Labour market prospects and study choices: a case study of the effects of labour market shortages on study choices in the Netherlands

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Abstract

This paper examines the relationship between labour market demand and study choices in Dutch higher education. Using a mixed-methods approach that combines vacancy rates, enrolment data, and student surveys, I test if there is a significant effect of vacancy rates on study enrolment. I then test two supporting hypotheses: first, students in highly in demand fields place greater importance on career prospects; second, students' opinions respond to market changes in different ways depending on the field of study. This study finds that the effect of sector level vacancy rates on study enrolment is insignificant. In some fields there does however seem to be an effect on student opinion. These findings are in accordance with the student study choice literature. Students' opinions are affected by new information but their major choices are not. There is also some indication that macro-economic effects could affect student enrolment on the whole.

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1. Introduction

The Netherlands is currently facing a tight labour market that is predicted to become even tighter in the coming years (De Nederlandsche Bank, 2024). The Social-Economic Council is an important research institute part of the Dutch ministry of Social Affairs and Employment and has reported that 2021 marked a turning point in the vacancy rate on the Dutch labour market (Sociaal-Economische Raad, 2023, p. 39). From that point onwards, there were more total vacancies than total unemployed individuals, a phenomenon they state is long term and structural. They project that the structural labour shortage will especially increase from 2025 to 2030 (2023, pp. 51–54). The main cause for the labour shortage is simple, the workers that retire cannot be fully replaced. The shift in demand of goods and services however also plays a role; an older population will have a higher demand for healthcare.

The Dutch population, and populations of other developed countries, are projected to change in age distribution which will result in a decrease of the labour supply and relatively less working age individuals for each retired person. The old-age dependency ratio, or simply dependency ratio for short, is given by dividing the population above retirement age by the working age population and multiplying the result by a hundred (Bannock et al., 2011). It is projected by the Scientific Council for Government policy (WRR), that the Dutch population will have a dependency ratio of about 45% in the 2040s after which the ratio will slump down for a decade (Wetenschappelijke Raad voor het Regeringsbeleid, 2024). After this temporary decrease the ratio will increase again and peak at around 55% in the 2070s.

In a report written by the WRR, they identify five key risks as a result of an ageing population: economic stagnation, high levels of government debt, diverging interests of EU member states, inflation and increased political tension within and between countries (2024: 128-131). They especially emphasise that an ageing population is a broader trend not limited to the Netherlands and that an ageing population in the European Union as a whole in addition to an ageing population in the Netherlands compounds the economic and societal uncertainties (Wetenschappelijke Raad voor het Regeringsbeleid, 2024, p. 30). The Dutch economy, in particular, is very internationally connected. That means that shifts in demand in connected economies heavily impact the Dutch economy. Much of the capital in the Dutch pension system is invested abroad, which means economic troubles abroad will also reflect back on the return on invested pensions (31). This has led to the idea that it might be possible to offset economic troubles with a more efficient use of the labour supply. In addition, there is the question of whether prospective students will respond to these shortages and move to industries with larger shortages, to contribute to a more efficient use of labour supply.

A great deal of policy solutions and reforms are under consideration to deal with what has been dubbed the “demographic time bomb” (Bannock et al., 2011, p. 92). One of these policy solutions is the possibility of increasing productivity. This route comes with a large degree of uncertainty in what is attainable and how it can be attained. Talks about productivity growth in the light of demographic change is in some ways simply repackaging an already existing debate surrounding productivity. Productivity growth has been steadily declining in the Western world for some time (Wetenschappelijke Raad voor het Regeringsbeleid, 2024, pp. 115–116). Concerns about the lack of productivity growth are in fact quite old and the academic debate explaining the productivity puzzle goes back to mid-2000 (Rodríguez-Pose & Ganau, 2022). This means demographic changes have increased the interest of policy makers in productivity increasing policies and has spurred the need for new scientific research, but many of the foundational texts and concepts are already in place and there is an established body of research to draw from.

The research question that follows is: Are students influenced by labour market demand when picking their major in higher education? This research question is answered in two stages. First, do the vacancy rates in specific sectors affect study enrolment in study fields likely to end up in these sectors? Second, do students of different study fields place a different level of value on career prospects in making their study choice and do changes in vacancy rates influence whether they value career prospects?

My main hypothesis is that there is a weak but significant effect of vacancy rates on study enrolment. In support of this hypothesis, there are two sub hypotheses. First, students in highly in demand fields place greater importance on career prospects. Second, students’ opinions respond to market changes in different ways depending on the field of study. Generally, it seems intuitive that students would choose for studies with good career opportunities. Previous research however has not found a link between post graduation income and study enrolment (Non et al., 2024). Other research has made use of a differences-in-differences type methodology to analyse a major reform to Dutch higher education which traded universal grants for parental-income contingent loans (Bolhaar et al., 2023). They found no evidence of impact on the total level of study enrolment and no negative effect on the share of students choosing to major in a STEM field. In fact the coefficient for STEM is significant and positive, but quite small. Students might not decide what to study based solely on what gives them the highest possible expected utility of income, but instead based on a series of considerations with a feasible career path being only one of them. In this view, a lack of career prospects pushes students away from certain studies and towards studies with a more feasible career path as shown by vacancy rates, but not necessarily always towards the studies with the highest income.

The research question is answered in two steps. First, there is an analysis of the correlation between vacancy rates in a sector and enrolment in studies corresponding to that sector, the aggregate data is sourced from the Dutch bureau of statistics and from the executive service for education (DUO). Second, there is an analysis of the answers given by Dutch students in a survey by the Studentenmonitor (ResearchNed, 2023), regarding whether or not they found career important when picking their Master's study. The analysis is carried out in two steps due to the relative weakness of the two models employed. The main issue is that study categorisation is done on a relatively high level of abstraction, this means quite strongly varying studies are grouped together even though there are sizable differences in the demand. As a result of this, any shifts within these educational groupings would not be caught by our model. The second step is meant to give further insights into what was found in the first step. If there is a correlation between vacancy rates and enrolment for some studies, but not others, the second step could show career as being an important factor for only the studies with the correlation for example. If no correlation is found in the first step, the second step might still provide clues as to why. It could also point to whether there might still be differences within study groupings and show possible avenues of future research. For the second step there are two hypotheses that serve to support the main hypothesis. First, students in highly in demand fields place greater importance on career prospects. Second, students' opinions respond to market changes in different ways depending on the field of study.

The main explanatory variable in the first step of the analysis, and partially also the second step, is vacancy rates in different economic sectors. The economic sectors are defined according to the standard industrial classifications (SBI) classification created by the Dutch bureau of statistics (Centraal Bureau voor Statistiek, n.d.). For most regressions a weighted yearly average is utilised. This means a weight is first created for the top five sectors where most graduates of each study field group end up working with the sum of weights equal to one. After this, a single yearly vacancy rate value is created for a series of years for each study field group based on the values of the top five sectors. The vacancy rates are calculated from 2015 to 2024 and the explanatory variables are calculated at one, three and five years before enrolment. One of the possible issues is that this period includes the COVID-19 lockdowns during which vacancy rates dropped sharply and after which vacancy rates spiked. This means the period is unusual and the findings might not be generally representative. Then again, general economic downturns and upturns also occur and we might see a similar development under such circumstances.

The dependent variable in the first step of the analysis is study enrolment in Bachelor's programmes and Master's programmes. Study enrolment is measured on the level of the educational field. Specifically with use of the HOOP study field categorisation (Ministerie van Onderwijs, 2017). This categorisation puts higher education into 10 categories: Economics, behaviour and society,

healthcare, agriculture and the natural environment, nature, education, law, language and culture, technology and cross sector. I omit the cross sector category from the research, because it is ill suited to draw conclusions from on account of its catch-all definition. I use a publicly available dataset which shows the enrolment in all studies in the Netherlands of the previous five years (Dienst Uitvoering Onderwijs, 2025)

Dutch higher education has two levels, vocational higher education (typically translated as attending a university of applied sciences), and university education (typically referred to as attending a research university). This study focuses specifically on (research) university-level education. On this level of education the connection with the labour market is often more opaque compared to vocational education where the link is more straightforward. This is particularly salient as university level education is in high demand in some sectors and for some functions, but the connection to the workfield is more tenuous and tangential and as a result it can be difficult to assess whether policy intervention is warranted.

For the second step of the analysis, where student motivation is analysed, there are two models. First there is a model with career motivation as the main explanatory variable with a series of control variables and enrolment chances of various studies in a multinomial logistic regression. Then in order to be able to run a regular regression and test for an association between career importance and vacancy rates I ran a regression with career importance as the dependent variable and the study field groups interacted with vacancy rates as independent variables. The second regression could not be used to make a causal statement, but does provide insight as to whether vacancy rates have any association with students' views whatsoever. The survey utilised in this paper only included the question of whether career was important for master's students, which unfortunately means we cannot compare between bachelor's and master's students. For the second step HBO level master's programmes are included but also controlled for.

I have limited my analysis to a single country because the current body of literature has not reached a consensus and the focus on a single country can help with limiting the scope of the research. Limiting the research to a single country also keeps possible explanatory factors such as culture, student loans and institutional framework constant. I have chosen the Netherlands specifically because it has had ambitious plans for building a knowledge based economy and the possibility of a mismatch between university level education and labour market demands is a hot topic. Even so, similar debates are also present across western Europe.

Most of the academic research that exists regarding student major choices originates from the United States. Surveys and controlled experiments are therefore carried out with American

participants and within an American context. Some questions can be raised whether the results are transferable to outside of the United States. It could be, for example, that there is a particularly high value placed on career in American culture and that students as a result value studies with higher career prospects higher than their counterparts across the ocean. Alternatively, American students might be under more financial pressure and as a result more career motivated on a base level. The literature can still be taken as a suggestion of what we could see, but not all the results from the literature covered in the theoretical framework can be taken as applying to the examined population.

The policy implications of whether students are influenced by vacancy rates are quite large as there is quite some discussion about which policies should be undertaken to address productivity. The demographic time bomb and the reïnvigorated debate on how to increase productivity are featured prominently in Mario Draghi's influential report on the future of European competitiveness and this report gives some indication as to what could be done. It specifically states that a lack of productivity growth is a great concern with regards to the EU's demographic outlook (Mario Draghi, 2024, pp. 23–27). The main explanation given for the lack of productivity growth in the EU is the failure to capitalise on the digital revolution. The EU lacks large companies in the tech sector and there has been less technological diffusion into the wider economy.

The Draghi report also calls attention to a skills shortage as a cause for a lack of productivity growth (2024: 36-37). Even though there are many excellent universities turning out highly educated graduates, the EU has relatively fewer STEM students compared to the United States, 850 per million inhabitants per year versus 1100 in the United States. On top of this, there is a brain drain away from the EU as people with highly demanded skills move to the United States for better employment opportunities. There is also a worrying trend of a decline in high-school student performance. As a result of the lack of technological skills, the diffusion and adoption of new technologies throughout the economy is lacking, investments cannot be carried out and vacancies cannot be filled.

The Draghi report recommends for governments to play a more active role in reducing skill gaps. For one, governments should actively monitor where skills gaps exist and will exist in the future (2024: 37). Second, education needs to be more responsive to the demands of the future job market. Third, certificates and qualifications need to be streamlined across EU countries to promote interstate mobility. Fourth, education funding from the EU level should be more targeted and evaluated more rigorously. The recommendations from the Draghi report are made from a big picture view and as a result are fairly abstract. The interpretation of these goals and the specific policy design will mostly be done by the member states. Nonetheless, the concepts can still be examined and the current responsiveness of student enrolment to labour demand is a key question.

