

## LONG-RUN NEGATIVE WAGE EFFECTS OF GRADUATING DURING A RECESSION IN THE NETHERLANDS.

*An analysis on the effects of graduating during a recession on the wages nowadays with respect to education and working experience.*

People who graduate during a recession might have lower wages nowadays, as they might have to settle for lower-wage jobs, or take longer to find a job, hence losing on experience. In this paper the effects of graduating are researched in the Netherlands for the period 1970-2008 based on the Mincer Model. It is found that working experience could be negative for subjects who graduate during a recession, as graduates with more experience might give up more of their wages. No definitive proof is found for general long-run negative wage effects for graduating during a recession. The negative wage effect does seem to exist for low-skilled workers, but is not found for high-skilled workers.

Long-Run wage effects, Graduating Effects, Mincer Model, Working Experience,  
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## Introduction

The normal route to achieve a master's degree in the Netherlands takes about eighteen years of your life. This consists of eight years on primary school, six years on middle school, three years as a bachelor student, and one year as a master's student. After these eighteen year you probably have the idea that you will get a high wage and a nice job. The Dutch paper NRC Next checked this and found that master students do seem to get a higher wage over time than other students. (Berger, 2012). But it remains to be seen whether this is a valid perception of the job market of these days. Graduates seem to take longer in finding a job, and need to settle for a lower wage. (van der Meulen & van Mossevelde, 2012)

The times are changing. The Netherlands are currently in the aftermath of a recession and there is a decrease in demand. This means that there are less jobs, which means graduates might miss out on importance job experiences when they cannot find the job they want. Next to this the wages will also decrease as a result of this lower demand. Higher educated people will move towards lower jobs to replace the lower educated people and will thus be underpaid relative to their skills. These disadvantages are visible from the start of their careers in an economy. But it is even possible that these disadvantages will haunt graduates for the rest of their career. Multiple research suggest that there are long term effects of graduating in a recession.

Nevisky (2013) for example looked at the career effects on wages for people in the United States who graduated during a recession. He states that there are losses in the wages compared to other students, and these are the largest in the beginning of the graduates' career; the wages of graduates are found to be significantly lower when they graduated during a recession. This thus indicates that there is some sort of handicap on wages for graduates in a bad economy. Nevisky also found that up to 70 percent of these losses should have disappeared after five years. Similar research is done by Philip Oreopoulos, Till von Wachter, and Andrew Heisz (2012) who looked at the short and long term effects of graduating in a recession for Canadian people. They found that Canadians who graduate during a recession start at a lower wage compared to people who do not graduate during a recession. Furthermore they also found that the wages of these people who graduate during a recession does seem to recover over time. Lisa Kahn (2010) also looked at the wage effects and found that this negative effect persists longer for the people who graduated during a recession.

These negative effects leaves graduates with two choices: either switch to a lower level job or remain unemployed. Both might result in disadvantages later on in their career. Most of the current research on these negative effects looked at the United States of America and England. The question remains however whether this negative relation also exists in the Netherlands, which is the main focus point of the research from this paper. The paper will look at the wage effects of graduating during a recession in the Netherlands for the period between 1970 and 2008. The main graduates of interest are those who are currently employed (as data on their current wages is needed), where all the degrees have been included and no group has been excluded.

This paper will be following the current findings by basing the analysis on similar models of these previous researches. Combining the findings from previous research therefore leads to the following main research question: Are there any negative wage effects in the Netherlands? Next to this, one might wonder whether these negative effects persists, and whether there is any differentiation in this effect. Together this results in the following research hypothesis that will be used to analyze this:

*Does graduating during a recession in the Netherlands result in lasting negative wage effects?*

It is likely that there might be different effects for people with different years of working experience, or with a higher educational degree. Therefore an additional hypothesis is posed:

*Are the negative wage effects for graduates in a recession dependant on their experience or educational degree?*

