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The Effects of Student Financing on Employment, Parental Contributions and Expenditure

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Abstract

This thesis exploited an exogenous variation in student loans in order to estimate causal relationships between student loan, parental contributions, labour income and expenditure levels of students. The goal of this paper was to provide a new perspective and comprehensive model on the financial considerations of students in light of the Dutch student finance system.

The main findings are that students entering the borrowing phase with a lowered default loan continued to borrow significantly less than in the old situation. This resulted in increased parental contributions and lower expenditure levels. There were no significant changes in labour income during the research period (2009-2015) but this does not necessarily indicate that there were no effects. The economic crisis might have affected the observed relationship between student loans and labour income.

Most importantly, this thesis has quantified the level and extent of intergenerational support for young adult Dutch students in times of liquidity constraints and has shown that maximizing loans for students entering the borrowing phase induced extra consumption.

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1. Introduction

Student financing has long been a heavily debated subject in the Netherlands. It was the current prime minister Mark Rutte who in 2006, at the time being active as state secretary for the ministry of Education, Culture and Science (OCW), started a campaign to promote student loans for higher education[1]. The campaign was intended to help students make an informed decision about whether or not to borrow money from the government and to inform them about the conditions of these loans. Rutte emphasized that the campaign was not intended to stimulate students to borrow money without good reason. He argued that students were working too much and because of that were investing too little time in their education and other academically enriching activities. The legitimization of this campaign was based on the findings of a study done by the Radboud University of Nijmegen, which found that students were more inclined to work then to take on a student loan to finance their way through higher education (Van den Broek & Van de Wiel, 2005). There are several considerations when designing policies regarding the student finance system.

1.1 The considerations of promoting student loans

The field of behavioural economics it has been found that children and young adults are less preoccupied with the long-term consequences of their decisions but more with short-term gratification (Lavecchia, Liu & Oreopoulos, 2014, Koch, Nafziger & Nielsen, 2014). This comes into play when students decide on how much to invest in education and whether they allocate their time to work or studying. Next to that, there are a lot of considerations when it comes to student loans. This can contribute to something called cognitive dissonance: mental stress caused by overload of stimuli/information which can lead to inactivity and students forgoing worthwhile education opportunities (Lavecchia, Liu & Oreopoulos, 2014, P. 15-16). A combination of these factors could result in underinvestment of time and money in education by students who do not fully appreciate the long-term benefits of higher education. This would attest to the claims made by Rutte.

It should be noted though, that from the perspective of behavioural economics one could also argue that students are less equipped to deal with the responsibilities that come with student loans and could run the risk of becoming overly indebted. A large body of evidence has been collected that shows that the resilience of one's financial choices is greatly determined by earlier experiences with

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[1] NRC: *'Twee dagen werken, drie dagen studeren'* By Mark Duursma. Published on: 26-01-2006, accessed on: https://www.nrc.nl/nieuws/2006/01/26/twee-dagen-werken-drie-dagen-studeren-11074538-a391695

financial matters and the extent of economic and financial knowledge one possesses (See; Lusardi, 2009/ 2014/ 2015, or Xiao et al. 2010/ 2014). This is also described as 'financial literacy'. Lusardi & Mitchell argue that individuals undertake investments in financial knowledge only when it is directly relevant. Young adults are less likely to have invested in financial knowledge and are prone to financial mistakes (Lusardi & Mitchell, 2014, p. 21). This raises the question whether there is a need to prevent irresponsible borrowing behaviour of students.

1.2 The role of government policy in student financing

Both visions on student financing come in and out of fashion every now and then. This is illustrated by the fact that in 2009, just three years after the campaign initiated by state secretary Rutte, the Minister of OCW sent out a letter to all students calling on them to borrow responsibly[2]. However, it is hard to determine to what extent a student is still borrowing responsibly since this differs per individual.

The Dutch government closely monitors the average student loan and the factors that determine student borrowing behaviour (Van den Broek & Van der Wiel, 2005, Oosterbeek & Van den Broek, 2008, NIBUD 2010/ 2015). But connecting these statistics to a normative judgement is complex since there are multiple (partly unobserved) factors that determine whether and how much a student should optimally borrow. Avery and Turner (2012) dedicated a paper to this question. They came to the conclusion that higher education is a worthwhile investment, but that it is important for students to contemplate the economic consequences of a student loan. This means weighing off the potential increase in future wage against the costs of the loan as precisely as possible. The Dutch government would like students to finish their studies quicker and with better results and there is a general belief that student loans will help facilitate this. At the same time, the government has taken up a role in assisting students to make conscious and well-informed decisions regarding student loans.

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[2] NRC: *'Plasterk: 'student, leen bewust!'*. By Sander Heijne. Published on 06-03-2009, accessed on:
https://www.nrc.nl/nieuws/2009/03/06/plasterk-student-leen-bewust-11692973-a1092419

1.3 Recent policy changes

This thesis exploits a policy change by DUO[3] which was intended to 'nudge' students towards reconsidering the height of their student loan. Nudging is a phrase coined in the equally named book 'Nudge' by Thaler and Sunstein (2008). It entails altering people's behaviour through so called 'choice architecture' in a predictable way without forbidding any options or significantly changing economic incentives (Thaler & Sunstein, 2008, P. 6). Choice architecture can be anything from structuring complex choices in a certain way in order to influence a certain outcome, changing defaults or giving feedback on choices in order to influence them. Using behavioural insights to formulate policy has become popular since the book by Thaler and Sunstein was published. The Dutch Ministry of Education, Culture and Science (OCW) has also investigated the possibilities of behavioural influencing in conjunction with DUO to stimulate responsible borrowing behaviour.

The policy change DUO entailed lowering the height of the loan students would automatically receive after four years of student financing. Previously, students were granted an allowance for four years, after which they would enter the borrowing phase. In order to prevent a sudden loss of income when entering the borrowing phase, the standard practice from DUO was to automatically maximize loans in the fifth year. After 2009, this default loan was adjusted to the height of the initial allowance plus the most recent loan. This significantly decreased the number of maximum loans from 68 to 11 percent and lowered the average student loan[4].

Through lowering of the average student loan, the intervention is likely to have affected the income and expenditure patterns of students. Perhaps the induced reduction of student loans caused students to work more. This in turn might have negatively influenced their academic performances, as mentioned in the introduction. Students could have also turned to alternative sources of income. In order to formulate a clear perspective on the benefits and effects of the before mentioned modification of the student finance system, it is it is important to have an insight in the motives of student borrowing behaviour.

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[3] The Dutch organization responsible for the student finance system (*'Dienst Uitvoering Onderwijs'*)
[4] NRC: *'Studieschuld stevig verminderd dankzij simpele nudging-trucs op aanvraagformulieren'.* Published on: 13-04-2015, Accessed on: https://www.nrc.nl/nieuws/2015/04/13/studiefinanciering-studieschuld-stevig-verminderd-1486199-a215924

1.4 Research question

The result from the intervention by DUO is noteworthy and the significant decrease in student loans opens the possibility to examine the relationship between student loans and the income and expenditure patterns of students. Any interaction effects between student loan and working behaviour of students can be measured with the help of this exogenous source of variation caused by the DUO modification. As the literature review will show, the main sources of income for students are the student loan, parental contributions and labour income. Therefore, the central question to this paper is:

How do student loans affect employment, parental contributions and the expenditure patterns of students?

In trying to find an answer to this research question, this paper is one of the few to empirically assess the causal effects of student loans on different income sources and the expenditure pattern of students. Especially with regard to the causal effect of student loans on parental contributions. In the process of creating a new model of causal relationships between these concepts, this paper will provide a better understanding of the financial behaviour of students which will be of value in assessing new policies with regards to the student finance system. In addition to the academic contribution, discussions about the relationship between student loans, employment, parental contributions and expenditures have important societal implications. If increased employment activity negatively affects student performance in higher education then this in turn might affect opportunities in the labour market. If student loans prove to take away some of the incentive to work and this stimulates academic performance, then a revision of policies regarding employment for students and stimulation of student loans should be open to discussion.

The research will consist of an empirical analysis on data from the so called 'Student Monitor' (Studentenmonitor Hoger Onderwijs[5]). The student monitor is a survey among students in higher education to track socio-economic factors, study progress, financial situation and other factors. To establish the effects of student loan on other sources of income and the expenditure patterns of students, first the decrease in student loan has to be substantiated. Then, the causal effects of this exogenous variation in student loans can be quantified using a combination of an instrumental

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[5] Website of the Student Monitor with 'about' section and publications: http://www.studentenmonitor.nl/

variable and difference-in-difference approach. By jointly estimating the different regressions, unobserved characteristics are accounted for, which will improve the efficiency of our estimates.

1.5 Findings & limitations

The main hypothesis was that changing the default loan for students entering the borrowing phase would encourage them to reconsider their borrowing motives and would lead to lowering of the average student loan. This effect was already established by van der Steeg in 2015, and corroborated in the first regression results. We established an average decrease of the monthly student loan with €81.18. This in turn resulted in increased parental contributions for the treatment group for up to four years after the intervention (2009-2013). Secondly, the DUO policy change lead to a generally lower level of expenditure. This implies that a portion of students increased consumption due to the maximized loans under the old student finance system. These expenses were cut after DUO lowered the default loans.

The secondary goal of this paper was to test whether stimulating students to take out a student loan would improve study results, since students could then focus their attention on academic activities instead of work. The mediating variable, student employment, did not show statistical significance for the effect of the reduction in student loans. Year dummy variables did establish significant and negative effects on labour income in the period 2009-2015, which might have been caused by the economic crisis. The crisis could have affected the employment opportunities for students and therefore the observed relationship between student loan and labour income. In addition, the descriptive statistics showed that after 2013, student employment was on the rise again and parental contributions slowly diminished for the treatment group, suggesting that the effects of the economic crisis and liquidity constraints were diminishing. However, since there is no statistical evidence to support this assumption we cannot rule out that there was no significant relationship between student loan and employment altogether.