A similar but slightly different perspective on labour market shortages and steering students towards specific studies is given by the Socio-Economic Council. Whereas the Draghi report and reports from the Anglo-Saxon language world tend to highly value STEM fields, reports from Dutch authorities and research institutes do not specifically focus on STEM fields and instead look more broadly at which fields experience a shortage of workers or are projected to in the future. In the report titled “perspective on broad prosperity in 2040”, the social-economic council states that the Netherlands should actively promote people to go into sectors where their labour provides the most added value (2024, pp. 27–28). Later in that same report they also note they see much potential in the increased provision of information for students regarding the career prospects of various studies (2024: 103-104). They argue that the financing of universities is done through attracting students and that universities are therefore incentivised to offer programmes that are popular with students. This could potentially be an issue if students are misinformed about the labour market and which skills are desirable and therefore undervalue certain programmes or courses, as it will also cause universities to undervalue them.

The Dutch Ministry of Finance has also written a report in which they reflect on steering student study choices towards sectors experiencing shortages (2020, pp. 35–38). They note students are often strongly influenced by the opinions of their parents and peers and often pay limited attention to work opportunities or starting salaries. In addition, the share of students who regret their choice of study is quite considerable; one in six graduates on the HBO and WO level states that they regret their choice of major. The most stated reason for the regret of study choice is the lack of employment opportunities. Ideally, studies and education should be re-evaluated to focus more on skills instead of specific professions, although much would have to be known before it would be possible to really implement such a reform.

To summarise, the demographic outlook of the Netherlands, and the EU as a whole, has prompted a reevaluation of which industries are of the greatest added value and which skills will be in great demand in the coming decades. Numerous reports by various governmental research organisations, and a report written for the European Commission, have all broadly underlined reforms to education are necessary. A better understanding of the current situation regarding students’ preferences and behaviour when deciding on a major will help decide on which policies are effective. If it turns out most students care about career prospects but do not self-select into studies with high career opportunities, this would indicate that simply providing information to prospective students should be effective. If students care very little about career when choosing their major, the room to influence them is probably quite limited. This brings us back to the crux of this paper: the current linkage between student study choices in higher education and the labour market. This is done by first

examining the academic literature and then conducting the two part statistical analysis, followed by a conclusion section and a discussion.

2 Theory

2.1 Rational choice theory modelling of study choice

There is a longstanding academic debate about the factors that influence students' choice of major, which offers a useful foundation for answering the research question. In essence rational choice theory models predict choices by looking at perceived utility gains that students expect to receive by following a particular education (or more broadly, investing in human capital) (Arcidiacono et al., 2012, 2020; Wiswall & Zafar, 2021). These models typically include three elements: first, a discount rate, that is to say students value benefits received sooner more highly; second, beliefs about ability, or whether students think they can complete the programme; and third, a perception variable that captures the idea that students' perceptions of expected utility might be inaccurate and subject to change over time.

Notably, although human capital investment models include expected utility, they usually only examine expected utility of consumption and as such mainly test their model by using expected earnings. Student preferences are generally modelled by an initial preference and then additional measurements after some time has passed (Arcidiacono et al., 2020; Stinebrickner & Stinebrickner, 2014; Wiswall & Zafar, 2021). This approach highlights that students might switch majors and specialisations and update their beliefs when they obtain new information, such as what they do and do not enjoy doing and what their future employment would entail. Although the datasets utilised for this paper do not allow for a tracking of beliefs across time, it is possible to analyse enrolment into master's programmes and bachelor's programmes separately. Due to time preferences and an updating of beliefs the results for bachelor's and master's enrolment cannot be assumed to be the same.

Stinebrickner and Stinebrickner (2014) conducted surveys at the Berea College in Kentucky to monitor how student preferences change over time. The students were first surveyed before the start of their first year and surveyed approximately twelve times each year whilst in the college and once in the years after. They grouped majors into seven different categories and added drop-out for a total of eight different study outcomes. Students were asked to assign a probability to each outcome which could then be compared to administrative graduation data. They noticed a relatively large discrepancy between the likelihood that students assign to major in science and the proportion of students that actually graduate with a science degree. 20% of students assign the highest probability to the science category and on average students gave a probability of 0.16, despite this only 7% of students completing a degree in science.

Stinebrickner and Stinebrickner conclude that the difference between the starting numbers and the numbers with which they ended, is a result of students being relatively more likely to leave science fields if they enrolled in a science field, and less likely to enroll in a science field if they did not start in one, in comparison to other fields (Stinebrickner & Stinebrickner, 2014, p. 467). They find that beliefs about future grade performance play a large and statistically significant role in a student's choice to major in a science field and that future earnings play a small but statistically significant role. Suggesting a stronger effect for ability beliefs than for earnings preferences. Grades from non-science courses are generally uninformative of what the grades in the science courses would be, and as a result, the only way for a student to learn whether they have aptitude for science courses is by taking science courses. They simulate what students would study if they had perfect information about their abilities from the start of their study, by replacing the numbers of the expectations of their grades with the distribution centred around average grade performance. The probabilities that students would assign to majoring in science then starts to closely resemble the graduation numbers. Based on this Stinebrickner and Stinebrickner come to the conclusion that the students who can and want to major in science, do. They end with the advice that if governments wish to see more science graduates they have to improve pre-college science education. As a main takeaway for this research, students are limited by abilities and there is a path dependency to a student's study path. Any given student could not pick any given study even if they were strongly motivated by career prospects.

Another key element of rational choice theory models focuses on the ex-ante returns of major choice, that is to say, the beliefs that a person holds of what they will gain when they make the decision to major in a particular field (Arcidiacono et al., 2020). Arcidiacono et al. (2020) conducted research using panel data collected from students at Duke University. The data was collected in two phases. In the first phase in 2009 undergraduates were surveyed and in the second phase 7 years later those same people were surveyed again. The main causal question they sought to answer was if the elicited beliefs about future occupational choices and earnings predict study choices made and actually realised earnings. The second causal question is whether students select for future occupational possibilities and earnings. The third causal question is what the role and importance of non-pecuniary factors is. The treatment used is the differences in the beliefs students hold about their expected earnings.

Arcidiacono et al. (2020) conclude from their analysis that the beliefs students hold are strongly predictive for their future earnings and occupational choices. Individuals estimate strong differences in earnings between different occupations and are more likely to believe they will end up working somewhere if they believe they will earn more, consistent with their own beliefs about their own future earnings. They also point out that although expected earnings play a significant role, they

are not sufficient in fully explaining student choices; other non-monetary concerns also play a large role. They estimate the earnings elasticity of occupational choices to be quite large, on average for all students and occupations, a 10% increase in expected earnings for an occupation lead to a 7.9% increase in the subjective probability participants gave to that occupation.

Wiswall and Zafar (2021) build on the conclusions of previous works that analyse expected earnings (Arcidiacono et al., 2012, 2020; Giustinelli, 2016; Stinebrickner & Stinebrickner, 2014; Wiswall & Zafar, 2015; Zafar, 2013), and add to it by looking at how people think their study choice will affect other future prospects aside from earnings, specifically marriage prospects, spouse characteristics and fertility. This way they seek to create a more holistic picture and operationalise expected utility in a broader sense than simply expected utility of income. They note that studies often establish causal relations based on observed differences between educational groups. Comparisons are drawn between the different marriage rates, fertility rates and employment patterns for example with the assumption that students are aware of how their study choice will impact their lives more broadly and choose in accordance. This could potentially be a flawed approach if students are not aware of the ramifications of their choices. They tested whether students considered the broader effects of study choices and whether their estimations were actually predictive.

Wiswall and Zafar used a dataset obtained by surveying 493 undergraduate students at New York University (2021, pp. 1375, 1413–1414, 175–176). Students were asked about their beliefs about their own future and of the future of the general population. In 2016, Wiswall and Zafar surveyed the same students as from the previous surveys to ask them about their current situation. Notably, the initially measured expectations seemed to be strongly predictive of the later realised outcomes. The treatment in their methodology was majoring in either business or science as compared to the humanities, but the research could arguably be seen as being descriptive and cross-sectional rather than experimental as they mostly measure and describe associations. There are almost two different research questions, first, whether students consider fertility and marriage when picking a major and whether believing fertility and marriage are higher leads is associated with higher enrolment in associated studies. Second, whether the expectations are actually predictive of the future.

Students were asked what they thought their income would be at approximately age 23 and when asked years later at around 23 their answers were comparable (Wiswall & Zafar, 2021, pp. 1376, 1413–1419). The mean of their expectation of future earnings and the standard distribution were very similar when adjusted for inflation. On an individual level however the picture looks slightly less rosy, a 1% higher expectation is associated with realised earnings that are 0.39 % higher, according to the R-squared about 9% of realised earnings is explained by the students' individual predictions. The

result was more significant for women than for men, Wiswall and Zafar speculate that this is possibly due to men overestimating their future earnings.

When it comes to the expectations associated with various degrees there are large differences between men and women. Women seem to believe that choosing a major in business or science will lead to delayed marriage and a decrease in fertility in comparison to the humanities at the age of 30, but the same does not hold for men (Wiswall & Zafar, 2021, p. 1363). A degree in the natural sciences or business is expected to reduce the chances of part-time employment by 36% for men and 28% for women. Women also believe that being married at 30 years old will cause the probability of full-time employment to decrease by 18%, whereas men do not expect it to have any effect. Participants also seem to believe that they are quite likely to end up with someone who completed a study in a comparable field as a spouse, and that in tandem with this, their future spouses' earnings would be comparatively higher if they had either a business or science degree as opposed to a degree in the humanities (Wiswall & Zafar, 2021, pp. 1395–1397). Sadly the fertility and marriage rates could not be tested against a realised number because most people marry and have children quite some years later than 23, so other variables are used as stand-in (Wiswall & Zafar, 2021, pp. 1416–1418), although relationships can probably not be treated the same as marriage.

Expected major is strongly indicative of the actual graduation major, for the categories economics/business, humanities/social sciences and natural sciences over 80% of respondents graduated in the field that they said they were most likely to graduate in (Wiswall & Zafar, 2021, p. 1418). The percentage is notably lower for engineering but the respondents still attributed the highest probability to engineering. It could be due to random chance as the engineering category only has a sample size of 8, much smaller than the other categories encompassing many different disciplines. Then again, this percentage could also reflect that this group of students had a lack of trust in their ability to complete this degree.

In an experiment by Ersoy and Speer (2022) they echo many of the conclusions found by Wiswall and Zafar (2021), namely that other factors than income play a large role in study choice. They conducted an information treatment type experiment and had students rank the likelihood of studying any particular major. They found that students would change the ranking order of which majors they were likely to graduate in based on information provided. Some students who were 100 % confident in their study choice were not affected, but students who were not completely sure were affected and changed the order and percentages attributed to each study field. Only 20 out of 270 students or 7 % of students actually switched their top major choice. Ersoy and Speer state based on this that the effects of increased information are probably not large enough to be clearly visible in administrative enrolment numbers. Nonetheless, it likely still influences students when they pick

electives and minors or decide between subfields, which will in turn affect their future career. Ersoy and Speer find that the effects of information about the job market come almost solely from employment prospects and that future earnings play a largely insignificant role. Other notable influences were student body gender composition, study workload and future work flexibility.

2.2 The story of the STEM shortage

Historically much of the academic literature aimed at study choices has been focussed on the STEM fields. STEM is an acronym that stands for: science, technology, engineering and mathematics. It has historically been seen as being both crucial to wider economic development and as providing graduates with a guaranteed good future career. Often scientific papers compare STEM to non-STEM students and increasing STEM enrolment is an often stated policy goal. Although this paper does not focus specifically on the STEM fields in the analysis, the literature around STEM is still insightful as the lessons and theories can be applied more widely.