The nature of the research will be both theoretical and empirical. The theoretical part will focus on theories on wages and economies in a recession, and also on education. These theories will help to build an empirical model to test the main hypotheses described above. The empirical part will be a data analysis mainly focused on the effect of education and the state of the economy on the wages of graduates. The analysis is therefore based on a regression analysis. The data from these graduates is collected from the institute of labor supply panel of the Netherlands.<sup>1</sup> This is a questionnaire answered every two year by over 5000 people. It has over 200 questions regarding work, education, and income, but also questions about when and how people graduated. The questionnaire used in this research dates from 2008, as this covers graduated people in the broadest time period. (1945-2008) This will be filtered for the questions needed to create a dataset for the main questions.

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<sup>1</sup> O(rganisatie) S(trategisch) A(rbeidsmarktonderzoek) Arbeidsaanbodpanel

The observations will be linked through the graduation years of their highest educational degree, and will be expanded with external data on unemployment and economical growth. This results in a large cross sectional data set. The goal of the empirical part will be to find whether the negative relation between wages and recessions holds for the Netherlands to reach an answer to the research hypothesis. The main findings from this research are that no clear evidence is found on the first hypothesis for the Netherlands. The second hypothesis showed that there are negative wage effects for low-skilled graduates.

The dataset and analysis will thus be differentiated for different levels of education, as the effect might be stronger for people with a higher educational degree. It can be the case that people will stay in school during an economical crisis, due to a low demand for labor. This might mean that the average graduate is slightly worse than it should be, as the people who do not continue to study will go to the labor market and try to find a job. The years of experience will also be taken into account in the analysis as this is an important factor of influence on the wages and the possibility of getting a job.

This research will follow a classical setup. The next section will discuss previous literature, followed by a theoretical framework, resulting in hypothesis and a model to test. This is described in the next section, the methodology, which also described the methods used to test the model. The data description will give an outline of what the data used looks like, as well as what variables are used. The results will give the outcome of the regression analysis, and also show some robustness checks. Finally, the conclusion will give the answer to the research hypotheses.



## Literature review

In this section previous literature will be discussed. It will deal with empirical research on the effect of graduating in a recession on wages, and what it means for the Netherlands. These literature findings result in indicators of what drives the effects of graduating during a recession. This will be discussed in the theoretical part. It also results in some expectations of the findings.

The first part will deal with literature on education. Because the research will be dealing with different levels of educations, private returns to education come to mind. Private returns to education are a measure for the effect of an individual's education on his wage. George Psacharopoulos (1994) did research to global returns to investment in education and the private returns. He found that the private returns to education are quite high, but that they are decreasing along the per capita income of a country. Furthermore he found that private returns to education diminish with the level of private investment return. This implies that there are negative marginal effects for private returns for education. This holds for primary – secondary – higher education. Psacharopoulos also found that the effects are stronger in the private than the public sector. Furthermore there are not many differences between developed countries. However when he compared developed countries to developing countries, Psacharopoulos found that the private returns to education are stronger for developing countries. This because there are more marginal gains possible in these countries. These private returns to education thus help to explain why people might stay in school, due to the possible marginal gains.

Multiple researchers found that there are increasing private returns when the level of education rises, for example from college to university. These researches are done on developing countries (Amin & Awung, 2005) (Lambropoulos & Psacharopoulos, 1992). There is also research done on the private returns of education in developed countries. For example, research done on the 21 OECD countries shows that there is a positive relation between the growths of human capital and the output per capita. This research looked at the years of education and also measured the speed of convergence. (Bassini & Scarpetta, 2002)

Paul Oyer (2006a) looked at the initial career placement for economic graduates, and compared the differences by taking the state of the economy into account. Oyer found that a graduate's initial career placement seems to matter a lot in the career of an economist; people who are working at the top of the chain started their career at close proximity of the top. The skills which graduates can develop in one job can help them to get a comparative advantage over other jobs. Timing your entry to the market by waiting for a good state of the economy could therefore be efficient according to Oyer.