1.6 Reading guide

The following chapter provides an institutional background for the system of student financing in the Netherlands and a more elaborate description of the research that inspired this paper. After that, a comprehensive literature review of the existing theories and empirical research regarding the income and expense pattern of students will be discussed, which will result in the hypotheses. Chapter 4 consists of a discussion of the research design followed by a descriptive data analysis. In chapter 5, the hypotheses are tested, the regression results examined and the research design will be tested for robustness using a placebo test. The discussion, chapter 6, provides an answer to the research question and discusses the implications of this paper. Finally, the limitations of the paper will be discussed and interesting extensions for future research suggested.

2. Institutional background

2.1 The Dutch student financing system

The Netherlands has instituted a system in which students can borrow money from the government with relative ease and at a low interest rate (currently around 0.01%[6]). Originally, this system was instituted for students coming from low income families. In 1986 the government extended the financial facilities to children of all backgrounds. The Dutch organization DUO ('Dienst Uitvoering Onderwijs') is the executive organization for this system. The borrowing system (see table 1) can be broken down into several components, of which the basic allowance is most important. Students received this allowance for 4 years conditionally on completing their study within 10 years[7]. If this condition is not met, the allowance must be refunded. Then there is a supplementary allowance for students whose parents earn below a certain income, the possibility of a loan for tuition fees and a compensation for public transportation (in the form of a free transportation card). Finally, there is the possibility to borrow extra money up to a certain limit. Student are eligible for this system when they turn eighteen or start their higher education.

The first four years after a student applies for student finance is called the nominal period. DUO offers students the possibility to borrow for up to three years after the nominal period, the 'borrowing phase', which makes seven years in total. Table 1 gives an illustration of the components of student financing[8]. The amounts are adjusted yearly and are therefore slightly higher than at the time of the DUO intervention. The table shows that students can easily (the loan can be changed online on a monthly basis) borrow up to a thousand euros per month.

Table 1. Make up of student finance (on a monthly basis)

	Living independently	Living with parents
Basic allowance	290,68	104,40
Supplementary allowance	274,68	252,91
Loan for tuition fees	165,33	165,33
Regular loan	302,32	302,32
Total	**1.033,01**	**824,96**

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[6] Source: DUO: *'Rentepercentages'* Retrieved from: https://duo.nl/apps/rentepercentage/index.html
[7] This system changed in September 2015 (Staatsblad, 2015, 51). From that point on, there are no longer allowances and students can now only apply for a loan from DUO ('Sociaal Leenstelsel'). This does not have any implications for the research design since we analyse the period prior to that.
[8] Source: DUO: '*Het oude stelsel van studiefinanciering'*. Retrieved from: https://duo.nl/particulier/student-hbo-of-universiteit/het-oude-stelsel-van-studiefinanciering.jsp#

2.2 Statistical analyses of the Dutch context

The Dutch National Institute for Family Finance Information (NIBUD) has published several studies in the context of student finances. In 2010 it conducted an online survey (N = 2.395). This study found that about 67 percent of students received income from a (part time) job and in total 43 percent of respondents borrowed money from DUO (NIBUD, 2010). In 2015, a similar analysis was done and it found comparable results: 71 percent of students received income from employment, 57 percent of students received financial support from their parents and 32 percent of all students borrowed money (Nibud, 2015, P.20).

ResearchNed, responsible for processing the Student Monitor survey, conducted similar analyses of student finances. Van den Broek et al. (2012) found relatively consistent statistics compared to other studies. Around a quarter of students took out a student loan in the period 2003-2009. A second study was conducted by the same bureau three years later. Again, around two thirds (66 percent) of students complemented their income with a part time job. Of the younger students about 35 percent had a student loan. Older students borrowed more frequently. About 55 percent of these students had a student loan (Van den Broek et al. 2013).

In sum, empirical research shows that in general a high percentage of students work: about two thirds of all students complement their income with a job during their study whereas about a quarter of all students take out a student loan. These percentages vary between students of different age groups and education levels. Students that follow a scientific education program ('WO') tend to borrow more often than higher vocational students ('HBO'). This might have to do with the higher expected future wage. The reports also found that important determinants of student borrowing behaviour are: age, housing situation, study progress and the level of parental contributions. Older students living independently generally have more financial obligations, receive less support from their parents and therefore need to borrow or work more (Nibud, 2010, P.22).

2.3 The effects of the modifications of the student finance system on student loan

Van der Steeg (2015) studied the effects of two policy changes made by DUO on the height of student loans. The interventions were aimed at influencing the decision-making process of taking up a student loan.

The first intervention van der Steeg examined was in 2009. As described in section 1.3, this intervention entailed changing the default loans, which were maximized for individuals entering the

borrowing phase. After 2009 this default loan was lowered from the maximum amount to the basic allowance plus the height of the additional loan that was already in place. This intervention decreased the number of maximum loans from 68 to 11 percent between the academic years 2008-2009 and 2010-2011[9]. An absolute change of 57 percentage points. This also significantly decreased the average loan with 129 euros per month.

The effect of the second intervention in 2014, removing the option "Maximize student loan" on the DUO website, was measured among first year students that first encountered the possibilities of student finance facilities. The number of students that applied for a maximum loan decreased from 69 to 34 percent compared to the year prior to the modification of the website.

This thesis uses the first intervention in an instrumental variable approach to investigate the causal effect of student loan on employment, parental contributions and the expenditure patterns of students. The second intervention is not used because examination of the Student Monitor resulted in a sample of 163 students for which these effects could be tested. This would lead to biased and inefficient estimates.

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[9] The academic year 2009-2010 is left out of the analysis because it took until 2010 before the change was implemented completely. This is due to the fact that DUO sets out the loans for students a year in advance. This means that only students entering the borrowing phase in 2009, who signed out and back in for a study in 2009, were subject to the new system.

3. Literature review

This chapter first describes the rationale behind student loans. Secondly, empirical research on student loans, other sources of income for students and studying will be discussed. This chapter will conclude with several expectations regarding the research question based on the discussed literature.

3.1 The rationale behind student loans

The justification of student loans can be derived from the life cycle consumption model, which was originally conceived by Franco Modigliani (1963). This model states that, on average, one's lifetime consumption pattern is adjusted to the trend of earned income which is lower when young, highest during middle age and drops after retirement (see figure 1). The model assumes that for people to maximize lifetime utility, consumption levels must be smoothened. In order to achieve this, borrowing in the earlier years of life and saving income for after retirement is necessary.

Figure 1. Life time consumption model
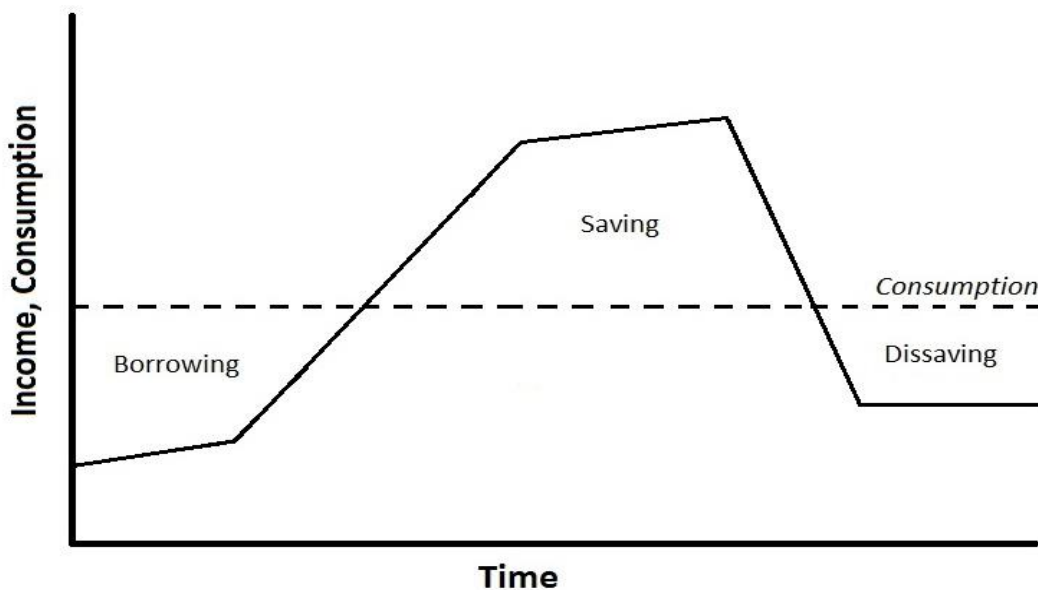
The governmental system of student financing is a way of facilitating consumption smoothing since it allows students to finance their years through higher education with borrowed money. The line of reasoning behind investing in higher education for the individual is that it will result in higher future wages. Society in general also benefits from a knowledge based economy, which is why the student financing system is aimed to facilitate accessible education for people from all socio-economic backgrounds (WRR, 1995).