There is a persistent narrative circulating in governments around the world that there is a chronic shortage of STEM students. The STEM shortage narrative has three pillars (Smith & White, 2024, pp. 399–400): a lack of students studying STEM subjects, a shortage of specialised teachers, and an insufficient level of skills of STEM graduates. The shortage in STEM graduates supposedly creates a drag on productivity growth and economic growth. In a non-exhaustive list there have been articles and reports written about a STEM shortage in the United States (Beamer, 2023), in the United Kingdom (Department for Science, Innovation and Technology, 2024), in Australia (Swinburne University of Technology, 2024), in Germany (Anger et al., 2024), and in Canada (Mahboubi, 2022). The Draghi report also explicitly mentions STEM, and points to a lack of mathematical skills among EU graduates in comparison to the US as a major factor of lagging European growth (Mario Draghi, 2024, pp. 36–37).

Panizzon et al. conducted research in Australia to see if there was a supply shortage of STEM graduates and note that one of the major issues with STEM is that there is no internationally agreed upon exact definition (2015). The way how universities structure their programmes differs, and even within Australia different institutions use different definitions. Psychology is typically excluded, despite some Australian states grouping it under science. Some countries include medicine as part of STEM in their statistics and others do not. STEM sometimes only applies to Bachelor's degrees and above, and other times also applies to relevant vocational programmes. They also give an example of how there is a shortage of engineers in some fields of engineering, but an abundance in others, in this case petroleum engineering. As a result, grouping studies at too high of a level paints a misleading picture of the job demand.

According to Hira, there has been little evidence supporting a shortage of STEM workers in the United States (2022). The STEM focus does not differentiate between the different market dynamics between fields or sub fields, educational attainment or geographies (Hira, 2022: 31). Hira points out that while future demand can be projected for some skills and qualifications, it is nigh impossible to do for others due to technological changes, offshoring, and the possibility of abrupt big shifts in consumption patterns. Hira shows that the US Bureau of Labor Statistics has consistently been far off with their predictions because their data is not representative for the future, a slow economic recovery in the early 2010s for example caused an underestimation of the growth in demand for mathematical and computer oriented occupations. He also notes that the amount of Bachelor's degrees awarded in 2020 in the categories computing and mathematics, and engineering is much higher than the projected annual growth in demand in the decade of 2020-2030.

Hira also looks at unemployment rates and wage growth for would-be signs of a STEM graduate shortage and he once again found no indicators of a shortage (2022, pp. 33–35). For computer and mathematical occupations full employment is estimated to entail a 2% unemployment rate, whereas the percentage was consistently above 2% for the period of 2011-2020. Although I would like to add that according to his graph the unemployment rate had been going downwards from 2011 to 2019, up until the COVID-19 pandemic. When Hira looked at wage growth and real wage growth he observed that only a few occupational categories saw higher nominal and higher real wage growth compared to the general working population and that many engineering and information technology occupations saw a decrease in real wages.

Smith and White looked at the educational path of STEM students in the United Kingdom and concluded that the government of the United Kingdom has not succeeded in increasing the amount of STEM students and that there does not appear to be a shortage of STEM graduates (2024). The UK government has been concerned about a perceived shortage of STEM students and a skills shortage for some time and has enacted a great number of initiatives and educational reforms to try to remedy it. Smith and White argue that making an increase in the supply of STEM students a goal of the general education system is misguided. If there is a shortage of very specialised professional scientists, the solution is not to increase the overall supply of graduates.

Smith and White firstly examined secondary school reforms. Policy makers speculated that a lack of exposure caused students to not develop an interest in science subjects (Smith & White, 2024: 406-412). Secondary school students were required to follow more science classes until a later age with the hope that more exposure would lead to more interest. Also, this way students would not disqualify themselves from studying science subjects by dropping a subject at a young age. Although

more students were exposed to science subjects for a longer time, there was no clear effect of the reform and the subjects were often dropped once students were allowed to drop courses. There seems to be a trend of a modest increase in the amount of students following biology, but no clear increase in the amount of students following chemistry or physics classes at the end of their secondary education.

On the undergraduate level, there has been a story of mixed success in attempts to increase the amount of STEM students (Smith & White, 2024, pp. 409–413). The UK government has had initiatives to increase the amount of STEM students and the amount that eventually end up working in related occupations. The share of student applications to STEM studies does seem to have risen starting in 2008, but the growth is mostly driven by an increase in the number of psychology students and medical students. Notably, the fields of engineering and physics, which were the fields of greatest concern to policy makers, had stable application shares. The throughput of more secondary school exposure to science did not seem to lead to more students applying for undergraduate studies in the hard sciences. They also note that there was a sharp increase in the admittance of applicants to computer science studies until the dot.com bubble crash, after which there was a sharp decline in admittance. The number of computer science students admitted has since recovered, but the graph does raise questions about what happens when demand for a skill falls off, there at the very least does seem to be a clear market and enrolment connection there.

Smith and White examined data on STEM graduates up to 6 months after graduation and once again found no evidence of a shortage of graduates (Smith & White, 2024: 412-415). Although unemployment rates are relatively low for graduates, the unemployment rate for computer science graduates and engineering graduates is actually relatively high compared to the unemployment rate for all graduates. In 2017, 9% of computer science graduates, 8% of engineering graduates and 6% of all graduates were unemployed. Smith and White also note that most engineering graduates, about 70%, entered highly skilled STEM occupations in 2017 and about 40% of non-medical STEM graduates end up in highly skilled STEM occupations. The percentage of engineering graduates who enter a related highly skilled occupation seems to have grown from about 50% to about 70%, with a notable temporary dip after the 2008 financial crisis. Smith and White comment that it is noteworthy that engineering seems to supply a relatively large portion of the highly skilled STEM jobs, whereas biology attracts the largest group of students. Engineering graduates were about three times as likely as biology students to end up in highly skilled STEM jobs.

The key takeaways from the research into the STEM fields for the purposes of this paper are as follows: STEM is a very broad categorisation and as a result there are different dynamics for different studies and specialisations. There is also disagreement about what is part of STEM and what is not. Medicine in particular is noteworthy because it is not always included but does see a generally

increasing trend of applications (Smith & White, 2024: 411). There is no general STEM shortage, but there are shortages in specific specialisations. Because of this it is possible for there to be a simultaneous undersupply and oversupply of a field of study. This fits together well with what was mentioned by Ersoy and Speer (2022), where students do seem to be influenced by information about market dynamics, but rarely switch majors. An aggregate level of analysis could miss key insights into student choice dynamics. Student choices might be made at the margin, between different specialisations. In addition, a student might be more concerned with career opportunities when they start approaching the end of their study time, so the choice of master's programme is the most likely point where we would see a correlation between the labour market and enrolment. The increasing popularity of biological sciences and medical sciences (Smith & White, 2024: 411) could also indicate that some studies are more susceptible to market dynamics than others.

2.3 Existing research in the Netherlands

Non et al. (2024) conducted research into the link between the Dutch labour market and employment and concluded that they could not find an obvious connection. They conducted research based on aggregate level data on enrolment numbers and expectations obtained from the Dutch central bureau of statistics (CBS). They assume that students base their expectations on the experiences of the last three graduation cohorts, they take the labour results one year after graduation and average the three numbers. The results are then compared across disciplines, but on the same educational level, with percentual differences from the mean of the hourly wages of all disciplines used as an explanatory variable. Non et al. (2024) examine all levels of Dutch higher education. In the Dutch higher education system there are three main categories of institution: universities (WO), universities of applied sciences (HBO) and vocational training (MBO).

On the WO-level, they find that there has been a relative decline of the income of the economics cluster from above average to about average, and that there has been a relative increase of the income of the technical cluster (Non et al., 2024, p. 7). They note that the social science cluster and the humanities cluster graduates are more likely to work part-time, which is in line with the expectations found by Wiswall and Zafar (2021, p. 1401). The clusters of healthcare, nature, and law show a mixed image (Non et al., 2024, p. 9). The per hour wage of law graduates is above average and the percentage that have labour as main income is stable at around or slightly above average, but the share of stable contracts is relatively low. A similar story is true for graduates of the healthcare cluster.

For HBO, the vocational variant of higher education, perspectives are particularly good for the healthcare cluster, educational cluster, and technical cluster (Non et al., 2024, pp. 8–9). For the

healthcare cluster and educational cluster the hourly wages are above average, the share of graduates who obtain most of their income through work is above average and the share of graduates with permanent contracts is above average. For the technical cluster, the hourly earnings are about average but the share of students who derive most of their income from work is above average and the share with a permanent contract is above average. The economics cluster and the language and culture cluster have below average numbers for hourly earnings, percentage deriving most of their income from work and permanent contracts, although the economics cluster fairs better than the language and culture cluster. The clusters for social science, law, and agriculture have mixed numbers. The hourly wages for law are about average, but the share of graduates who derive most of their income from work fluctuates quite strongly over the years and the share with permanent contracts is low. The social science cluster has average numbers for hourly earnings and work as the main source of income, but has a low share of permanent contracts.

There is a notable increase in the share of students that enroll into the technical cluster on HBO and WO level from the base year of 2005 (Non et al., 2024, p. 14). The enrolment peaked in 2015-2016, and declined from there, though not back to the level of 2005. The share of students in the social science cluster and the language and culture cluster has declined slightly. There is also an increase in enrolment into the nature cluster on the WO level. The development of the technical cluster, healthcare cluster, and language and culture cluster is mostly consistent with the idea that students base their study choice on expected income. However, there are also studies that do not follow this pattern. Enrolment into the education cluster has consistently gone down despite above average pay and enrolment into the economics cluster has gone up on WO level despite declining income. The researchers speculate that the weight of interests and capacity could possibly explain the lack of a clear correlation between enrolment trends and income. They further substantiate their argument with a scatter plot with hourly wages and enrolment and the scatter plot does not show a pattern for both the WO and HBO levels.

2.4 Conceptual framework

In summary of the literature, students do in fact seem to choose studies based on what they believe the future career prospects of that study are (Arcidiacono et al., 2020; Stinebrickner & Stinebrickner, 2014; Wiswall & Zafar, 2021). Before the start of their study, students are relatively poorly informed of the average future income, life and work prospects of different majors (Ersoy & Speer, 2022), but in the long term the predictions about their own future seem relatively accurate (Wiswall & Zafar, 2021). Students self-select into studies based on ability and motivation (Arcidiacono et al., 2020; Stinebrickner & Stinebrickner, 2014), which means programmes focussed on increasing, for example, mathematical skills could theoretically increase enrolment into specific studies by increasing how

many students are capable of studying them. On the aggregate, the analysis of Non et al. (2024) finds no clear evidence of increases in enrolment in fields based on starting salaries. Ersoy and Speer (2022) however, note that students seem to value the likelihood of finding work much higher than starting salaries. Smith and White (2024) would add to this that shortages in the science fields in particular are often at the very advanced professional level, which would further disincentivise students from certain careers if the high earnings and vacancies are only at the tail end of the career path.

Current rational choice theory does not yet fully explain study enrolment patterns. Student motivations are complicated. If one were to for example try to predict the effectiveness of a policy package to encourage enrolment into specific fields, it would be difficult to do so. There is also quite some reason to doubt whether students are well informed about the implications of their study choice, as a result labour shortages might not be resolved automatically by more students enrolling in relevant fields. An important addition to rational choice theory would be actually finding a good aggregate predictor of study enrolment.