Next to this, Oyer (2006a) also found that this is only holds when not everyone is aware of this and are also waiting to find a job. Therefore graduates should try to outsmart other graduates if they want to profit from it, for example through their own network.

In another research Oyer (2006b) also looked at bankers and how macroeconomic shocks affect them. Oyer measures a macroeconomic shock by looking at stock price movements. Again, he found that initial job placement seems to matter a lot for the wage of bankers, and macroeconomic shocks can make or break their future earnings. (Oyer, 2006) Combining the findings from both researches from Oyer thus indicate that the initial career placement of graduates matters for their future earnings, and shocks in the economy can have a large effect on them.

The next step is to zoom in on problem-specific research. An interesting research related to this is the research that is done on the labor market consequences of graduating in a bad economy in the United States by Lisa Kahn (2010). Lisa Kahn looked at the labor market consequences of graduating in a bad economy, focusing on the effects of the wages. She found that there are large negative wage effects for people who graduate in times of a bad economy. Kahn used the following model to analyze this:

*dependent variable*

$$= a + b1 * college + b2 * college * experience + b3 * AFQT + b4 * Y + b5 * State + b6 * experience + b7 * experience * experience + \epsilon$$

Kahn used multiple dependant variables. These are either the log wages, week worked per year, weeks of tenure at the current job, occupation prestige score, and a dummy variable for being employed. *College* measured the college unemployment rate. *Experience* measures the number of years after graduation. *AFQT* measures the age adjusted Armed Forces Qualification Test score, which measures ability. *Y* measures the year indicators, and *state* is the state unemployment rate of the individual's state of residence of the year the dependant variable is used.

Similar research on the effects of graduating in a recession is done by Ayako Kondo (2008). Kondo differs from the research by Kahn by looking specifically at the differences across race and gender. In general, Kondo found lasting negative wage effects for people who graduate during a recession. She also finds that these effects are stronger for foreign and male workers. The effects are also stronger for people with stronger labor force attachments. This implies that the effects will be different depending on the type of contract an employee has.

For the general analysis, Kondo used the following model, which is quite similar to that of Kahn:

$$\log w = B * u_{ys} + \gamma * u_{ts} + d * X + \varphi + n + \mu + \varepsilon$$

W here measures the hourly wages for an observation who graduated at a specific year in a specific state.  $u_{ys}$  measures the unemployment rate at the entry of the labor market, whereas  $u_{ts}$  measures the current unemployment rate. X measures control variables like the potential experience, highest education received, and the AFQT test scores. The error terms  $\varphi$ ,  $n$ , and  $\mu$  measure respectively the calendar year fixed effects, the entry-state fixed effect, and the entry year fixed effects.

Other research by Philip Oreopoulos, Till von Wachter, and Andrew Heisz (2012) looked at both the short and long run effects of graduating in a recession in Canada. They found that students in Canada who graduate during a recession will start to work for a lower wage at a lower job compared to students who graduate outside a recession. Oreopoulos et al. explain this with the fact that graduates have a large money demand in the first years of their career to live. Over time, these graduates will reach a higher wage, but it will take a while. According to Oreopoulos et al, the difference in wages between these two types of graduates should have disappeared after ten years. The people with the highest degrees seem to recover the quickest. This is explained by the fact that these graduates are more eager to switch firms. Oreopoulos, von Wachter, and Heisz used the following model in their research:

$$Y = a + B1 * UR + \varphi + \vartheta + \gamma + X + \varepsilon$$

Y measures the log of annual earnings. UR measures the unemployment rate at time of graduation at the region in which they lived after graduation.  $\varphi$  measures the fixed effects of the calendar year,  $\vartheta$  for the fixed effect for the first region of residence of the year of graduation, X for the year of graduation, and  $\gamma$  measures the calendar year.

The next section will describe the underlying theories of interest in this analysis.