3.2 Literature on student loans and alternative sources of income

The first step is to assess the relationship between student loan and working. Perna et al. (2007) argued that in light of improving the educational opportunities for students, it might prove beneficial to remove work incentives through providing more extensive financial facilities. However, this statement was not supported by any empirical research, nor is there much research that directly quantifies the relationship between student loans and employment. There is enough research suggesting that students prefer working over a student loan. Van den Broek & Van de Wiel (2005) did a cross-sectional study on the attitudes of students on student loans by way of an online survey (N = 9.902). The research found that around a quarter of students had a student loan, but that most students, 64 percent, preferred not to borrow money (Van den Broek & Van de Wiel, 2005, P.12). International literature also establishes this tendency of students to work during their study in order to minimize the total student loan (Beerkens et al, Mägi & Liis, 2010/ Riggert et al. 2006). Oosterbeek & Van den Broek (2008) investigated the factors underlying this behaviour. They first explored the standard economic borrowing considerations and found that for some students it is not necessary to borrow money. This group has access to financial means other than the student finance system and is more frequently supported by their parents. Students that do borrow money generally have good earnings prospects or are more willing to take risks. Also, students with higher discount rates, meaning their appreciation of an X amount of money is higher in the present than in the future, were more likely to take up a student loan (Oosterbeek & Van den Broek, 2008, P. 176-177). They also tested for a 'non-standard factor' of borrowing behaviour which is called debt aversion. Debt aversion is a reluctance or aversion towards borrowing money because of the risk of not being able to pay back the loan or because of the complexity of credit terms. Oosterbeek & Van den Broek established a significant effect of debt aversion on borrowing behaviour and concluded that it is a large contributing factor in why students work during their study and do not take full advantage of the student loan facilities. Both Booij, Leuven & Oosterbeek, (2011) and Van den Broek & Van de Wiel (2005) corroborated these findings, whereby the latter added that the attitudes of parents also play a role in the debt aversion of students.

Secondly, financial support from parents is an important source of income for Dutch students. Around forty to fifty percent of students receive financial contributions from their parents (NIBUD 2010/2015). Cox (1990) first discussed the importance of intergenerational transfers for liquidity-constrained consumers and how some households may face financial problems because of the

absence of connections with nonliquidity-constrained households. More specifically, with regard to students, Keane and Wolpin (2001) examined the relationship between parental transfers and the positive correlation between parents and children in educational attainment. They concluded that a part of the correlation in school attainment between generations is due to the fact that more educated parents make larger financial contributions to their children. They add that these relative differences are not reliant on the existence of any borrowing constraints for other students. In their simulations, they tested this assumption and found that relaxing borrowing constraints increased net borrowing by students, which lead to a reduction in earnings from work and increase in consumption (Keane & Wolpin, 2001, P.1089-1090). Relaxing borrowing constraints would only increase extra spending by students. Oosterbeek & Van den Broek (2008) also found that students with more affluent parents generally receive more financial support and concluded that these students are therefore less likely to take up a student loan. However, they did not quantify this in actual income streams. One paper which does quantify the relationship between different income streams is from Rozenzweig & Wolpin (1994). They present a model in which interaction between welfare benefits and the provision of parental support, in the form of financial transfers and shared residence, is estimated for young women and their children. They find that, for women around the age of 20-24, 28- to 42% receive parental support. While there is substitution of public assistance for parental support, reductions in government aid only marginally reduce parental contributions.

Though there is not much empirical research that directly establishes a causal relationship between student loans and parental contributions for higher education students, the literature suggests there is intergenerational redistribution or support between parents and children and that this is contingent on other income streams such as wage earnings, or possibly student loans. Other papers focus on younger students and the relationship between parental allowances and employment (Dustmann et al, 2009, Pabilonia, 2001, and Wolff, 2006). In that respect, Kalenkoski & Pabilonia (2008) found that lower parental transfers and greater costs of attending college increased the number of hours students work, which indicates compensation effects. Assuming that some costs for students are fixed, such as rent, tuition fees, study materials and other daily necessities means the distribution of income resembles a zero-sum game (a mathematical situation in which all gains or losses of a certain unit have to be balanced, so that the net change equals zero). If the level of expenditure is fixed to a certain amount, one would expect that any changes to one of the important income sources (in this research design that would be student loan) would have to be compensated

through the others. Of course, not all costs are fixed and student can also cut back on the expenses which are not absolutely necessary. Therefore, expenditure levels are also accounted for in the research design.

3.3 Student employment vs. academic performance

To provide a background for understanding the potential trade-off between working and study results, two theoretical perspectives will shortly be discussed. The first one being the zero-sum model (Warren, 2002). According to the zero-sum model there is a direct trade-off between the time and energy which is allocated towards working and that which is used for studying. The assumption of this model is that time which is devoted to work cannot be detracted from activities other than studying. Next to that, it could be that students reconsider or decide on their employment activities depending on how well they are doing in their study (Warren, 2002, P. 370-371). The second model is the primary orientation model. This model assumes that there are pre-existing differences between students that explain the varying effect working has on study results. Students who are primarily oriented towards school will do well in school regardless of how much they work, whereas other students are more drawn towards work instead of formal education. Other social psychological factors such as motivation or ability may also play a role. Most research seems to affirm the primary orientation model. Lillydahl (1950) established that modest levels of part-time employment do not significantly interfere with academic performances. Dundes & Marx (2006) found that working a moderate amount of hours (10-19) per week actually leads to more structure and discipline for students, which benefitted their study results. Darolia (2013) reached a similar conclusion, but found that students that work close to full-time complete fewer credits per term. Several studies have found that the adverse effects that can be found between employment and academic outcomes are attributable to pre-existing differences between students (Schoenhals, Tienda, Schneider, 1998 & Waren, Lepore, Mare, 2000). Wolbers (2008) did a survey among Dutch students (N = 8.259) to account for the negative association between part-time employment and school achievement. He found that this effect was attributable to the socio-economic backgrounds of students and that it diminished when checking for previous school results and attitudes towards education. Finally, Pass et al. (2010) conducted an analysis of variance (ANOVA) and found that students working in a part-time job did not underperform compared to their non-working fellow students. On the contrary, students that did not work completed less ECTS than students that did. An increase in working hours positively influenced the amount of ECTS completed (Pass et al, 2010, P. 248-253).

3.4 Hypotheses regarding the research question

Van der Steeg (2015) showed that the DUO intervention to the student finance system resulted in a considerable decrease in average student loan. The first step of the research design is to establish this effect on the data of the Student Monitor (first hypothesis). Next, we assume this decrease in income has to be compensated trough either an increased dependency on alternative income sources or by decreasing expenditure levels. Individually each of these factors have been studied but there is not much research on their respective influences on one another. Figure 2 illustrates the theoretical model central to this paper with the presumed relationships between student loan, labour income, expenditure, and in term academic results[10].

Figure 2. The theoretical model
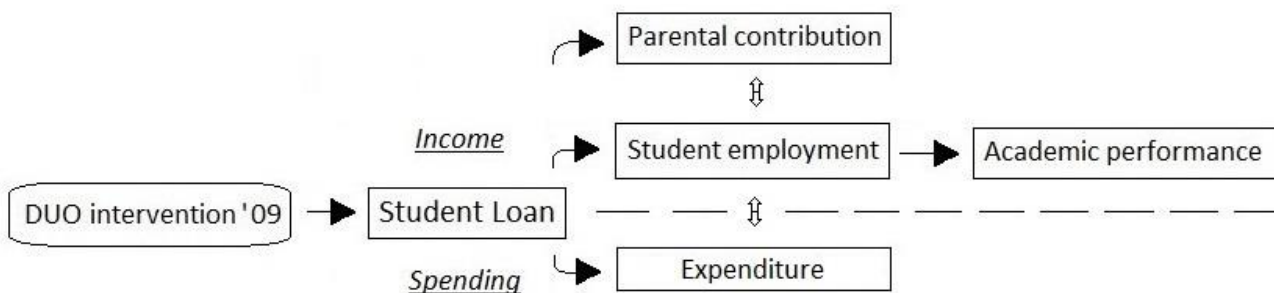
Based on the findings from previous empirical research, we know that a majority of students prefer working over a student loan (Van den Broek & Van de Wiel, 2005). Students that do borrow, mostly do so out of necessity. Nevertheless, there is a group of students that was affected by the intervention of DUO. It is likely that this observed decline in student loan comes from students that were not as thoughtful about their borrowing behaviour, and who were pushed to reconsider their stance on student financing regarding their earnings prospects or risk assessment (Oosterbeek & Van den Broek, 2008) due to lowered default loan. The second hypothesis therefore states that these students will have increased employment:

> H0 = no effect of change in student loan on employment
> H1 = increased employment due to change in student loan

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[10] The variables in the theoretical model are likely to be causally related to one another (indicated by the white arrows). These relationships are not specified in the research design apart from checking for correlations in error terms between the individual regressions (see section 4.2 and 5.1).

Dutch students are frequently supported by their parents. Around forty to fifty percent of students receive parental contributions in one form or another (NIBUD, 2010/2015). International literature also suggests that intergenerational transfers are of relative importance for young adults and that these transfers are contingent on changes in other income streams (Cox, 1990/ Rosenzweig & Wolpin, 1994/ Keane & Wolpin, 2001). Therefore, the third hypothesis states that parents are likely to contribute financially if students become liquidity-constrained due to the renewed DUO policy:

H0 = no effect of change in student loan on parental contributions

H1 = increased parental contributions due to change in student loan

As stated before, the decline in student loan does not have to be fully compensated through income. Some students might have increased expenditure with the maximized student loan in the borrowing phase (Keane & Wolpin, 2001, P.1089-1090). Therefore, we also expect to see a decrease in the expenditure of students:

H0= no effect on expenditure

H1= negative effect on expenditure

Finally, the primary orientation model suggests that a moderate amount of working hours is not likely to lead to any negative effects for academic performance. Depending on the level of increased employment, we do not expect to see any significant negative effects on the academic performance of students. However, first a causal relationship between student loan and employment has to be established since this is the pathway through which student loan affects academic performance.

4. Research design

The following chapter will first operationalize the concepts which are measured in the thesis and explain the methodology of the research design. Then, the origins of the data set will briefly be discussed, followed by the descriptive statistics.

4.1 Operationalization

The DUO intervention was first implemented at the start of the academic year 2009-2010. However, only a small group of students received the lower default loan (hereafter 'treatment') this year. This is because DUO sets out all student loans administratively one year in advance. Therefore, DUO only processed students that un- and re-enrolled in 2009, whilst entering the borrowing phase, to receive the treatment. Coincidently, this year the Student monitor was not administered[11]. Therefore, the first year in which the student loan effect is measured is the survey year 2011, which applies to the academic year 2010-2011[12].