3 Research Design

3.1 Research question and hypotheses

The research question of this paper is: Are students influenced by shifts in the labour market when picking their major in higher education? In the theoretical framework it is explained that students do in fact consider career prospects when choosing their study, but they seem to mostly value the likelihood of obtaining work and are not strongly affected by expected income (Ersoy & Speer, 2022). An analysis of the effects of post graduation income also showed no significant influence (Non et al., 2024). It therefore makes sense to look at vacancy rates as a possible cause for increased enrolment in certain studies, as it could be seen as an indicator for the job finding chance. My hypothesis is that there is a weak but significant effect of vacancy rates on study choice. I expect the effect to be weak because study choice preferences are formed over a long period of time and are path dependent on a student's previous education. In addition there are many different factors students consider when making a choice of study such as the student body gender composition and the expected work-life balance (Ersoy & Speer, 2022).

The hypothesis is tested in two steps. In the first step different variations of a regression analysis are carried out to see if there is a correlation between weighted vacancy rates per sector and educational enrolment for bachelor's programmes and master's programmes. Since students continually update their preferences as they learn more and might be more interested in seeking information about the job market the closer they are to graduation, we could see different effects for

bachelor's enrolment and master's enrolment. Students might switch towards studies in the economics category or technical studies for example. Market labour demand and job finding chances were approximated with a weighted vacancy rate corresponding to a HOOP educational field. Enrolment is measured as first year's enrolment in every HOOP educational field category.

In the second step, I ran a multinomial logistic regression using survey data to see if being motivated by career prospects affects master study choice when controlled for with a series of control variables. If a student is highly motivated by career prospects and this turns out to push them into a certain sector, this would indicate that that sector could be more heavily affected by changes in the labour market. I also ran a regular regression with career importance as the dependent variable to see if educational fields with a high vacancy rate are associated with students stating that they were motivated by career perspectives when choosing their study. If there is an association it could also indicate a connection between vacancy rates and study choice. This however could also pertain to the specific study choice within a wider study category and not just the study category as with the first step of the analysis. At the same time, if high vacancy rates are associated with more students stating that they were motivated by career opportunities, this could also indicate students actually justify their motivations after their study choice had been made with information they did not have at the time they opted for their study.

This study focuses on the Netherlands because of policy relevance. Debates around labour shortages and a lack of productivity growth are topical and the former is an especially pressing issue for policy makers as labour shortages have caused delays in the implementation of policy (Ministerie van Financiën, 2024, pp. 25–26). The focus on a single country also keeps possible confounding institutional and cultural factors constant. According to the evidence selection philosophy as described by Toshkov (2016, pp. 294–297), the evidence considered by this paper would be classified as a "smoking gun". The evidence is low in certitude, which means the hypothesis could still be true even if we do not find any evidence for it. At the same time it is high in uniqueness, which means that if we find evidence it could only support one hypothesis; that students are influenced in their study choice by the amount of open jobs in a sector.

3.2 First step dataset and variables

For answering the first step of the research question I constructed a dataset from three other datasets: two from the Dutch central bureau of statistics (CBS) (Centraal Bureau voor Statistiek, 2024, 2025) and one from the executive service of education (DUO).

From the first CBS dataset (Centraal Bureau voor Statistiek, 2024), I obtained data about graduate employment outcomes per study field as classified by the HOOP categorisation. This registry has ten categories: Technology, law, healthcare, language and culture, behaviour and society, agriculture and natural environment, education, economics, and nature (Ministerie van Onderwijs, 2017). For each HOOP category I selected the top five economic sectors in which graduates were employed one year after graduating. The economic sectors are defined according to the standard industrial classifications (SBI) categorisation. With this information I could create weights for the vacancy rates in various sectors for each respective HOOP study category. Each sector's weight is equal to their respective share in the top five and the sum of weights is equal to one. I used the 2017-2018 graduation cohort as the baseline group. This cohort is chosen as the last pre-pandemic cohort, but I assume the relative weights for each sector would be about the same regardless of baseline year. The decision of limiting the selection to the top five sectors was based on coverage and parsimony: The top five sectors encompassed 92% of graduates for the highest category which was education and 65% for the lowest category which was language and culture. Limiting the scope of the analysis to the top five captured most of the relevant employment changes without being bogged down with tiny sectors.

From a second dataset from the CBS (Centraal Bureau voor Statistiek, 2025), I obtained the vacancy rates for each of the SBI sectors for the years from 2015 to 2024. Vacancy rates are measured by counting the number of open vacancies per 1000 jobs in a sector. I specifically picked the vacancy rate at the end of the first quarter of the year. The idea is that the first quarter of the year, January to March, would roughly be when most prospective students orient themselves towards what they want to study the next academic year. The vacancy rates for each sector were later multiplied by the weights for each sector for each study category. These values were then summed to create a single weighted vacancy rate for each study for each year. The formula for the weighted vacancy rate for field f in year t is given as:

$$weightvac_{f,t} = \sum_{s=1}^{5} w_{f,s} \times v_{s,t}$$

Where:

- s lists the top five sectors employing graduates in field f
- $w_{f,s}$ is the share of graduates from field f employed in sector s
- $v_{s,t}$ is the vacancy rate in sector s in the year t

From the third dataset from DUO (Dienst Uitvoering Onderwijs, 2025), I collected the enrolment numbers for each study programme in the Netherlands from 2020 to 2024, along with the corresponding HOOP classification. I then added the enrolment numbers up to get the total enrolment for each HOOP category, separated into bachelor's and master's programmes.

I only had access to the public dataset which only contained the last five years. Five years is actually a convenient timespan as it is approximately the duration of a bachelor's and master's programme taken together. Over a longer period of time a researcher would have to take into account that a high enrolment into a study could lead to a lower vacancy rate in the future in corresponding sectors, but with five years this should only be true for a few studies which means the overall effect would still be negligible. The public dataset also contained a privacy limitation: studies with fewer than five students were labeled as "<5". I recoded these entries as 2, so I could still approximate enrolment for small studies. This was particularly important for fields such as education, where many programmes are small in size and dropping them would have skewed the results. An additional complication came from the "post-master" category, which was only used for studies in the educational category. When I inspected some of the programmes in question it appeared that these programmes were listed as standard master's degrees on the respective university websites, although often pursued after another master's. I simply treated them as part of regular master's enrolment.

3.3 First step regression formulas

The initial regression is to see if there is any effect of the weighted vacancies variable on enrolment into Bachelor's and Master's programmes. Cluster-robust standard errors clustered around study level are used, since I assume that observations in the same field are subject to mutual unobserved effects. Enrollment also varies strongly across fields which means there is an increased risk of heteroskedasticity which warrants the usage of robust standard errors. The initial regression is given by:

$$ln(Y_{f,l,t}) = \alpha_0 + \beta_1 ln(weightvac_{f,t-1}) + \beta_2 Master_l + \beta_3 \left(ln(weightvac_{f,t-1}) \times Master_l\right) + \gamma_f + \delta_t + \varepsilon_{f,l,t}$$

Where:

- $Y_{f,l,t}$ refers to enrolment in field f at the level l (Master or Bachelor) in the year t.
- α_0 is the intercept
- $weightvac_{f,t-1}$ is the weighted vacancy rate for field f, lagged by one year
- $Master_l$ is a dummy variable equal to one when l is a master's programme

- γ_f is a fixed effect for field of study or HOOP category
- δ_t is a fixed effect for the study year
- $\varepsilon_{f,l,t}$ is the error term

After this regression a series of other regressions are carried out to see whether the results are robust or only hold under the specifications of the first model. For these later regressions master's enrolment is separated from bachelor's enrolment to keep the model simple, otherwise each year would require a separate Master's dummy. First, we see if multiple years with a separate coefficient are significant.

$$ln(Y^B_{f,t}) = \alpha_0 + \beta_1 ln(weightvac_{f,t-1}) + \beta_2 ln(weightvac_{f,t-2}) + \beta_3 ln(weightvac_{f,t-3}) + \gamma_f + \delta_t + \varepsilon_{f,t}$$

$$ln(Y^M_{f,t}) = \alpha_0 + \beta_1 ln(weightvac_{f,t-1}) + \beta_2 ln(weightvac_{f,t-2}) + \beta_3 ln(weightvac_{f,t-3}) + \gamma_f + \delta_t + \varepsilon_{f,t}$$

Second, another variant of the same model is used which instead takes the average of the three natural logarithms of the previous three years as explanatory variable as so:

$$ln(Y^B_{f,t}) = \alpha_0 + \beta_1 \frac{1}{3} \sum_{k=1}^{3} ln(weightvac_{f,t-k}) + \gamma_f + \delta_t + \varepsilon_{f,t}$$

$$ln(Y^M_{f,t}) = \alpha_0 + \beta_1 \frac{1}{3} \sum_{k=1}^{3} ln(weightvac_{f,t-k}) + \gamma_f + \delta_t + \varepsilon_{f,t}$$

The same is then done again but for the five year average of logarithms of weighted vacancies:

$$ln(Y^B_{f,t}) = \alpha_0 + \beta_1 \frac{1}{5} \sum_{k=1}^{5} ln(weightvac_{f,t-k}) + \gamma_f + \delta_t + \varepsilon_{f,t}$$

$$ln(Y^M_{f,t}) = \alpha_0 + \beta_1 \frac{1}{5} \sum_{k=1}^{5} ln(weightvac_{f,t-k}) + \gamma_f + \delta_t + \varepsilon_{f,t}$$

Finally, a regression is carried out which does not look at weighted vacancy rates and instead looks at just the vacancy rates in the educational sector and healthcare sector and their effect on enrolment in the respective educational fields. I picked these sectors specifically because the link between the educational study field and the employment sector is very strong and the same is true for the healthcare study field and employment in the healthcare industry. The reason for using unweighted vacancy rates is because the weighing vacancy rates causes vacancy rate changes to be less volatile, which could cause issues if weighted vacancy rates move up and down in parallel.

$$ln(Y_{f,l,t}) = \alpha_0 + \beta_1 ln(vacancies_{f,t-1}) + \beta_2 Master_l + \beta_3 \left(ln(vacancies_{f,t-1}) \times Master_l\right) + \gamma_f + \delta_t + \varepsilon_{f,l,t}$$

Then a follow up regression is run with only master's enrolment for as the dependent variable:

$$ln(Y_{f,t}) = \alpha_0 + \beta_1 ln(vacancies_{f,t-1}) + \gamma_f + \delta_t + \varepsilon_{f,t}$$

For every other educational field the largest employment sector was specialised business services. A regression is run with the vacancy rates in the specialised business services sector. In this case a time control variable was not possible because it would need to take the exact values of the specialised business services sector and be perfectly collinear. The regression formulas are identical to above except without the time control and the educational fields except healthcare and education as dependent variable:

$$ln(Y_{f,l,t}) = \alpha_0 + \beta_1 ln(vacancies_{f,t-1}) + \beta_2 Master_l + \beta_3 \left(ln(vacancies_{f,t-1}) \times Master_l\right) + \gamma_f + \varepsilon_{f,l,t}$$

$$ln(Y_{f,t}) = \alpha_0 + \beta_1 ln(vacancies_{f,t-1}) + \gamma_f + \varepsilon_{f,t}$$

A combined regression with all fields and the vacancy rates for the top employment sector is then executed:

$$ln(Y_{f,l,t}) = \alpha_0 + \beta_1 ln(vacancies_{f,t-1}) + \beta_2 Master_l + \beta_3 \left(ln(vacancies_{f,t-1}) \times Master_l\right) + \gamma_f + \delta_t + \varepsilon_{f,l,t}$$

$$ln(Y_{f,t}) = \alpha_0 + \beta_1 ln(vacancies_{f,t-1}) + \gamma_f + \delta_t + \varepsilon_{f,t}$$

3.4 Second step dataset and variables

For the second step, I ran two different regressions to look more into the connection between career motivation and master's programme enrolment. I made use of the answers given by Dutch students in a survey by the Studentenmonitor (ResearchNed, 2023, 2025b, 2025a) regarding whether or not they were motivated by career in their choice of Master's programme. The reason I only look at the choice of Master's programme here is because the survey only included a career related question when it came to Master's choice. In light of the literature this would also be the point where students are most motivated by career as they are close to the start of their career. The survey is conducted yearly and I used the 2023 survey for the first regression in the second step. The surveys from 2021 and 2022 are also used for another regression in the second step. The survey is conducted at the end of the academic year, which means 2023 refers to the study year 2022-2023.