## Theory

This section discusses the theoretical background of the research, resulting in the model that will be used to test the hypotheses. It will first discuss the general idea behind private returns to education. After that the theory will zoom in on recessions and its effects on wages and unemployment. Next to that, theory on unemployment wage, and the timing of working for graduates will be discussed. Working experience will also be discussed, to see how it affects wages and chances of finding a job. These theories will help to understand the relation between the factors and how these factors are related with each other.

## Education

The main question a graduate has regarding education in a recession is whether he should start working, or keep studying to build up more human capital. This tradeoff is related to the Mincer equation. Jacob Mincer (1974) described the main determinants for human capital. He founds that earnings are a function of the years of education and the potential experience. Potential experience can be measured by the current age of a graduate minus the years of schooling, minus six<sup>2</sup>. The following equation is used as a general Mincer equation:

$$\log Y = \log \gamma_0 + rS + \beta_1 X + \beta_2 X^2 + \epsilon$$

Here, Y measures the earnings, where  $\gamma_0$  measures the earnings for someone without schooling or education. S measures the years spend in school, and X measures the potential experience. Interesting is the direction of the r, as this measures the return to education. This Mincer equation is the building block of the model in this research, as it describes what determines wages. The Mincer equation is derived from human capital investment models.

More recent theory states that the results seem to differ between different education groups. The wages for non-experience high skilled workers seem to have increased a lot nowadays, relative to experienced high skilled workers. (Lemieux, 2006) Related to this, it is also found that school enrollments rates are lower when the general wage level is relatively high. (Gustman & Steinmeier, 1981) This means that the choice between studying and working can be affected by the wages and the labor market prospects. If the results between countries are compared it therefore is important to correct for the general wage level in a country to correct for this effect.

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<sup>2</sup> The minus six is included to correct for the first six years of one's life, where no study or work is possible

Furthermore it seems that people who are overqualified are more punished in their career than undereducated people (in developed countries) because undereducated people have received more training, hence more experience. (Hartog, 2000) But it is not always possible to find a job. The school enrollment rates of young people seem to rise during a recession because there are fewer jobs available. (Pencavel, 1987) This explains why graduates will keep studying instead of going to the job market. It also implies that graduates will have a higher age when they start looking for a job.

## Recession

The next factor of interest are economic recessions. An economical recession will affect a lot of factors in an economy. For instance, there will be less economical activity in general; a negative business cycle, less demand and supply of product, and a higher unemployment rate. The statistical definition of a recession that is used most of the times is that an economy has multiple (two quarters) consequent periods of negative economical growth. This is based on the growth of the Gross Domestic Product (GDP) (Shiskin, 1974). Other definitions look at the unemployment and state that an economy is in a recession when there is a 1.5% increase in unemployment over the last twelve months, as this reflects the effect of the change in both the output and demand. (U.S. Bureau of Labor Statistics, 2012) .

A short note on the unemployment as a measure of a recession is that it might take a while for a recession to take its effect on the labor market. This because output falls at first (which is reflected in the GDP) and then has its effect on the unemployment rate. Research shows that it takes at least six months up to one year for the output to have its effect on the labor market and its unemployment rate. (Officie for National Statistics, 2009) Therefore it might important to correct for a lagged effect if the unemployment rate is used. Looking at households in a recession, it can be seen that the household unemployment sharply increased and less money is available. Both of these are a result of the rise in macro economical unemployment and a general lower wage level. (Hurd & Rohwedder, 2010)

The wages in a recession have decreased mainly due to the effect of a recession on the middle class jobs. This is because the upper and middle class jobs are the ones in which there is most pressure during a recession. Management and government will make most of the cuts in the lower class jobs to correct for the lower demand. There will be a downwards pressure on these wages, because there are less jobs available. But if a country wants to get out of a recession, the demand of the industries who made the cuts will eventually rise again, because there eventually an increase in demand. Low class jobs are thus essential to get out of a recession because these jobs are needed to deal with the change in demand in industries. (Plumer, 2013)