The treatment group is defined as all students between 23 and 27 years old who no longer receive a basic allowance after 2010. Students are eligible for the basic allowance from the age of 18 and receive the allowance for four years. 18 + 4 = 22, which means most students enter the borrowing phase at the age of 23. Though students can apply for the allowance at a later age, it is not possible to distinguish which students did so in the data set. To cancel out any students who already lost their right of basic allowance, the cut off is set at the age of 27. This way we account for all students that could have dealt with the intervention from 2010 onwards. This logic is illustrated in table 2.

Table 2. Definition of the treatment group

Treatment period									
2009							23	24	25
2010						23	24	25	26
2011					23	24	25	26	Etc.
2012				23	24	25	-	-	-
2013			23	24	25	26	-	-	-
2014		23	24	25	26	27	-	-	-
2015*	23	24	25	26	27	28	-	-	-

*The years 2009 &2015 are not included in the data set

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[11] The year 2010 is missing from the data set because the survey was not administered that year. Since only a small group of students underwent the new DUO policy that survey year, this has no significant consequences for the research design.

[12] Each survey year applies to the academic year before that. This is also why in table 2 the year 2015 is not represented in the analysis. The survey results of 2015 refer to the academic year 2014-2015, and the data set only spans 2001-2015

The control group consists of students between 21 and 27 with a basic allowance before and after the intervention. Younger students are included to control for period effects.

Both the independent and dependent variables in the analysis come from a self-reported measure in which students indicate how much of their income is coming from which income source respectively (For the complete survey and coding see: Van den Broek & Mens, 2017).

4.2 Methodology

From the theoretical model (figure 2, section 3.4) four different regressions follow. First, the effect of the DUO intervention in 2009 on student loans has to be established. Then follows the effect of this exogenous variation in student loan on expenditure levels, financial contributions by parents and student employment. Lastly, if we examine an increase in student employment we can measure how this affects academic performance.

We employ a difference-in-difference technique to measure the intervention effects between students that underwent the modification administered by DUO and those who did not. The differences between these two groups in average student loan over the research period will give the treatment effect. By using an instrumental variable approach, the DUO reform poses as an exogenous source of variation in student loans which enables us to establish any causal relationships with labour income, parental contributions and expenditure levels.

Estimating these equations using OLS would lead to biased results since student loan is endogenous. There may be unobserved characteristics that influence both student loan on the one hand and labour income and parental transfers on the other hand. For example, if a student is very debt averse, this may lead to a relatively low student loan and a relatively high labour income. Furthermore, if the parents of a student are very debt averse this may lead to a low student loan as well as a relatively high parental transfer. Reverse causality may also play a role: if a student receives a high contribution from his parents, this may lead to a relatively low student loan. To address these concerns the policy reform is used as an exogenous source of variation in student loans. Using the policy reform as instrumental variable relies on the assumption that the reform had no other effect on labour income and parental transfers than through its effect on student loan.

Period effects do not invalidate the identification strategy as younger students with a basic allowance (age 21-22) act as a control group. Therefore, only factors changing at the same time as the

introduction of the reform and exclusively affecting students in the treatment group (or only students in the control group) may be potential threats to the identification strategy.

To examine the effect of the DUO intervention on student loan the following regression model is estimated:

$$SL_{it} = \beta_0 + \beta_1 G_{it} + \beta_2 G_{it} T_t + \beta_3 age_{it} + \beta_4 man_{it} + \beta_5 education_{it} + \beta_6 Y_{2006} + \beta_7 Y_{2007} + (...) + \beta_{14} Y_{2015} + \epsilon_{it}$$

SL_{it}	Is the student loan of student i in period t
G	Represents a dummy for the treatment group
T_t	Is a dummy for the treatment period
β_1	Represents the effect between control and treatment group
β_2	Represents the treatment effect
$Y_{2006} + (...) Y_{2015}$	Represents a full set of year dummies
ϵ_{it}	Is the error term

The main coefficient of interest is β_2, which indicates how the reform affected the height of student loans. Control variables are age, sex and education level (university level or higher vocational: WO or HBO). Controls for the income of parents and debt aversion greatly reduced the sample size and were therefore excluded.

As with any difference-in-differences strategy, the assumption is that the treatment and control group do not follow differential trends in absence of the reform, the common trends assumption. This assumption can be tested by comparing the development of student loan, labour income, parental contributions and expenditure over time in the descriptive statistics. Secondly, a placebo test will be performed in which the treatment effects for the period 2007-2008 are estimated. This is the period just before the reform was introduced and should therefore yield no significant results.

To examine the effect of student loan on labour income, parental transfers and expenditure, the following regression models are used.

$$Lab_{it} = \gamma_0 + \gamma_1 Sl_{it} + \gamma_2 G_{it} + \gamma_3 age_{it} + \gamma_4 man_{it} + \gamma_5 education_{it} + \gamma_6 Y_{2006} + (\ldots) + \gamma_{14} Y_{2015} + u_{it}$$

$$Par_{it} = \delta_0 + \delta_1 SL_{it} + \delta_2 G_{it} + \delta_3 age_{it} + \delta_4 man_{it} + \delta_5 education_{it} + \delta_6 Y_{2006} + (\ldots) + \delta_{14} Y_{2015} + v_{it}$$

$$Exp_{it} = \varepsilon_0 + \varepsilon_1 SL_{it} + \varepsilon_2 G_{it} + \varepsilon_3 age_{it} + \varepsilon_4 man_{it} + \varepsilon_5 education_{it} + \varepsilon_6 Y_{2006} + (\ldots) + \varepsilon_{14} Y_{2015} + w_{it}$$

where Lab_{it} is the labour income of individual *i* in period *t*, Par_{it} is the contribution of parents received by student *i* in period *t* and Exp_{it} is the expenditure level of individual *i* in period *t*. Lastly, if there is a significant correlation between student loan and employment, then the effect of student employment on academic performance can be estimated.

The four equations above are jointly estimated, allowing for correlation among their error terms. Taking into account those correlations will control for unobserved variables and improve the derived estimates compared to single-equation OLS regressions.

4.3 Data

The research analyses data from the Student Monitor for Higher Education[13]. This is a yearly online survey initiated in 2000 in light of the Eurostudent project which aims to keep track of socioeconomic traits of students[14]. It has seen some changes over the years besides the changing focus of the Eurostudent project. Exogenous factors, such as the change in the Dutch bachelors-masters system in 2002 or changing policy interests, have also contributed to certain aspects of the survey being modified or omitted completely. The survey covers around 15 topics but the most relevant ones for this research include: current education, study progress, personal traits, socioeconomic background, characteristics of parents, income and expenses, paid labour and time allocation. Data collection takes place yearly around spring (May/June). Students are selected based on stratified sample selection. The data set runs from 2001 to 2015, totalling a number of 186.665 respondents. Since the DUO intervention took place in 2009, we only go back four years in the data set and disregard the first four years to assure representativeness of the samples. This means the analysis spans the period 2005-2015.

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[13] Website of the Student Monitor, 'about' section: http://www.studentenmonitor.nl/over/over1.htm?
[14] Website of Eurostudent, 'about' section: http://www.eurostudent.eu/about/intentions

4.4 Descriptive statistics

Table 3 shows the number of students that are left in the sample after excluding all respondents younger than 21 and older than 27.

Table 3. Characteristics of students

	Treat.	2005	2006	2007	2008	2009	2011	2012	2013	2014	2015	Total
N	0	5.687	5.596	4.775	4.162	3.922	10.590	5.552	10.131	7.765	9.286	67.466
	1	1.488	2.154	1.130	725	640	2.301	1.152	1.144	830	1.468	13.032
Age	0	23	23	23	23	22	22	22	23	23	23	22.8
	1	25	25	25	24	24	24	24	24	24	25	24.6
Male (%)	0	50	49	48	46	47	42	39	39	35	36	42
	1	53	53	53	54	52	46	46	41	36	39	48
HBO-WO	0	38/62	30/70	38/62	36/64	38/62	45/55	37/63	47/53	47/53	41/59	41/59
	1	21/79	12/88	17/83	17/83	17/83	21/79	17/83	27/73	30/70	23/77	20/80

Note: N is after excluding all students who do not belong to the treatment or control group and part time students

The average age of students in the Student Monitor is around 23 for the control group (treat = 0), and 25 for the treatment group (treat = 1).

The sex of students is redefined as a dummy variable (0 = female, 1 = male) which shows that the share of female students in the samples increases throughout the years. This might have to do with the fact that females in general are overrepresented in higher education compared to males.

The majority of students from the treatment group, around 80%, does a university-level study (WO). This percentage is lower for the control group at 59%. This might be due to the fact that the treatment group mostly includes students who applied for student finance at the age of 18. Most WO students do so when they are done with secondary school and go to university. The control group also includes younger students, which might account for the difference.

Income sources

Students in the Student Monitor are asked to specify the different sources of their monthly income. Figure 4 affirms that the most important sources of income are employment, the DUO allowance, financial contributions by parents and student loan. Remaining sources of income accounted for small portions of the total and were therefore combined. The figures show that the treatment group does not receive the basic allowance and relies more on other sources of income such as a student

loan or earnings from employment. We also see a significant drop in student loan for the treatment group after the treatment (DUO policy change). Compared to the situation before the treatment by DUO, the treatment group receives more money from parental transfers and less from employment, whereas this remains relatively the same with the control group.