The main explanatory variable for the first regression is a student stating they found career important for choosing their master's programme. The variables controlled for are enrolment in a university of applied sciences, gender, age, one or more highly educated parents, eligibility for a supplementary grant, and having one or more children. The career motivation variable is measured on a five point ordinal scale in the original dataset, but for this research I assigned a one to every student that responded by saying career opportunities were either an important or a very important factor, thereby turning the variable into a binary. For the gender variable there are two options in the dataset, self-reported and administrative. I use the administrative version to avoid the possibility of measurement error. But a quick analysis showed that there is a negligible number of people who answered differently than the administrative registry so it should not affect the end result either way. The age variable was centred which means the average student has a value of zero. The supplementary grant is used as a proxy for parental income, as students who are eligible for the grant have parents with income below a certain threshold.

The dependent variable is enrolment in a HOOP educational category. For this variable there was also one self-reported variant and one based on administrative data. I chose the administrative data version because it has more options and is therefore more detailed. It might also be more accurate as students might not always know where exactly they should order their study and will also be more consistent; different students might order their study differently. It is also used by Non et al. (2024).

The second model for which the Studentenmonitor surveys from 2021, 2022, and 2023 are used is to test if there is an association between high vacancy rates and students stating they found career to be important when picking their master's programme. Here career importance is the dependent variable. The different HOOP categories and these categories interacted with the respective weighted vacancy rates are independent variables. This regression is done to see if there is any connection whatsoever that could be investigated in future research and to see if there is some awareness among students of vacancy rates.

3.5 Second step regression formulas

For the second phase a multinomial logistic type regression is used. This is a type of regression used for unranked dependent variables (ScienceDirect, n.d.). The formula given is:

$$ln(\frac{P(Y_i=j)}{P(Y_i=J)}) = \alpha_j + \beta_{1j}X_{1i} + \beta_{2j}X_{2i} + \beta_{3j}X_{3i} + \beta_{4j}X_{4i} + \beta_{5j}X_{5i} + \beta_{6j}X_{6i} + \beta_{7j}X_{7i} + \epsilon_{i,f}$$

Where:

$J = base\ category\ odds$	$j = other\ categories$
$X_{1i} = career\ motivation$	$X_{2i} = University\ of\ Applied\ Sciences\ (HBO)$
$X_{3i} = gender$	$X_{4i} = age$ (centred)
$X_{5i} = 1\ or\ more\ highly\ educated\ parents$	$X_{6i} = eligible\ for\ supplementary\ grant$
$X_{7i} = has\ one\ or\ more\ children$	

I also run an analysis with a simple regression with each study category and an interaction between study category and weighted vacancy rates. There are separate intercepts for each study field and year control dummies. The formula is:

$$career_{it} = \sum_{f=1}^{9} \alpha_f HOOP_{i,f} + \sum_{f=1}^{9} \beta_f (HOOP_{i,f} \times weightvac_{f,t-1}) + \delta_t + \epsilon_{i,f,t}$$

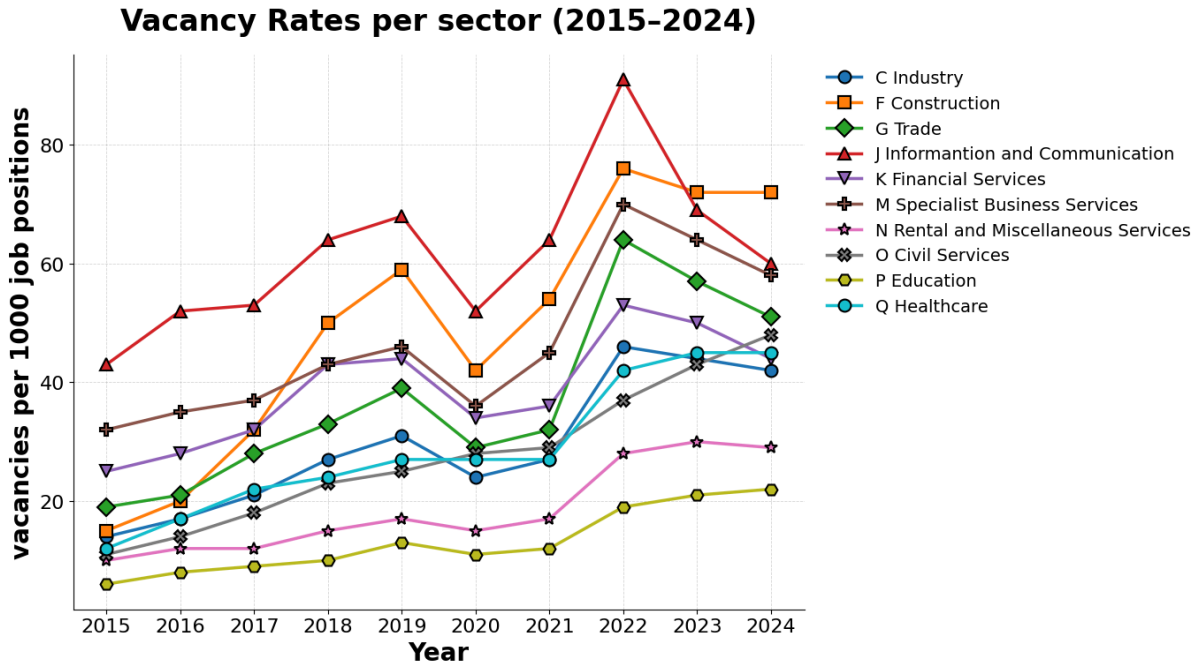
Where:

- $career_i$ is a binary variable that represents a student stating they found career to be an important or very important part of their study choice in year t.
- $HOOP_{if}$ is a dummy variable equal to one if a student is enrolled in HOOP category f, and zero for the other fields
- $weightvac_{f,t-1}$ is the weighted vacancy rate for field f in year t-1
- $HOOP_{if} \times weightvac_{f,t}$ is the interaction term between the study field f and the corresponding vacancy rate in year t-1
- δ is the fixed effect for the year
- ϵ_{if} is the error term for an individual in HOOP field f

4 Empirical findings

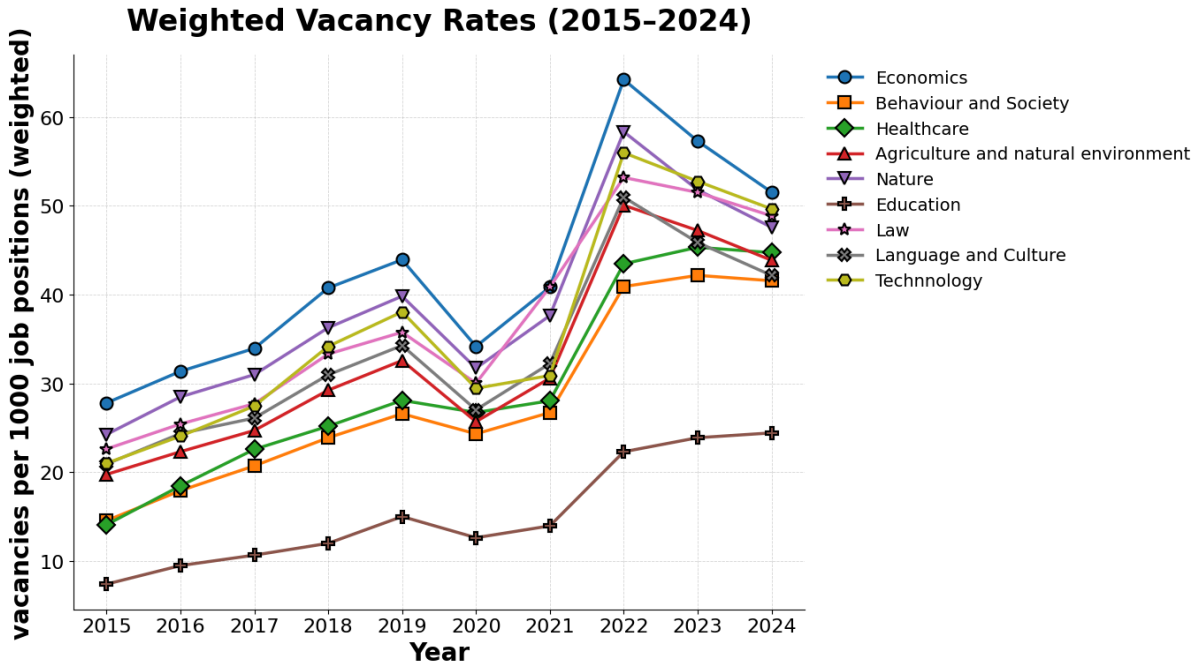
4.1 First step descriptive statistics

Graphic 1



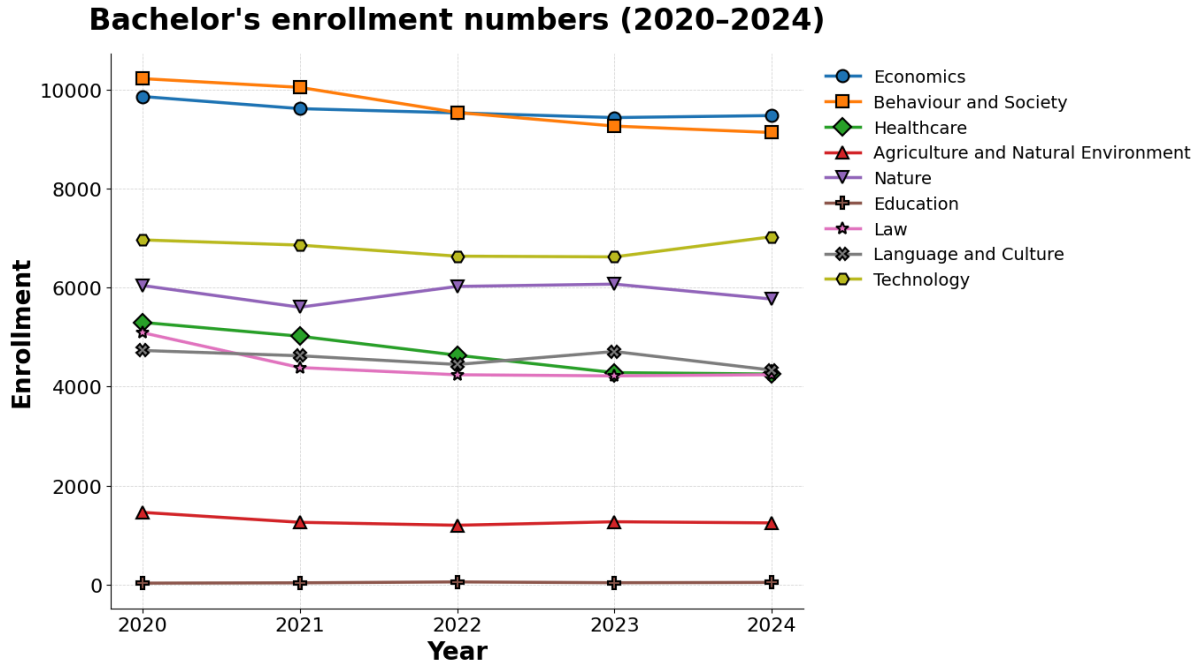
Graphic one shows the vacancy rates for all sectors that appeared among the top five employment destinations for the graduates of the HOOP educational fields. There are some broad trends apparent in the data. There is a clear decline in vacancy rates during the first year of the COVID-19 pandemic and a spike upwards during the recovery period. Across all sectors, vacancies trend upward between 2015 and 2024, something that is in line with statements made in various reports covered in the theoretical framework. The construction sector has moved from the fifth most vacancies to the sector with the highest vacancies, whereas the information and communication sector has moved down to be around equal with specialist business services. At the same time we can also see a sharp increase in the vacancy rate in the civil service.

