree has an expected negative and statistically significant effect on non-completion. In the previous estimation it was only having more highly educated fathers that had a negative and statistically significant effect on non-completion while the effect for mothers, although negative, was insignificant.

When examining current schooling characteristics both the fee status and enrolment intensity have a statistically significant effect. Paying a tuition fee again increases the likelihood of non-completion and this result was also found in Table 3. Being a full-time student has, in this estimation, the expected negative sign suggesting that part-time students are more at risk of not completing the first level of studies. The peer effect variables (P) are still found to be statistically insignificant. Unlike the previous regression results the effort variable is not statistically significant when imputation is considered. However, it has the expected positive sign. Finally, the dummy variables for years of enrolment are consistently negative and significant at one percent level. Their coefficients are again decreasing in absolute terms when approaching the more recent cohorts. These results suggest that students enrolled in the period from 1995-2001 have a higher probability of completing their first level in comparison to the omitted cohort of 2002.

6. Conclusion

Our work on Croatian HE differs from existing non-completion assessments in three important aspects. First, the focus was on first year leavers, estimating the probability that a student will drop out of university during his/her first year of study that has been identified as the "make or break year" i.e. it is the time when most of non-completion occurs. Non-completion was investigated for 8 consecutive cohorts of Croatian students (from 1995-2002). The problem of missing data was handled using multiple imputation technique, although casewise deletion of missing data dominates the empirical work.

Secondly, peer effects and student effort were used as potentially important variables in modelling non-completion in Croatian HE. Student effort, in particular, is an explanatory variable recognized in the theory on non-completion as indicating the student's commitment to the goal of completion. However, given the difficulty of obtaining data on student effort none of the empirical studies examined above used a similar variable in modelling non-completion, leading to potentially misspecified models.

Finally, a third contribution to knowledge is that part-time versus full time students are examined, whereas in most of the empirical work this distinction was overlooked and this issue ignored. In the Croatian HE system part-time students are an important part of student population, thus, the goal was to examine the link between enrolment intensity (part-time or full-time status) and the probability of non-completion.

From the analysis of models estimating the probability of first-year non-completion in it may be concluded that there is a great deal of similarity in results from both estimations (with and without the imputation) in terms of the significance and the expected signs of the coefficients. However, given the problem of missing data and the advantages of multiple imputation, the results when MI(20) was used are considered as more appropriate in analysing student non-completion. The empirical work presented in this paper established that mature students and the ones paying a tuition fee are more likely not to complete their studies, suggesting that any policy designed to reduce non-completion rates should be particularly sensitive to these students in order to help them progress. On the other hand, attending a gymnasium, having high secondary school grades, studying a related subject in secondary school, having a high score at the admission exam, being a full time student, and having parents with a university degree has a negative and significant effect, i.e. discourages non-completion. The statistically significant effects of the admission exam score and secondary school grades suggest that both variables are good predictors of student persistence in HE, and this may contribute to the discussion of the proposed reforms in the access to HE in Croatia.

However, the limitations of the empirical work need to be addressed given that a large-scale student-level dataset for Croatian students in the HE system is not yet available. Hence, at this point in time, the individual student level information is limited to a single HEI and cannot be used to draw conclusions about the entire HE system. Student non-completion can be a useful indicator of the internal efficiency of an HE system. However, the reasons for non-completion are varied and non-completion should not only be seen as a failure by individual students. It may also indicate that the education system is not meeting the needs of its customers, though given data limitations this line of inquiry could not be followed. Furthermore the dataset does not offer information on the reasons for student non-completion and it was not possible to follow individual students across HEIs to distinguish between transfer students and stopouts. Both limitations in the availability of data and techniques currently preclude such analysis. However, this research offered new insight into the characteristics of students who are not completing their first year of studies and it is also important for policy reasons as it may help to identify students who are more at risk of leaving the HEI before obtaining a degree.

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