Figure 4. Distribution of income sources

Income sources for treatment group

Before treatment (950)   After treatment (1040)

Income sources for control group

Before treatment (840)   After treatment (941)
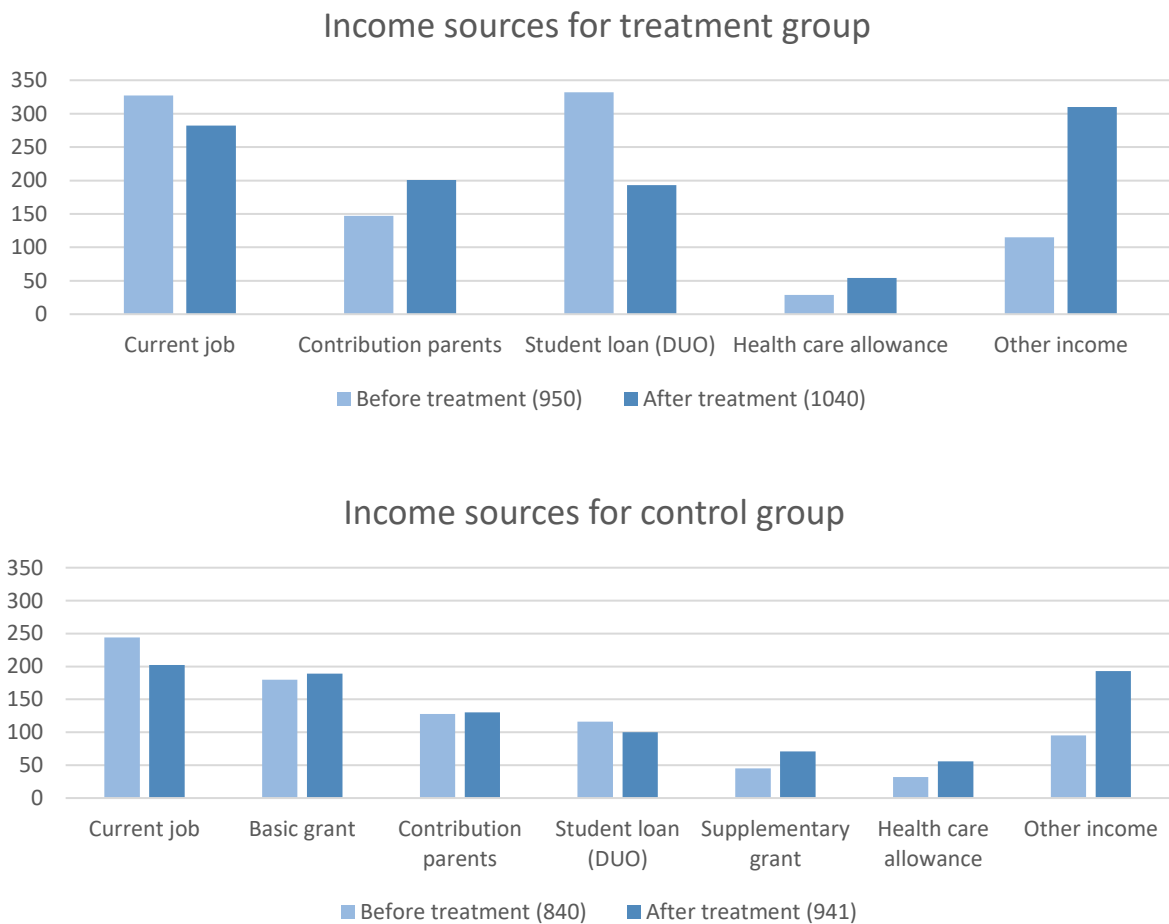
Finally, we see that both groups rely more heavily on alternative sources of income in the period after the treatment. These alternative sources of income range from savings, previous jobs, rent subsidy, scholarships and non-specified sources of income.

Next, we look at the development of student loan, labour income, parental contributions and expenditure levels to get an understanding of their respective growth or decline.

Student loan

Figure 5 shows that there is a significant decrease in the height of the average student loan for the treatment group after 2009 caused by the intervention of DUO.

Figure 5. Development of student loan
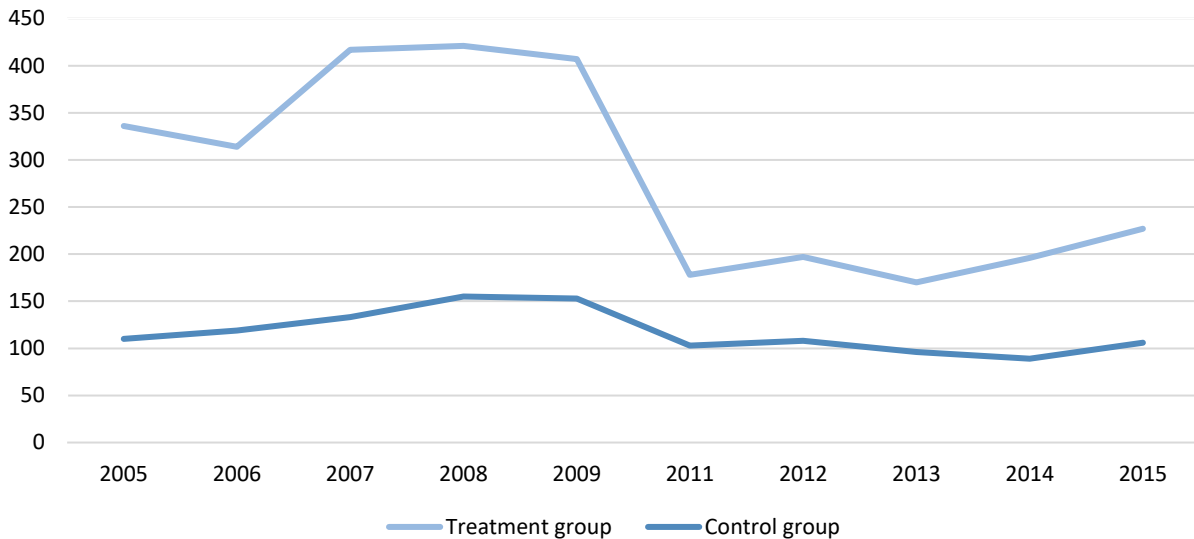
Interestingly, the control group also shows a decrease in student loan which is significantly less steep. Yet there is a small decline which might indicate period effects. Looking at the timing of the effect suggests that this could possibly be caused by the economic crisis of 2008. The crisis could have affected students' perception of earning prospects and therefore their willingness to borrow money (Oosterbeek & Van den Broek, 2008). Between 2013 and 2015 these effects seem to diminish and we observe an increase in student loan for the treatment and control group. This increase might have been caused by the effects of the economic crisis diminishing (labour markets starting to flourish again and students becoming more positive about their future job prospects) which reduced debt aversion.

Student employment

Up until 2009, the development of labour income of the treatment and control group is very similar. We see that there is a slight drop in labour income from 2009-2011 in figure 6 for both the treatment and control group. This is interesting to note, given the significant drop in student loan for the treatment group in that same period. We would have expected to see a compensation effect/ increase in labour income here for the treatment group due to the DUO intervention. Again, a possible explanation for this could be that this compensation effect was tempered by the economic

downturn of the financial crisis. With less economic growth there might have been a shortage of employment opportunities for students. As we saw with student loan, there is an increase in labour income for the treatment group after 2013. This might be the postponed compensation effect once the effects of the economic crisis diminished.

Figure 6. Development of labour income
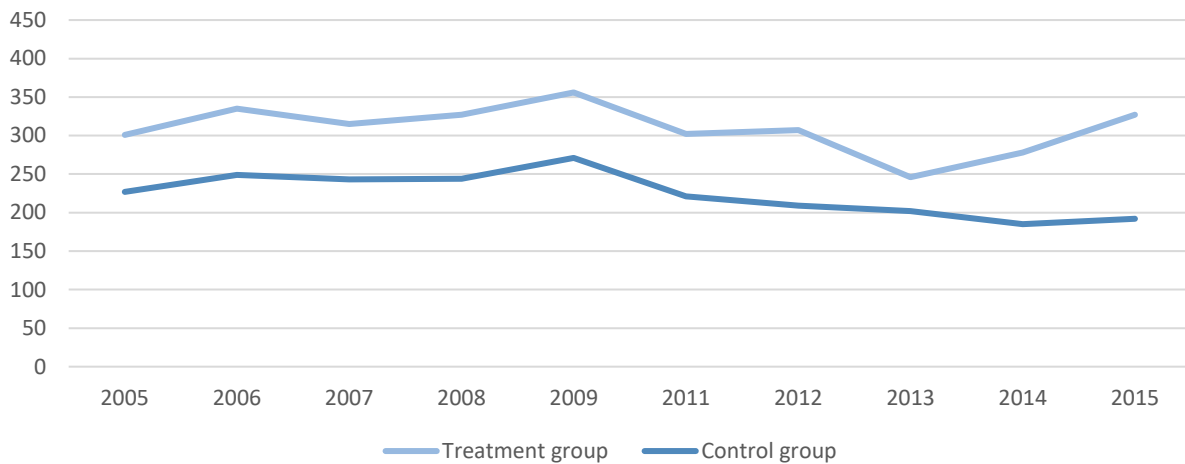
Parental support

Figure 7 shows that there has been a steady increase of parental contributions for the treatment group from 2009 up until 2013, after which the contributions decline. This is the same year in which student loan and labour income increased again for the treatment group. For the control group the contributions line remains relatively flat indicating that the increase in parental support for the treatment group can be attributed to the effects of the DUO intervention.