Graphic 2

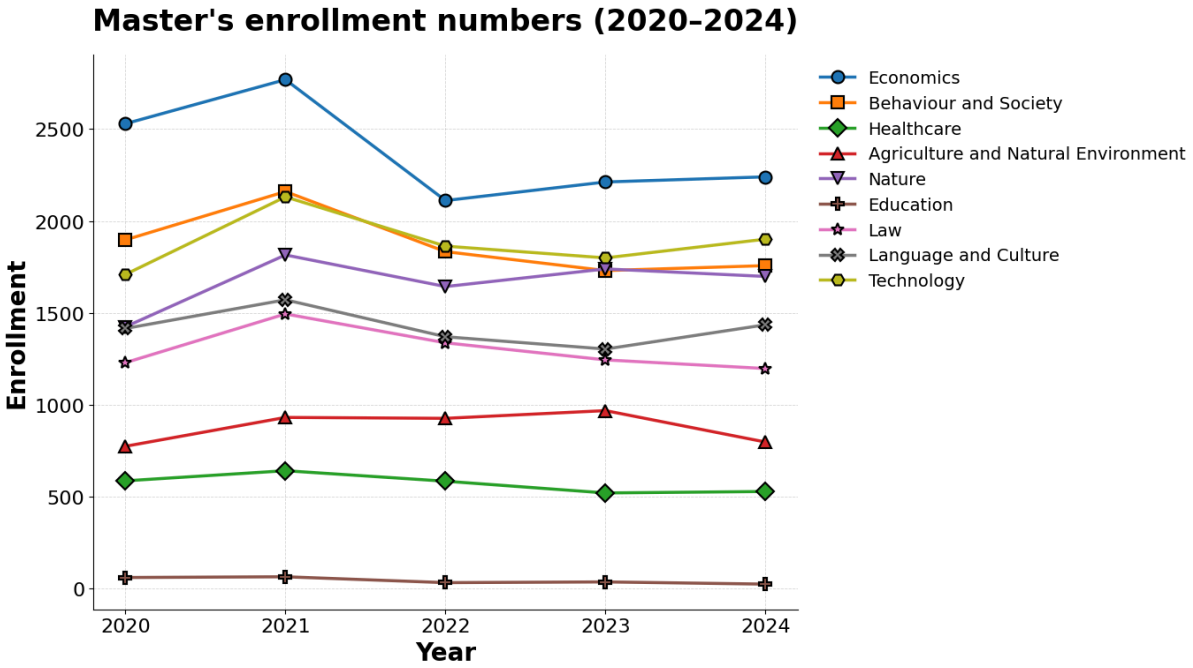


Graphic two shows the weighted vacancy rates for the HOOP educational fields. The trends mentioned at graphic one visible here. There is a clear pandemic related dip and rebound and an overall trend upwards. All HOOP fields have higher respective vacancy rates in 2024 compared to 2015. Notably, education consistently ranks as having the lowest vacancy rate. The technology field and healthcare field have moved up in relative position during the decade.

Graphic 3



Graphic 4



Graphic three and four show the enrolment numbers for the HOOP fields for respectively bachelor's and master's enrolment. Bachelor's enrolment is quite stable with only small year over year changes. There was a bump in nature enrolment in 2022 and in technology in 2024. Healthcare enrolment and law enrolment decrease slightly from 2020 to be at about the same level as language and culture in 2024. Behaviour and society decreased a little. In contrast, master's enrolment exhibits more fluctuation. There is a broad increase in enrolment in every field in 2021 and there are stronger year over year differences. The data suggests greater variability for master's enrolment.

4.2 First step regressions

4.2.1 Bachelor's and Master's enrolment 1-year lag

Table 1

(log) study enrolment	Coefficient
(log) weighted vacancy rate t-1	0.214 *(0.127)*
Master enrolment	1.89 *(1.797)*
Interaction weighted vacancy rate t-1 and master enrolment	-0.855 *(0.477)*
constant	7.22 *(0.516)*
N	90
R^2	0.965

*** p<0.01, ** p<0.05, * p<0.1, constant significance omitted

In table 1 the regression results for the first regression in the first step are displayed. Neither the weighted vacancy rate nor the interaction term with master's enrolment are significant. The model has a very high r-squared of 0.965 through the fixed effects of field and year. This indicates enrolment patterns are largely stable and not clearly driven by the vacancy rates in related sectors.

4.2.2 Bachelor's and Master's enrolment different lags

Table 2

Model/ Variable	(log) Bachelor enrolment (3 lags model)	(log) Bachelor enrolment (average of 3 lags model)	(log) Bachelor enrolment (average of 5 lags model)	(log) Master enrolment (3 lags model)	(log) Master enrolment (average of 3 lags model)	(log) Master enrolment (average of 5 lags model)
(log) Weight_vac _lag 1	0.077 (0.280)	-	-	-0.912 (0.674)	-	-
(log) Weight_vac _lag 2	0.466 (0.644)	-	-	-0.751 (0.605)	-	-
(log) Weight_vac _lag 3	0.128 (0.562)	-	-	-1.393 (0.848)	-	-
(log) Weight_vac _average lag 3	-	0.748 (1.450)	-	-	-2.933 (1.972)	-
(log) Weight_vac _average lag 5	-	-	0.633 (1.304)	-	-	-2.978 (1.939)
Constant	5.671 (4.993)	5.407 (4.995)	5.860 (4.374)	17.303 (7.062)	16.938 (6.795)	16.821 (6.505)
N	45	45	45	45	45	45
R^2	0.998	0.997	0.997	0.993	0.993	0.993

*** p<0.01, ** p<0.05, * p<0.1, constant significance omitted

In table 2 the results for other models which check for significant correlations between vacancies and enrolment are displayed. The results are again insignificant. Master's enrolment and bachelor's enrolment are measured separately and there is a test for three separate one year lags, an average of the last three years lag and a five year lag. The r-squared is once again very high and all of the variance seems to be explained by the year constants and the study field constants.

4.2.3 Bachelor's and Master's enrolment based on top employment sector

Table 3

Model/ Variable	(log) Bachelor and master enrolment healthcare and education	(log) Master enrolment
(log) vacancy rate lag 1 in healthcare and education	0.131 *(0.074)*	-
Master dummy	5.774 *(0.760)**	-
Interaction master dummy and vacancy rate	-2.191 *(0.148)***	-
Constant	5.607 *(8.998)*	-
N	20	-
R^2	0.9792	-

*** p<0.01, ** p<0.05, * p<0.1, constant significance omitted

Table 3 shows the results for the regression with the unweighted vacancy rate for the healthcare and education sectors as independent variables. The master's dummy is marginally significant and the interaction dummy is significant. The interaction dummy has a negative coefficient which would indicate an inverse relationship between vacancies and master's enrolment. Master's enrolment could however not be regressed separately as the fixed effects were too large when an estimation with only master's enrolment was attempted, which resulted in collinearity.

Table 4

Model/ Variable	(log) Bachelor and master enrolment every field except healthcare and education	(log) Master enrolment
(log) vacancy rate lag 1 business services	-0.042 *(0.025)*	-0.166 *(0.048)***
Master dummy	-0.710 *(0.110)****	-
Interaction master dummy and vacancy rate	-0.124 *(0.032)****	-
Constant	8.710 *(0.144)*	7.999 *(0.189)*
N	70	35
R^2	0.940	0.947

*** p<0.01, ** p<0.05, * p<0.1, constant significance omitted

In table 4 we can see the results for the effects of high vacancy rates in the specialised business services sector for all fields except healthcare and education. Specialised business services was the largest employment destination for every educational field. The table shows significant negative coefficients for both the master's enrolment and interaction term variables. The interaction term suggests higher vacancy rates in the specialised business services sector are associated with lower master's enrolment across the board. The vacancy rate lag variable also has a significant negative effect on master's enrolment in the second column, which confirms the results of the first column. Because the vacancy rate number only comes from a single sector it is not possible to have a time fixed effect control in the regressions for table 4, so the fixed effects only include study fields.

Table 5

Model/ Variable	(log) Bachelor and master enrolment	(log) Master enrolment
(log) vacancy rate lag 1 top sector	0.055 *(0.072)*	-0.502 *(0.312)*
Master dummy	1.312 *(1.692)*	-
Interaction master dummy and vacancy rate	-0.660 *(0.427)*	-
Constant	7.776 *(0.258)*	8.710 *(1.166)*
N	90	45
R^2	0.965	0.990

*** p<0.01, ** p<0.05, * p<0.1, constant significance omitted

In table five, table three and four are combined by including the vacancy rate of the largest employment destination for each study field. This table once again includes both time and field controls. The results show no significant correlation when combined and controlled.

4.3 Descriptive statistics Studentenmonitor

Table 6

Model/ Variable	Career importance		
	not (very) important	very (very) important	total
Total	1227 (30.37)	2813 (69.63)	4040 (100)
HBO	186 (29.52)	444 (70.48)	630 (100)
WO	1041 (30.53)	2369 (69.47)	3410 (100)
Male	399 (27.11)	1073 (72.89)	1472 (100)
Female	828 (32.24)	1740 (67.76)	2568 (100)
No highly educated parent	194 (26.18)	547 (73.82)	741 (100)
Highly educated parent	1033 (31.31)	2266 (68.69)	3299 (100)
Not entitled to grant	1067 (31.35)	2336 (68.65)	3403 (100)
Entitled to grant	160 (25.12)	477 (74.88)	637 (100)
No child(ren)	1109 (30.07)	2579 (69.93)	352 (100)
≥1 child	118 (33.52)	234 (66.48)	3688 (100)
N	-	-	4040

Average percentage in parentheses

In table 6 we can see the descriptive statistics for the Studentenmonitor 2023 survey. Overall, almost 70 percent of students indicated that career was (very) important to them in their master's study choice. This does not seem differ for HBO or WO students. Gender seems to have a small effect as men are slightly more likely to state that career was important to them in their choice of study. Having a highly educated parent seems to make a student slightly less career motivated.

HBO and WO seem about as likely to answer that career was an important factor for them in choosing their master's programme. Men and women are also relatively close together but with men being slightly more likely to state career was important to them. The vast majority of students have one or more parents who completed higher education, but the students that do not have a parent who completed higher education appear slightly more career motivated. Entitlement to a supplementary grant, which was used as a proxy for being from a lower income household, seems to make a student

around six percentage points more likely to be career motivated. Having a child seems to make a person slightly less likely to state they were career motivated.

Table 7

	not (very) important	very important
N	1227	2813
Average deviation from centred age	0.315	-0.137
Standard deviation	7.833	6.745

In table 7 the average deviation from the centred age variable is shown. Students who state career was not (very) important to them tend to be about a third of a standard deviation older and the students that state career was very important tend to be slightly younger. The career is not (very) important group is also a bit more age diverse with a higher standard deviation.