## Unemployment

Unemployment can thus be used as a measure for the state of the economy according to the theory above. It seems that there are large differences in unemployment between different groups and types of workers during a recession. Men are hit harder during a recession as their unemployment rates lies higher compared to women. (Meade, 2012) This can be explained by the fact that women are triggered to leave the labor market and stop searching for a job and settle down with children at home. (Officie for National Statistics, 2009) Furthermore, young people are the first ones that get fired in a recession, as they lack experiences and are easily replaceable. (Officie for National Statistics, 2009) The unemployment is also stronger in some sectors than other (e.g. construction, and manufacturing) whereas other sectors even benefit from a recession (e.g. education and health). This is because the decrease in demand means that there is less demand to produce. More people will go (back) to school, therefore the educational sector will benefit from it, as more teachers are needed. (Katz, 2010) Looking at the differences in ethnical groups, it can be seen that there is some sort of discrimination; there are more foreign people unemployed than native people, and this difference seems to be even larger during recessions. This is because in general the foreign people are poorer than the native people, and thus cannot make any investment, like starting a new study, and will thus (need to) become unemployed. (Lowrey, 2013)

## Wages

Experience is not the only reason that explains why there might be differences. During periods of economical growth there is more money available for investments, which can improve the efficiency of workers. (Becker, 1967) Naturally there is also a relation with wages; most of the growth of a graduates' wage happens in the first ten years since he started to work. These ten years account for almost two-third of the total growth of the wages from graduates. Changing in jobs can help to explain this. It was found that one-third of a graduates wage growth can be attributed to the switching of jobs. This can be explained by the fact that a previous job improves the bargaining position of an employee. (Topel. & Ward, 1992) Another aspect is that it will take longer to find a job during a recession, as there are fewer jobs available, due to the lower demand. This leads to relative lower average wages because the people who graduate during a recession have less experience compared to people who start working after graduating in a period of economical growth.<sup>3</sup>

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<sup>3</sup> As will be explained in the section on experiences.

The underlying problem is that these people who graduate during a recession will be placed in lower-level jobs, with fewer responsibilities and will therefore be underpaid relatively to what they are capable of. The reasoning behind this is that the value of the delivered work will be reflected by the wage of the workers. This is the result of task specific human capital, as described by Robert Gibbons and Michael Waldman (2004).

The above thus means that there will be differences in wages amongst graduates. These differences will not only be due to the state of the economy, but also the amount of experience these graduates have.<sup>4</sup> Related to this is the fact that human capital loses its utility when a worker switches jobs rather than when he switches firms. This means that the growth of the skills from the workers and their rewards, through wages and promotions, should be used to optimize the workers human capital in order to optimize the firm's efficiency and keep them in the firm. This is related to the so called *cohort effects*. Cohort effects measure how people, who are born in the same time period, region, or who have been through the same experiences in their life are affected in their development. These effects are thus group-specific effects. Gibbons and Waldman (2006) try to capture these cohort effects by using the previously described task specific human capital. They found that cohorts who start at a low wage and a low function in a firm will remain to earn a wage well below the average wage for many years to come, and will remain in a relative low function in a firm. Thus: the starting position of an employee is quite crucial for its future position and earnings. Kwon and Milgrom (2007) showed that workers who start to work in times of low unemployment and high economical growth are easier promoted, and will therefore have higher wages by. In line with Gibbons and Waldman (2006) they also found that these cohort effects could be driven by the task specific human capital. The findings from Kwon and Milgrom thus prove that the findings from Gibbons and Waldman also hold for periods of economic growth, as they found the opposite relation.

Another reason why wages might differ is because of the sector in which the graduate is employed. Research by the Central Bureau of Statistics in the Netherlands on the wages of graduates found that people with a higher level of education also have a higher income. But this also differs a lot between the sectors in which they are working. Law, Economics, and Health are the sectors with the most money in them. (CBS, Centraal Bureau Statistiek, 2011)

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<sup>4</sup> As will be shown in the section on experiences.