Figure 7. Development of parental contribution
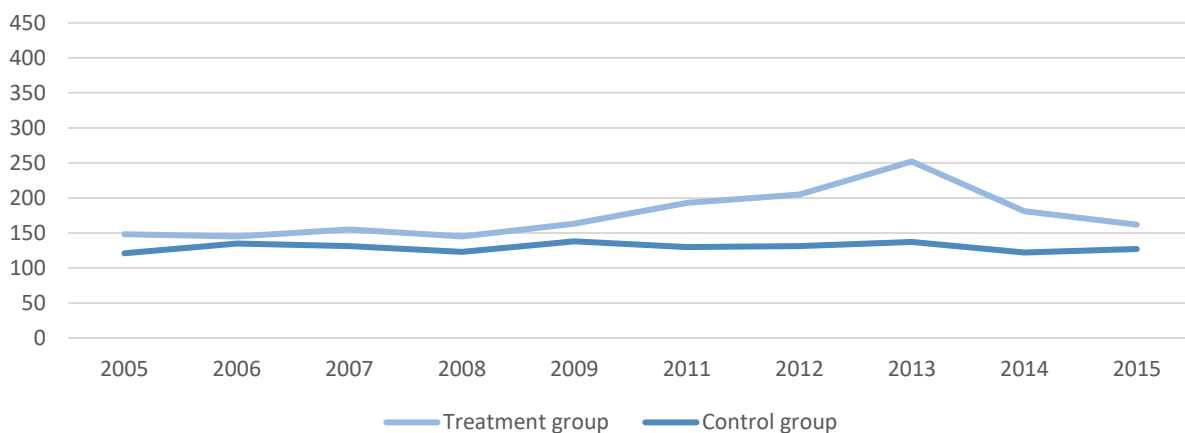
Expenditure

Figure 8 shows that the average level of expenditure decreased in the period 2009-2011 for both the treatment and control group. The interpretation of this result is ambiguous. Most likely the decrease in expenditure can be attributed to period effects since the control group also shows a significant drop in expenditure levels. However, the treatment group experiences a slightly larger decrease (298 vs. 265) which might indicate an additional compensation effect caused by the DUO intervention.

Figure 8. Development of expenditures
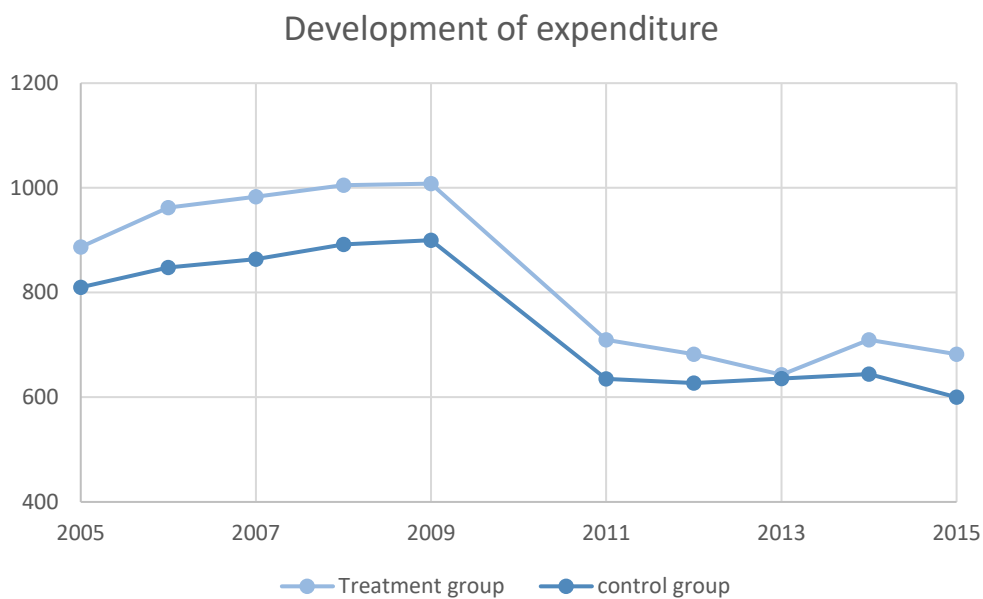
In general, we expected to see a larger compensation effect through increased labour income for the treatment group. Period effects of the economic crisis offer a possible explanation for a lack of evidence for this expectation and seem to be supported by the increase in labour income and student loan after 2013, which might indicate diminishing effects of the economic crisis. The regression analysis will have to give a decisive result on this since there could be no correlation with student loan at all. Parental contributions increase significantly for the treatment group, indicating a treatment effect, and diminish after 2013 once student loan and labour income increase again. We also observe a decrease in expenditure levels for both the treatment and control group after 2009 which might have been caused by the economic crisis.

5. Results

The following chapter discusses the results for the main regression. The regressions are estimated simultaneously but are discussed separately. Both the individual OLS and conditional IV regression results are shown in the tables, except for table 5 which shows the effects for the DUO intervention on student loan (which is the independent variable in the other regressions). The reduced form results are displayed in the appendix and will be discussed per hypothesis.

5.1 Main regression results

As discussed in section 4.2, the regressions are jointly estimated to control for unobserved variables. The correlation of error terms is shown in table 4 and indicated by ρ (Rho). The correlation between individual regressions is indicated by number whereby student loan is indicated by (1), labour income (2), parental contributions (3), expenditure (4).

Table 4. Correlation of the error terms

ρ	Coef.	Std. Err.	(95% Conf. Interval)	
Rho_12	-.0525601	.0499374	-.1496234	.0455067
Rho_13	.4877609	.0381645	.4094626	.5589265
Rho_14	.0383437	.0584114	-.0761426	.1518321
Rho_23	-.1173649	.0242866	-.1646611	-.0695302
Rho_24	.2193002	.0059008	.2077045	.2308343
Rho_34	.0499213	.0287254	-.0064784	.1060045

We can see that there is a significant correlation for Rho_13, Rho_23 and Rho_24. This means that there are unobserved variables that affect the correlation between student loan and parental contributions, labour income and parental contributions, and labour income and expenditure respectively. Since we investigate the effects of student loan on the other variables, the significance of Rho_13 is especially interesting. The positive coefficient tells us that there are characteristics that positively affect the relationship between student loan and parental contributions for some of the respondents in our sample. For instance, some students might want to upkeep a certain standard of living they were accustomed to when living with their parents and might therefore borrow money regardless of the support from their parents. Furthermore, Keane & Wolpin (2001) have established that more educated and affluent parents will support their children in order to stimulate school

attainment, which might explain why certain students both borrow more and receive more financial support.

We observe a significant and negative coefficient for labour income and parental contributions which indicates that for some students in our sample an increase in labour income leads to a decrease in parental contributions and vice versa. Furthermore, the positive coefficient for labour income and expenditure indicates that expenditure will rise with labour income. By taking into account these unobserved variables the regression estimates become more efficient, which is reflected in the estimates for the IV parameters. The relevant differences between OLS and IV estimates will be discussed per regression below.

Student loan

Table 5 shows the regression results for the effect of lowering the default loan on the average student loan. The 'Treatgroup' variable shows the effect of being part of the treatment group (students between the age of 23 and 27 without a basic allowance from DUO) on student loan. It shows a significant coefficient at a p level of <0.01. Older students without a basic allowance borrow €146 more than the control group, which is to be expected since they no longer receive a basic allowance yet still have financial obligations. Control variables are included for age, sex and education level and are positive and significant. This means that older, male, university level students on average have a higher student loan.

When checking for the treatment effect in the second row we see that this coefficient is negative (-81.18). This tells us that for students from the age of 23 without a basic allowance, the average student loan decreased with €-81 after the policy change. This coefficient is significant at a p level of <0.01, which corroborates the findings from van der Steeg (2015). This is the premise on which the other hypotheses can be tested.

This treatment effect is also reflected in the year dummy variables. We see a positive and increasing coefficient until 2009, after which the coefficient drops and no longer is significant. Except for 2012, the coefficient decreases until 2013 and becomes positive and significant again in 2015. The year dummies' effect on student loan from 2009 to 2011 (from 84,20 to 1.32) tells us that, where before students would borrow significantly more, the student loan is a lot smaller after the intervention by DUO, which is reflected in the treatment effect of -81.18.

Table 5. Main regression results

Student Loan

Treatgroup dummy	146.7***
	(2.588)
Treatment effect	-81.18***
	(4.055)
Age	18.33***
	(0.445)
Sex	8.077***
	(1.600)
HBOWO	19.45***
	(1.670)
Y2006	18.71***
	(3.153)
Y2007	58.78***
	(3.606)
Y2008	89.18***
	(4.114)
Y2009	84.20***
	(4.154)
Y2011	1.329
	(2.704)
Y2012	11.68***
	(3.431)
Y2013	-4.401
	(2.894)
Y2014	-2.813
	(3.161)
Y2015	13.62***
	(2.966)
Constant	-355.3***
	(10.47)
Observations	77,814

*$p < 0.10$, **$p < 0.05$, *** $p < 0.01$
Standard errors in parentheses

Labour income

The second hypothesis concerned the effect of changes in student loan on labour income. The assumption was that the change in student loan would lead to compensation effects and changes in the working behaviour of students due to the reconsideration of borrowing motives such as those discussed by Oosterbeek & Van den Broek (2008).

Looking at table 6 and the reduced form regression results (table A in appendix) we see that the coefficient for the treatment group (row 13) is significant and positive. This means that the treatment group earns €60 more from labour income than the control group, which is in line with general expectations since this group is a bit older.

Table 6 shows that the coefficient for the relationship between student loan and labour income is not significant (-0.0432) and that the coefficient is relatively small, though the direction is as we would have expected (meaning each extra euro of student loan decreases labour income with 0.04 cent and vice versa). When checking for the treatment effect in the reduced form regression results (row 14, table A in appendix), we see that this coefficient is not significant and relatively small. Meaning that the treatment group did not significantly alter its working behaviour in the period after the policy change by DUO. This means that the null hypothesis cannot be rejected and that there is no statistically significant effect of student loan on student employment.

However, in that respect it is interesting to note that the year dummies show significant coefficients for the period 2009-2014 in both the main regression and the reduced form results. All coefficients are significant and negative, peaking at 2014 after which they rise again. The economic crisis might have restricted employment possibilities for the treatment and control group and in turn diminished the observed relationship between student loan and working. Figure 6 of section 4.4 shows that after 2013, labour income for the treatment group rises again, which coincides with a reduction of parental contributions (figure 7). This would seem to imply that after 2013, employment opportunities for students increased again which reduced the need for parental contributions. However, this is not reflected in the regression tables and it could therefore also be that there is no effect on labour income whatsoever. It should be noted though that the regression works with averages of both the treatment and control group (which includes younger students as well). Nevertheless, since there is no significant causal effect of student loan on labour income, the null hypothesis is not rejected. This also means that the effects for a reduction in student loan on academic performance cannot be tested since student employment is the mediating variable between the two.