Table 8

study field	Mean value of career important
Economics	0.86
Behaviour and society	0.66
Healthcare	0.76
Agriculture and natural environment	0.69
Nature	0.73
Education	0.75
Law	0.79
Language and culture	0.48
Technology	0.79
Total average	0.73

In table 8 the proportion of students for each study field who reported that career was an important factor to them is shown. The average proportion across all fields is 0.73 and the highest proportion is 0.86 in economics, followed by the law field and technology field, both with 0.79. The only category with less than half of students stating they were motivated by career prospects is the language and culture field, with a proportion of 0.48 of students. Most study fields are around the 0.7 proportion, but there are large differences between the highest and lowest studies.

4.4 Results regressions Studentenmonitor

Table 9

Field/ variable	Education	Agriculture and natural environment	Nature	Technology	Healthcare	Economics	Law	Language and culture
Career important	0.751 (0.215) ***	0.133 (0.143)	0.256 (0.136) *	0.529 (0.144) ***	0.499 (0.128) ***	1.332 (0.207) ***	0.764 (0.176) ***	-0.744 (0.131) ***
WO level	-6.620 (0.724) ***	1.842 (0.388) ***	17.017 (0.153) ***	-0.097 (0.224)	0.402 (0.203) **	-0.657 (0.251) ***	17.428 (0.166) ***	-0.253 (0.215)
Female	-0.420 (0.211) **	-0.627 (0.156) ***	-1.352 (0.143) ***	-2.071 (0.146) ***	-0.047 (0.145)	-1.269 (0.167) ***	-0.534 (0.173) ***	-0.555 (0.148) ***
Age.c	0.045 (0.015) ***	-0.031 (0.019)	-0.064 (0.021) ***	-0.077 (0.019) ***	-0.029 (0.014) **	-0.061 (0.025) **	-0.004 (0.020)	0.045 (0.012) ***
Highly educated parent	0.090 (0.215)*	-0.120 (0.186)	0.010 (0.182)	0.129 (0.182)	-0.053 (0.160)	-0.257 (0.203)	-0.514 (0.194) ***	-0.040 (0.174)
Entitled to grant	-0.500 (0.290)*	0.00 (0.181)	-0.094 (0.174)	-0.023 (0.173)	-0.082 (0.161)	-0.143 (0.211)	-0.419 (0.218) *	0.146 (0.171)
Has ≥1 child	-0.128 (0.342)	-0.765 (0.463) *	-1.113 (0.549) **	-0.662 (0.407)	0.001 (0.323)	-0.970 (0.506) *	-1.255 (0.629) **	-1.721 (0.369)
constant	0.854 (0.402)	-2.321 (0.001)	-17.339 (0.537)	0.077 (4.62)	-0.366 (0.362)	-1.004 (0.506)	1.255 (0.629)	1.102 (0.285)
N	329	387	523	515	673	269	273	486

*** p<0.01, ** p<0.05, * p<0.1, constant significance omitted. The base category is the behaviour and society educational group

Table 9 reports the results of the multinomial logistic regression where enrolment probabilities are compared to the behaviour and society baseline. Stating that career is (very) important for the choice of master's programme is statistically significantly associated with being more likely to go into education, nature, technology, healthcare, economics or law. Language and culture students are statistically significantly associated with being less likely to state that career was an important factor to them. The control variable for female students is always negative and highly significant except for healthcare, reflecting that every study except healthcare has relatively more male students. Age also

has a significant effect on all studies except agriculture and environment and law. Education and language and culture students are on average slightly older than behaviour and society students, whilst nature, technology, healthcare and economics tend to have slightly younger students. The coefficients however are very small. Having a highly educated parent makes a student significantly less likely to study law compared to behaviour and society students. Being entitled to a supplementary grant has only a marginally significant effect on the enrolment chances of two studies as compared to behaviour and society; it makes students less likely to go into education or law. Having a child significantly negatively affects enrolment into the nature field and the law field. It also has a marginally significant negative effect on agriculture and natural environment enrolment and economics enrolment as compared to the baseline.

Table 10

Field/ variable	Career important
Economics	1.068 (0.101)***
Behaviour and society	0.377 (0.126)**
Healthcare	0.653 (0.130)***
Agriculture and natural environment	0.589 (0.091)***
Nature	0.316 (0.104)**
Education	0.832 (0.112)***
Law	0.561 (0.116)***
Language and culture	0.090 (0.097)
Technology	0.774 (0.090)***
Economics × vacancy rate	-0.005 (0.003)*
Behaviour and society × vacancy rate	0.010 (0.005)*
Healthcare × vacancy rate	0.003 (0.005)
Agriculture and natural environment × vacancy rate	0.004 (0.003)
Nature × vacancy rate	0.010 (0.003)***
Education × vacancy rate	-0.006 (0.009)
Law × vacancy rate	0.007 (0.003)
Language and culture × vacancy rate	0.013 (0.003)***
Technology × vacancy rate	-0.000 (0.003)
2022	-0.032 (0.013)**
2023	-0.622 (0.078)***

*** p<0.01, ** p<0.05, * p<0.1

In table 10 a second regression with the Studentenmonitor is reported. This time, career importance is the dependent variable in order to gauge whether there is a connection between the likelihood that career was stated as an important motivating factor in study choice and a high value for the weighted vacancy rate. The field coefficients show the baseline probabilities when vacancy rates would be zero.

A higher vacancy rate has a marginally significant negative effect on economics' students stating they found career important and a marginally significant positive effect on whether behaviour and society students found career important. For the nature and language and culture fields however there is a highly significant positive effect. This would suggest the responsiveness of studies to high vacancy rates varies from no response to either a positive or a negative response depending on the field of study.

5 Analysis

Research question: Are students influenced by shifts in the labour market when picking their major in higher education?

5.1 First step main hypothesis:

- There is a weak but significant effect of vacancy rates on study enrolment

5.1.1 First step analysis

Table 1 and 2 do not show any support for the hypothesis. A one year lag does not have any effect on bachelor's nor master's enrolment. The different set up ups of the same basic idea also prove insignificant. Separate one year lags, an average of three years of weighted vacancies and an average of five years of weighted vacancies also do not have any significant effect. Descriptive graphic three shows that bachelor's enrolment is very stable, which lines up with the insignificant results. Graphic four shows the enrolment for master's programmes fluctuates much more in comparison to bachelor's programmes. This does support one of the methodological assumptions of this paper: that master's programmes are more susceptible to labour market dynamics. Table 3 does include a significant and negative effect of vacancy rates master's enrolment in the interaction variable. But it should be noted that the type of teacher's programmes offered by universities would often be for the purpose of retraining specialists in a field into teachers in said field. The mainline teacher educational programmes fall under the HBO level and were not included in any of those regressions. It would make sense that when there are a lot of job opportunities there would be less people interested in becoming an educator, it might be seen as a safe or back up career choice. The healthcare category is more puzzling, perhaps more medicine students decide to enter employment and not continue their education to become a doctor.

Graphic one and two give the important insight that vacancy rates tend to move in parallel as the economy becomes more or less heated. This is methodologically a possible issue as the relative changes between sectors tend to not be as strong. It is however also an important theoretical insight. The differences between these fields tend to be relatively stable and therefore a student might also not

be convinced to switch due to changes. If one field trends downwards the other fields will probably also trend downwards and vice versa. When looking at the weighted vacancy rates as compared to sector fluctuations we see demand becomes even more uniform; as one sector goes down more graduates might become employed in a different sector.

There is solid evidence that students are actually affected by macro economic conditions in their choice to enroll for a master's. The first evidence of this comes from laying graphic one and two next to graphic three and four. There was a clear uptick in master's enrolment during the COVID-19 pandemic, but no noticeable uptick in bachelor's enrolment. This signals that master's students are more attuned to the labour market and highlights that whether or not a student continues their education stands in relation to the opportunity cost of continued studying. If there is less work there is not much of an opportunity cost to continue education. One could imagine many bachelor's students already have work or internships or look for work during the end of their programme. If however work opportunities dry up they might very well decide to continue their education and obtain a master's. There might also be people who already graduated some years ago and saw it as a good opportunity to go back to university.

Table 3, 4, and 5 also support the idea that macro economic conditions play an important role in master's enrolment. In table 4, the table without time fixed effects, vacancy rates in specialised business services have a statistically significant negative effect on master's enrolment. The effect on bachelor's enrolment is insignificant, but the interaction effect between master's enrolment and vacancy rates is significant. When the data from table 3 and 4 is combined into a new regression for table 5 and time fixed effects are reïntroduced, the significance disappears. This would further support that the significance seen in table 4 could be attributed to macro economic trends which shifted all sectors, and not to the specific vacancy rate in the specialised business sector.

Bachelor's enrolment is seemingly unaffected by macro economic conditions and vacancy rates and no significant coefficients appear in any of the tables. This would support the idea that bachelor's enrolment is very difficult to affect. It is most likely influenced by cultural factors, values, and personal factors such as the opinion of a high schooler's peers and parents and aptitude of the student. Some of those factors might be affected by economic factors, so in the very long term macro economic conditions could still play a role. The data shown also have implications for a possible age variable. As age goes up, a student is more influenced by the labour market since they are closer to entering it fully, when a (prospective) student however is much older, they might only study due to personal interest, regardless of labour market conditions. This would mean the effect of age is nonlinear.

A potential reason for not finding a correlation is because professions and industry are not the same thing. For example, a construction firm could employ a few accountants or the civil service could employ a data scientist. A student could pick their programme based on the skills they wish to acquire and not because they have an industry in mind in which they want to work. Quantifying skills would be tricky, but perhaps by looking at a small amount of specialised skills it could be done. Because certain skills are most likely to be in demand in multiple sectors it is logical that graphic two would be more uniform than graphic one. Yet, if students were selecting for marketable skills we might expect the weighted vacancy rate to have an effect as it captures the different industries a graduate is likely to be employed in, and this variable was insignificant. There might still be within-industry selection, where students pick between comparable master's programmes for the programme they think has the best opportunities.

The shortage in the educational sector is at odds with the low vacancy rate found in the first and second graphic. The vacancy rate however is only one indicator of a shortage. Whether there is a shortage is also based on what is valued in society. An overworked teacher or an undesirably large class of children is seen as a large issue and the non-monetary value placed on educators is high. A business could simply not expand or scale back certain operations without it immediately becoming a societal issue. In addition, there is not a general teacher shortage but a teacher shortage in very specific fields. The total vacancy rate is low but the shortage is especially bad for languages and the exact sciences in secondary education. According to the most prominent Dutch labour agency, the UWV, the shortage for many language teachers and teachers in the exact sciences is around seven percent (Kalkhoven, 2023), or 70 open vacancies so we can compare to table 1. A relatively high number, but only for a few very specific types of teachers.

In summary, the regressions in the first step of the analysis did not find clear evidence that vacancy rates impact student enrolment choices. However, some evidence does exist that macro economic conditions do impact master's enrolment. The choice of whether to study or what to study seems unimpacted, but the choice to continue studying does seem influenced.

5.2 Second step main hypothesis:

- Students in highly in demand fields place greater importance on career prospects.
- Students' opinions respond to market changes in different ways depending on the field of study.

5.2.1 Second step analysis

The first hypothesis seems broadly true. If we consider the survey was taken in 2023 at the end of the study year and that these are master's students surveyed, we can assume they probably started their education in 2018 or 2019 and started their master's orientation in 2021 and 2022. In table 8 the lowest values given are for the language and culture field and for the behaviour and society field. Two fields also broadly on the lower end in the weighted vacancy rates graphic (graphic two). The economics category has both the highest ratio of students that state career is important and also consistently the highest weighted vacancy rate. Law and technology are both in second place for the highest ratio of students stating they found career important. They also consistently are among the fields with the highest vacancy rates. Nature seems to be an exemption with a ratio of students equal to the average of all students stating they found career important, despite having a relatively high number of vacancies.