Table 6. Main regression results

Labour Income	OLS	IV
Treatgroup dummy	75.02119***	66.57***
	(3.008)	(8.593)
Student loan	-.1147***	-0.0432
	(.005)	(0.0682)
Age	18.833***	17.47***
	(.6120)	(1.438)
Sex	25.00***	24.41***
	(2.184)	(2.259)
HBOWO	-46.79***	-48.19***
	(2.281)	(2.642)
Y2006	16.12***	14.69***
	(4.303)	(4.518)
Y2007	10.15**	5.998
	(4.927)	(6.321)
Y2008	33.44***	27.13***
	(5.630)	(8.242)
Y2009	59.33***	53.42***
	(5.681)	(8.009)
Y2011	-6.48	-6.089*
	(3.660)	(3.684)
Y2012	-10.71**	-10.75**
	(4.620)	(4.626)
Y2013	-43.79***	-42.50***
	(3.837)	(4.036)
Y2014	-49.95***	-48.80***
	(4.217)	(4.363)
Y2015	-32.47***	-32.30***
	(3.898)	(3.907)
Constant	-117.79***	-91.63***
	(14.37)	(19.85)
Observations	77,814	77,814

*$p < 0.10$, **$p < 0.05$, *** $p < 0.01$*
Standard errors in parentheses

Parental contributions

The third hypothesis concerned the effect of the reduction in student loan on parental contributions. Figure 7 of the descriptive statistics established a steady increase in parental contributions for the treatment group after 2009, which would indicate that parents gave their children some extra financial support in the adaptation phase to the new DUO regime.

Table 7 confirms that there is a significant effect of student loan on parental contributions. The treatment effect of -.540 indicates that for each euro of student loan, students receive 54 cents less parental support. Or, when student loan decreases, students will on average receive 54 cents from their parents for every euro decrease. In the OLS estimate, this coefficient is larger (-.0829). As was illustrated in table 4 (Rho_13), there are unobserved characteristics that decrease the negative relationship between student loan and parental contributions in the IV estimate. One possible explanation could be that if students are used to a high standard of living with their parents that this standard will be upheld once the student moves out, which means that both student loan and parental contributions are higher for this group. But different factors could be at play. Higher educated parents in general earn more money and therefore can contribute more to their children (Oosterbeek & Van den Broek, 2008, Keane & Wolpin, 2001). They might also appreciate the benefits of investments in education more and therefore instil less debt aversion in their children when it comes to student loans.

When checking for the effect on parental contributions in the reduced form results table (Table A in appendix) we see that the coefficients for both being assigned to the treatment group (15.21) and the effect during the treatment period (43.83) are significant. This means that the treatment group received extra financial support in comparison to the control group. This relationship is validated by the year dummy variables which are significant from 2009-2014. We also see that the coefficients for the year dummies decrease in size, indicating that parents cut down on the financial support after 2013.

The first regression showed that the average student loan for the treatment group decreased with €81.18 after the DUO intervention. The coefficient from table 7 tells us that the treatment group would then receive 54 cents of support for each euro of student loan less, which comes down to the treatment effect (increased financial contributions) of €43.83 in the reduced form table (Table A in appendix).

Table 7. Main regression results

Parental contributions	OLS	IV
Treatgroup dummy	40.37***	94.41***
	(1.814)	(5.925)
Student loan	-.0829***	-0.540***
	(.00294)	(0.0470)
Age	-.583***	8.152***
	(.3692)	(0.991)
Sex	-4.245***	-0.437
	(1.317)	(1.557)
HBOWO	82.05***	90.97***
	(1.376)	(1.821)
Y2006	3.553	12.68***
	(2.595)	(3.115)
Y2007	14.74***	41.27***
	(2.972)	(4.358)
Y2008	5.46	45.84***
	(3.396)	(5.682)
Y2009	22.90***	60.76***
	(3.427)	(5.522)
Y2011	19.58***	17.08***
	(2.208)	(2.540)
Y2012	17.35***	17.61***
	(2.787)	(3.189)
Y2013	33.26***	24.97***
	(2.314)	(2.782)
Y2014	10.96***	3.601
	(2.544)	(3.008)
Y2015	9.35***	8.279***
	(2.351)	(2.693)
Constant	8.29	-159.1***
	(8.669)	(0.0470)
Observations	77,814	77,814

*$p < 0.10$, **$p < 0.05$, *** $p < 0.01$*
Standard errors in parentheses

Expenditure

Next, we look at the fourth hypothesis which stated that students would lower their expenses due to the decrease in student loan, since it is quite plausible that students borrowed more than necessary in the first place due to the maximized loans.

Table 8 shows a significant and positive correlation between student loan and expenditure of .389. This means that for every euro of student loan, students increase their expenditure with 39 cents. If the average student loan drops with 81.18 euro's this also means that expenditure will decrease with 31 euro's. This amount is shown as the treatment effect (-31.80) in the fourth column of table A in the appendix. It is interesting to note the positive effect of student loan on expenditure, seeing that DUO used to maximize loans for all students entering the borrowing phase. This is likely to have instigated extra consumption by students.

Since the coefficient for student loan is significant in table 8, the null hypothesis can be rejected and we can assume there is a correlation between student loan and expenditure. The year dummies also show significant and relatively large negative coefficients after 2009, which indicates that the effects from the economic crisis also caused the control group students to cut on expenses. However, the 'treatgroup' variable shows that the treatment group cut back a little more than the control group due to the DUO policy change.

Together with the increased financial contribution by parents (43.83), the decrease in expenditure (31.80) almost completely accounts for the average reduction in student loans (81.18). Figure 4 of the descriptive statistics showed that both the treatment and control group saw an increase in other sources of income which were not specified in the figure. These included: savings, rent subsidy, scholarships etc. These alternative sources of income most likely accounted for the remaining (81.18-75.63) €5.55.

Table 8. Main regression results

Expenditure	OLS	IV
Treatgroup dummy	-80.11***	-72.33***
	(4.817)	(12.91)
Student loan	.457***	0.389***
	(.00768)	(0.105)
Age	44.54***	46.39***
	(.969)	(2.238)
Sex	.3523	2.092
	(3.490)	(3.584)
HBOWO	49.307***	48.63***
	(3.646)	(4.161)
Y2006	43.77***	43.53***
	(7.656)	(7.905)
Y2007	49.69***	50.57***
	(8.37)	(10.35)
Y2008	66.844***	71.23***
	(9.256)	(13.09)
Y2009	97.66***	102.5***
	(9.30)	(12.73)
Y2011	-116.29***	-117.3***
	(6.826)	(6.784)
Y2012	-132.88***	-133.4***
	(7.967)	(7.913)
Y2013	-163.11***	-167.2***
	(7.437)	(7.605)
Y2014	-133.12***	-137.6***
	(7.99)	(8.097)
Y2015	-181.467***	-181.9***
	(7.25)	(7.183)
Constant	-358.31***	-391.7***
	(23.16)	(45.03)
Observations	53,220	77,814

*$p < 0.10$, **$p < 0.05$, *** $p < 0.01$*
Standard errors in parentheses

5.2 Robustness check

For the difference-in-difference strategy to be valid it is important that the treatment and control group do not follow differential trends over time. Besides the descriptive statistics, this assumption is also tested using a placebo test. The placebo test will estimate the treatment effects for a period which was not affected by the DUO intervention to cancel out any disturbances in the observed relationships in the main regression.

Placebo test: testing for treatment effects in the pre-treatment period (2007-2009)

The results of the placebo test are displayed in table 9 and table B (reduced form results) in the appendix.

Table 9. Placebo test: Treatment effects for pre-treatment period (2007-2009)

VARIABLES	(1) Student loan	(2) Labour income	(3) Par. contributions	(4) Exp.
(1) Age	22.44***	-9.925	-18.67	-8.924
	(0.785)	(20.48)	(11.54)	(37.21)
(2) Sex	5.950**	21.80***	-7.651*	-3.572
	(2.558)	(7.237)	(4.078)	(13.61)
(3) Hbowo	13.86***	-69.57***	61.31***	1.982
	(2.802)	(13.80)	(7.775)	(25.40)
(4) Y2006	16.92***	-3.153	-7.337	3.814
	(3.456)	(16.66)	(9.385)	(30.62)
(5) Y2007	58.47***	-60.65	-30.85	-90.98
	(3.984)	(55.04)	(31.01)	(100.2)
(6) Y2008	92.14***	-80.36	-67.75	-154.5
	(4.666)	(86.82)	(48.91)	(157.9)
(7) Y2009	87.32***	-49.38	-47.63	-113.5
	(4.761)	(82.80)	(46.65)	(150.6)
(8) Treatgroup	167.6***	-119.7	-100.8	-467.6
	(3.604)	(156.0)	(87.90)	(284.8)
(9) DUO Treatment effect for period 2007-2009	15.19**			
	(7.529)			
(10) Student Loan		1.074	0.674	2.735
		(0.916)	(0.516)	(1.665)
Constant	-446.8***	469.2	392.7*	740.5
	(18.27)	(408.6)	(230.2)	(742.4)
Observations	35,386	35,386	35,386	35,386

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 9 (row 10) shows the effects of student loan on labour income, parental contributions and expenditure during the placebo test period of 2007-2009. The size of all coefficients is greatly reduced compared to the main regression results and none of the coefficients is statistically significant. This tells us that there were no significant differences in the effect of student loan on the other dependent variables for the treatment or control group beforehand which might have interfered with our research design.

Student loan (column 1, row 9) does show a significant, yet small, and positive coefficient during the placebo period as it does in the reduced form results. The treatgroup variable (row 8, column 1) shows that the treatment group borrowed more than the control group.