Overall, placing a relatively high value on a career corresponds fairly well with studying in a field with a relatively high vacancy rate and vice versa. The order of the ratio of finding career important lines up relatively well with the order of the height of weighted vacancy rates. The exception is the education field with low vacancies and a slightly above average ratio of students stating they found career important. Then again, the education sector weighted vacancy rate seems unrepresentative as there is very high demand for some specific types of teachers, meaning that for those individual teacher fields the motivation might correspond to the vacancy rate. The variable career importance is a binary variable, but if we assume the answers are normally distributed, we could look at the ratio and say that the student body in a particular field is on the whole more career motivated, with some outliers on either side.

The variation between study fields is further supported by table 9. In the multinomial regression we can see that, relative to the baseline of behaviour and society, students in education, technology, healthcare, economics, and law are significantly more likely to state that career opportunities were an important factor for their choice of study. At the same time language and culture students were significantly less likely to state career opportunities were important to them.

The differences in the value of career prospects are also reflected in graduate employment concentration. In educational fields where students reported high career motivation, the largest employment sector generally had a larger share of graduates. In technology, economics, and law, the largest employment sector among the top five includes 46%, 45%, and 51 % of graduates respectively. For behaviour and society and language and culture, the largest sector employed 35% and 25%, respectively. For healthcare and education, the top employment sector employed 74 % and 89% of

graduates, respectively. This could also provide a hint as to the above average value placed on career importance in these fields, as most students will enter these studies with a clear view of where they will end up.

Causation can plausibly be inferred from the correlation between career motivation and vacancy rates. One of the main possible issues is reverse causality. Students were surveyed at the end of the year of their programme and were asked what their motivation for choosing their programme about a year before was. Perhaps students actually looked at their current employment prospects and in hindsight decided that their study put them on the right track. The order of the vacancy rates however did not meaningfully change in this timespan. A student's retrospective account is based on more or less the same labour market conditions as when they made their decision. Reverse causality cannot be fully ruled out, but is unlikely to fully explain the patterns seen.

There is also substantial evidence to support the second hypothesis. In table 10, nature, and language and culture have significant positive interaction effects between students stating they find career important and higher vacancy rates in the previous year. The same is true for behaviour and society, although the effect is marginally significant. This means that for these studies, when job prospects improve, students are more likely to state they find career important. When job opportunities improve, these students most likely become more optimistic about future employment possibilities and where their education could bring them. Economics had a negative interaction effect, although only marginally significant. This would mean that economics students actually found a career to be less important as job prospects improved. Since this field started with a very high motivation and highest relative vacancy rate, students might start to feel their additional education is unnecessary. The effects of labour market conditions on career motivation are not the same across study fields. Some fields are completely inelastic, some fields are positively affected and one field is possibly negatively affected.

5.3 Synthesis of the two step analysis

For the main hypothesis, this study has not found any evidence for students taking job landing chances, approximated with sectoral vacancy rates, into account when choosing their bachelor's programme or master's programme. However, the descriptive statistics and positive results when time controls are omitted, suggest that the choice to continue studying does seem to be affected by large macro economic shifts such as the COVID-19 pandemic, when job prospects were strongly eroded. At the same time, students do seem to be generally aware of relative market conditions and respond to them in opinion surveys. The ratio of students that state career is important to them in a given study seems generally in line with the relative labour demand of a study. This is consistent with the

literature in the research field regarding student expectations (Arcidiacono et al., 2020; Stinebrickner & Stinebrickner, 2014; Wiswall & Zafar, 2021), which finds that students are able to make relatively accurate long term predictions about expected labour market returns.

The fields with highly career motivated students tend to also funnel graduates into a specific sector, whereas students with lower career motivation have much more diffuse employment outcomes. In table 10 we can also observe that for several study fields, nature, language and culture, and behaviour and society, career motivation increases with higher vacancy rates. For an already highly career motivated field, economics, there is even an indication that career motivation might go down as vacancy rates rise. Other fields seemed completely unaffected. Taken together, hypothesis 2 and 3 help explain why the main hypothesis did not hold. Students are generally aware of labour market prospects and are influenced in their attitudes towards their study, but this attitude change is not strong enough to actually manifest in behavioural change.

6 Conclusion

This paper examined the connection between the labour market demand and student enrollment in higher education. Labour market demand was proxied using a weighted vacancy rate corresponding to the sectors where graduates were likely to end up working. Enrolment was measured using the HOOP educational category used by the ministry of education for classification (Ministerie van Onderwijs, 2017). The research question asked was: Are students influenced by shifts in the labour market when picking their major in higher education? The analysis was made up of two parts. First, a series of regressions were carried out to check for a correlation between bachelor's and master's programmes (hypothesis 1). Second, the descriptive statistics of student survey data were examined and regressions using vacancy rates were carried out, to check whether opinions tended to be in line with labour demand and whether opinions were responsive to labour demand (hypothesis 2 and 3).

6.1 Key findings

The results of the analysis showed no support for the first hypothesis. Across a range of regression models and different time lags there is no statistically significant relationship between labour market demand and enrolment when controlled for time and study field. Enrolment patterns for bachelor's programmes are remarkably stable with very little changes in the examined period. For the master's programmes there is more fluctuation. This would suggest that master's programme enrolment is contingent on more factors such as labour market conditions in specific (sub-) fields and student motivation. Whereas bachelor's enrolment in comparison is based on nigh immutable factors such as the average student's abilities, interests and ideals.

Vacancy rates tend to move up and down in parallel and when vacancy rates are grouped this becomes even more apparent. It seems that demand rises and falls together. When we compare graphics one and two to graphics three and four we can see that there was a notable uptick in master's programme enrolment during the COVID-19 pandemic. It is quite likely that a lack of job opportunities and general economic slump caused students to wager that there would be little opportunity cost to continue studying. This insight is further supported by the regression in table 4, once time controls are not present the results are significant. Although the pandemic was a unique situation, it is possible other economic shocks could have a similar effect on increased master's enrolment.

The analysis showed substantial support for hypothesis two and three. The results from table eight and table nine show that students in a field with high demand tend to also care about their career more, and in fields with worse labour demand students on the whole care relatively less about career. There also seems to be a pattern where if a field's graduates are concentrated in a single sector, such as with healthcare and education, instead of equally spread out over multiple sectors, it also seems to correlate with high career motivation. The results from table ten also show that students from some fields value career more as vacancy rates rise and that for the economics field career motivation might actually decrease as vacancies rise. This could signal that if the job landing chances are sufficiently high enough, students might start caring about career prospects less.

6.2 Theoretical implications

The findings of this study suggest that labour market signals are picked up by students and manifest in attitude changes, but do not seem to translate into behavioural change. This is in line with the findings of Ersoy and Speer (2022) discussed in the theoretical framework; students are affected by information and change their opinion, but few students end up switching their major. At the same time, students who seem to value career prospects higher generally seem to be in study fields with higher demand and vice versa. This is consistent with the findings of Arcidiacono et al. (2020) and Wiswall and Zafar (2021). They found that students were generally accurate in predicting future expected income and that expectations for broader lifestyle consequences were broadly accurate. Taken together, a picture is painted of educational choice as strongly bounded and study trajectory as strongly path dependent.

When it comes to the purported STEM shortage, an increased emphasis on the marketability of skills could also push STEM students towards the specialisations for which the demand is highest. The career motivation for the technology category was quite high, in line with the market demand, but the vacancy rate seemed to not affect student enrolment or opinion. Future research of student

behaviour should take into account that students pick studies for different reasons. As a result student responses to treatment are not always in the same direction and some studies may not respond at all. Aggregate analyses could turn out insignificant if a model assumes coefficients are the same across studies

6.3 Public policy implications

The literature and findings of this paper support the idea that steering students into specific fields by only providing information would likely be quite limited in effectiveness. The students in fields with relatively low demand tend to be comparatively less career interested. As such simply providing information to prospective first year's students would probably have quite limited results. Students' education trajectories are path dependent and the labour market is quite far away, until it is one day not.

Looking back at the key issues discussed in the introduction, the aging population and the Draghi report's skills gap concerns, this paper does still allow for some possible successful policy intervention. A government sufficiently determined to influence student behaviour could consider providing more information at a much younger age, or reducing institutional barriers to make switching to highly demanded or vocational programmes easier. For one, providing information to secondary school students of important and in demand skills could prove more effective in reducing skills gaps. Students could get used to thinking about the labour market and what skills are in demand well before having to choose a major. In addition, thinking more long term about what skills are important could help students with choosing electives, minors and extracurricular programmes.

Another route could be by reducing the institutional and capacity barriers students face when adjusting their study trajectory. This could for example mean making it easier and more affordable for students who want to go into a shortage sector to follow a pre-master's programme. Students at the bachelor's enrolment stage are relatively unmovable, but it seems that master's enrollment is generally more variable. This would indicate that interventions could have more success there as students might be more open to hearing about more vocationally oriented programmes. This paper also found that students in fields with lower average career motivation increased in their level of motivation when vacancies rose. This would suggest that even in the less career oriented fields, students could still be looking to acquire skills that fit the labour market.

Implementing changes to push students to think about the labour market could also have the added benefit of giving study choice a more important place in the public consciousness. If we really want to change the education system to adapt to better conform to the needs of society, this view

would have to be carried in society. The findings of this paper suggest there is little reason to believe critical labour shortages will naturally correct themselves. In fact, since vacancy rates will most likely stay relatively high everywhere, there would not be much need for a prospective student to be worried about not finding work.

6.4 Methodological reflection

This study's methodology has had the advantage of being able to draw from a large body of literature. As a result, the analysis could be done in a mostly deductive manner, where the results of previous research could be tested in a new context. The mixed-methods approach helped deal with some of the limitations of an analysis done on a high level of aggregation. If only the first step had been carried out, the null result would not have been that robust. But the significant results in the second step helped reinforce that the null result in the first step was not a fluke. It could not be dismissed based solely on the level of data aggregation, as the second analysis did find significant results on the same level of aggregation. The mixed method approach helped with connecting this paper to the literature so both behavioural patterns and attitudinal changes were measured.

The internal validity of this paper is strong. Multiple variants of models are used with multiple time lags which creates a robust result. Lagging the vacancy rates also helped make sure there was no reverse causality. The time fixed effects made sure year specific shocks were accounted for. The external validity is also quite high. The findings of this paper are consistent with what has been written about student populations from quite a few countries. As a result, this paper reïnforces that the lack of student behavioural response is likely a pattern across higher education systems in the developed world.

The reliability of the research is also strong. Only one period was examined, but there would not be a good reason to assume that events in this period have biased the results. There was a substantial reform to Dutch higher education with the reimplementation of universal grants. But research, covered in the theoretical framework, showed this reform did not affect enrolment numbers or enrolment decisions (Bolhaar et al., 2023). The usage of data and categories created by the Central Bureau of Statistics also helps make sure measurement is done consistently and professionally. If another researcher wanted to replicate the results they could do so with publicly available data.

The study did have some serious limitations. The only grouping of studies available, grouped studies at a relatively high level, which would mask any within-field shifts. It would have been interesting to see if many students for example made a substantial field switch when going from their undergraduate to graduate education. Anecdotally, I know quite a few students with a technical

background who switched to a data science master's because it was in higher demand. There has also been a large increase in the enrolment into artificial intelligence fields in the last decade. It would have been interesting to see if this has come at the cost of other technical fields for example.

Future research could look into these more marginal shifts. The Central Bureau of Statistics collects microdata on the outcomes of students for every study, which allows the public organisation *studiekeuze123* to display the percentage of students who find education level appropriate work and their average starting salaries. A researcher with the necessary clearances could do an analysis of whether students move into sectors with better job finding chances and starting salaries with very little aggregation.

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