Table B in the appendix shows the treatment effects (row 9) for the period 2007-2009 for all variables. The coefficient for labour income is not significant. The treatment coefficient for student loan is only slightly significant (at a lower *p* level of 0.10) and with €14.73, the coefficient is relatively small. The same goes for the expenditure coefficient. It is significant (at a *p* level of 0.10) but also positive, meaning the fake treatment group was spending more before the actual treatment period. Only the treatment effect for parental contributions is significant and positive in the placebo test as it is in the main regression. Yet the coefficient is less significant (at *p*<0.10) and relatively small. Around €10 compared to the €44 of the main regression.

When interpreting the placebo test we can conclude that there was only a slight difference between the treatment and control group in the expected directions as found in the descriptive statistics. Interesting is the coefficient for parental financial support, yet this coefficient is not nearly as large as after the DUO intervention. Other than that, there is no significant effect of student loan on any of the other variables and we can conclude that the findings from the placebo test do not invalidate the observed relationships from the main regression.

6. Discussion & conclusion

This study was inspired by a paper published by van der Steeg (2015) which showed that Dutch students significantly borrowed less money after the default loans in the borrowing phase of the student finance system were lowered. Through a combination of an instrumental variable and difference in difference approach, we exploited the change in default loans to establish causal relationships between student loan and labour income, parental contributions and expenditure levels. The goal of this research was to provide a new perspective and comprehensive model on the financial considerations of students in light of the Dutch student finance system. The central research question was: *How do student loans affect employment, parental contributions and the expenditure patterns of students?*

The main hypothesis was that changing the default loan would nudge students to reconsider their borrowing motives and would lead to lowering of the average student loan. This effect was already established by van der Steeg but corroborated in the first regression results. We established that the average student loan decreased €81.18 for students entering the borrowing phase under the renewed DUO borrowing scheme. This decrease in student loan opened up the possibility to quantify the causal relationship of student loan with other income sources.

The second hypothesis stated that students would compensate the decreased student loan trough extra labour income. Against the expectation, we found no statistical significance for this hypothesis. We suggested that the explanation for this could be that the economic crisis restricted students' ability to work additional hours. The descriptive statistics seem to affirm this suggestion and show that after 2013 student employment and student loans increased again and parental contributions decreased. Which suggests that the effects of the economic crisis and liquidity constraints were diminishing. Nevertheless, this is not reflected in the main regression tables and it could therefore also be that there was no effect on labour income whatsoever.

We could not test for any causal relationship between student loans and academic performance (originally the fifth hypothesis) since this relationship is mediated by student employment. However, theory suggests that the promotion of student loans as a way of stimulating students to increase study hours is not likely to be effective since the relationship between employment and academic efforts seems fairly inelastic (Warren, 2002).

The third hypothesis concerned an increase in financial contributions by parents. Empirical research shows that around fifty percent of Dutch students is financially supported by their parents and that intergenerational transfers are of relative importance for young adults and responsive to changes in other income sources (Cox, 1990/ Rosenzweig & Wolpin, 1994/ Keane & Wolpin, 2001). We observed a significant and positive effect of the decrease in student loan on parental transfers. Students received around 50 cents per euro decrease of student loan, which amounted to an average of €43.83 to compensate for the adaptation to the new borrowing phase. This result quantifies the extent of intergenerational transfers and contingency on student loans, which is especially interesting since this relationship had not been quantified in such a similar fashion yet.

The fourth hypothesis, regarding the expenditure of students, was also found statistically significant. After lowering of the default loan by DUO, students cut their expenses with around 31 euro's. As Keane & Wolpin (2001, P.1089-1090) discussed, when borrowing constraints are relaxed, a portion of students will not critically consider the amount they borrow and instead increase consumption. In the case of the default loan by DUO, some students likely did not bother to change the maximized loan and instead increased their expenditure.

Academic & practical implications

Academically, this paper is one of the first to quantify the causal relationship between student loan and alternative sources of income in the Netherlands. It therefore provides a valuable addition to the existing theories on the financial considerations of higher education students. With regard to the practical implications, there was no prior empirical evidence on the trade-off between student loans and parental contributions. The increase in parental support after adjusting the default loans shows that intergenerational support is relatively important for young-adult Dutch students in times where there might be constraints in liquidity. We also saw that the decrease in student loan did not significantly alter the working behaviour of students. This is interesting in light of the discussion on student employment and academic performances, because it implies that promoting student loans to stimulate students to spend more time on education is not an effective policy solution. However, as pointed out in section 5.1, the economic crisis may have weakened this observed relationship.

Furthermore, the significant reduction in expenditure levels of students implies that the old policy of maximizing student loans in the borrowing phase induced students to unnecessary spending. After decreasing the default loan, students borrowed significantly less and lowered their expenditure.

Limitations & future research direction

Before making the above-mentioned inferences, it is important to critically examine some of the possible threats for the internal validity of the research design. The variables used to measure changes in income sources and expenditure were all self-reported averages by students and could therefore be less accurate. Endogeneity and reversed causality were some of the more important threats to the research design. Unobserved characteristics such as debt aversion could influence both student loan and labour income and reversed causality likewise. By using the policy reform as an instrumental variable, these problems were mitigated. For that, the assumption of common trends had to be addressed. Both the descriptive statistics and placebo test showed that the treatment and control group developed similarly over time with regard to the measured variables. This allowed us to assume that any significant differences between the treatment and control group during the treatment period were attributable to the DUO modification.

This research employed the exogenous variation in student loans due to the DUO policy change to establish causal relationships between student loan and parental contributions, labour income and expenditure. To strengthen these findings, the model would have to be extended and tested through similar research designs with varying instrumental variables. For instance, by taking changes in labour income or parental contributions as instrument. Quantifying the effects of unobserved characteristics such as debt aversion or perceived labour market prospects also provide more insight in the causal relationships.

Since this research focussed completely on Dutch students entering the borrowing phase, it is difficult to generalize these findings among students of different age groups or internationally. A practical suggestion would be to study the effects of the 2015 modification of the DUO website (since this affected mostly first year students) as discussed in section 2.3, once the collected data for this becomes sufficient.

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Appendix

Table A. Main Regression Reduced Form Results

VARIABLES	(1) Student loan	(2) Labour income	(3) Par. contributions	(4) Exp.
(1) Age	18.41***	16.77***	-1.739***	54.48***
	(0.443)	(0.608)	(0.368)	(0.881)
(2) Sex	7.668***	23.61***	-4.813***	1.026
	(1.598)	(2.189)	(1.322)	(3.437)
(3) Hbowo	19.30***	-49.19***	80.46***	54.37***
	(1.668)	(2.285)	(1.380)	(3.586)
(4) Y2006	18.44***	13.59***	2.571	49.91***
	(3.150)	(4.315)	(2.605)	(7.522)
(5) Y2007	58.18***	2.807	9.512***	69.49***
	(3.598)	(4.930)	(2.979)	(8.109)
(6) Y2008	90.66***	24.88***	-2.259	120.6***
	(4.096)	(5.617)	(3.399)	(8.635)
(7) Y2009	84.97***	50.61***	15.32***	143.8***
	(4.141)	(5.676)	(3.432)	(8.890)
(8) Y2011	1.274	-6.207*	16.36***	-115.6***
	(2.702)	(3.700)	(2.234)	(6.727)
(9) Y2012	11.10***	-11.89**	11.28***	-132.2***
	(3.427)	(4.694)	(2.835)	(7.908)
(10) Y2013	-3.981	-41.85***	27.36***	-163.3***
	(2.892)	(3.961)	(2.391)	(7.389)
(11) Y2014	-2.638	-48.48***	5.126**	-135.6***
	(3.159)	(4.326)	(2.611)	(7.942)
(12) Y2015	13.52***	-33.00***	0.920	-175.8***
	(2.964)	(4.059)	(2.451)	(7.252)
(13) Treatgroup	146.6***	60.20***	15.21***	-15.45***
	(2.586)	(3.541)	(2.138)	(5.822)
(14) DUO Treatment effect	-81.18***	3.499	43.83***	-31.80***
	(4.058)	(5.554)	(3.350)	(8.892)
Constant	-357.0***	-78.05***	32.67***	-549.3***
	(10.43)	(14.29)	(8.647)	(21.36)
Observations	84,848	84,848	84,848	84,848

Standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table B. Placebo test: Treatment effects for pre-treatment period (2007-2009) Reduced Form Results

VARIABLES	(1) Student loan	(2) Labour income	(3) Par. contributions	(4) Exp.
(1) Age	22.53***	14.30***	-3.504***	54.46***
	(0.783)	(1.112)	(0.583)	(1.742)
(2) Sex	5.623**	27.77***	-3.810**	5.145
	(2.556)	(3.630)	(1.901)	(6.599)
(3) Hbowo	13.72***	-54.86***	70.57***	36.19***
	(2.801)	(3.977)	(2.083)	(7.279)
(4) Y2006	16.78***	14.84***	3.991	49.14***
	(3.454)	(4.905)	(2.568)	(9.307)
(5) Y2007	58.21***	1.822	8.417***	66.07***
	(3.980)	(5.652)	(2.960)	(10.06)
(6) Y2008	93.15***	19.94***	-5.140	115.6***
	(4.657)	(6.615)	(3.465)	(10.88)
(7) Y2009	87.94***	45.24***	11.53***	137.4***
	(4.753)	(6.751)	(3.536)	(11.31)
(8) Treatgroup	167.5***	60.29***	12.12***	-10.41
	(3.601)	(5.114)	(2.678)	(9.758)
(9) DUO Treatment effect for period 2007-2009	14.73*	15.71	9.995*	33.85*
	(7.517)	(10.67)	(5.588)	(17.96)
Constant	-448.4***	-12.89	90.77***	-520.1***
	(18.23)	(25.89)	(13.56)	(41.39)
Observations	38,971	38,971	38,971	38,971

Standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$