Wages are furthermore affected by bargaining. Of course, collective bargaining through labor unions comes to mind here. But in this case the private bargaining powers are more interesting, as people need to bargain based upon their own skills and experience. Because of the lower demand there will be fewer jobs, meaning that graduates can get placed in a position for which they are overqualified. It is found that overqualified people are paid higher wages to prevent them from shifting to a better job when it comes up. This is mainly the case at the medium and low skilled jobs, as this is where high educated people start to work in times of recession. (Muysken, Vallizadeh, & Ziesemer, 2012) Due to growth it could be the case that a firm requires more skills. Since the firm has employees who are overqualified, it might mean that they already have these skills. Thus in theory, overqualified employees might be used for the increasing demand in skill, which will be reflected in the wage of these overqualified employees. The problem is that this is not happening in practice, and when it is happening, it is hard to measure. The current evidence points towards overqualified personnel remaining to be underpaid. (Brynin, 2002)

## Experience

The general idea behind the problem seem to be the long run effects of poor job experience after graduation. People who graduate during a recession can either try to find a job, or continue to study. When they try to find a job, it can be very hard to find a job which corresponds with their achieved degree in their sector of interest. This is especially the case during a recession, as there are fewer jobs available. Therefore graduates might settle for a lower wage in a lower job, as they need the money to maintain your life, and will switch jobs around a lot. (Shimer, 2008) This thus mean that a graduate will lose experience compared to someone who graduated in economical high times and who found a good job immediately after graduating.

This switching of jobs is often called job-hopping, and does not have to be a bad thing per se. Rosella Gardecki and David Neumark (1998) prove that the labor market outcomes between the ages of twenty and thirty are not related to early labor market experiences. This means that the shifting of jobs in that period of a graduate's life might not have a large impact for their final job. However, they do conclude that early job experiences will help graduates to achieve a higher wage in the future of their life A problem related to this is that people who graduated in a recession will work in a different situation compared to people who work in periods of economical growth. The recession can affect the differences in the experience they gained, which means that there will be differences in efficiency of workers, depending on whether the period in which they started working had a high or low economical growth. (Becker, 1967) Experience thus does not seem affect the job a graduate will get, but will affect their future wage.



## Conclusion

Based upon the theory described above, several conclusions can be drawn. Firstly, both GDP and unemployment can be used as a measure for the state of the economy, but unemployment might have a lagged effect. In a recession, there will be lower wages and higher unemployment. In more detail, this means that unemployment can differ between sectors, ethnic groups, and gender. These effects will also be stronger during a recession. Furthermore, experience is not important for what kind of job a graduate will get at the end of his career. A recession will affect the efficiency in experience they receive. This experience is important for the wage they will receive later on. Wages will grow the most in the first ten years of graduates' career. The wages seem to differ based upon the sector graduates work in and these wages will be higher when a graduate is overqualified compared to people with normal qualifications. People will stay in school during a recession after they are graduated, and the returns to education seem to be increasing with the educational level (college towards university in the United States, MBO towards HBO/WO in the Netherlands).

All these conclusions and relations can be combined in a model to test the main hypothesis, which is done in the methodology.

## Methodology

In this section the methodology will be discussed. It will describe the models used to answer the research question and how the findings will be checked and expanded. The methodology will also point out differences in this approach compared to other researches. The starting point is the model used.

### Model used

To analyze the effect on the wages, regression analyzes will be used. For this a general model to be tested is needed, which is based upon the relations found in the theory and the papers from Kahn (2010) and Oreopoulos et al (2012). The main dependent variable in the model will be the wages, as the main relation of interested is the effect of the variables on the wages. These wages will be measured by the monthly wage in the year 2008 in euros. These monthly incomes are derived from two sub questions in the questionnaire database; “what is your wage?”, and “over what period did you receive this wage?”. These two sub questions are combined into one variable in the labor supply panel dataset from 2008. As there are a lot of high wages in the dataset, the right side tail of the wage distribution will be scaled, which is done by taking the log from the wages. The variable is labeled: *Log (wages)*.

Since the effect of graduating in a recession is of interest, a measure for the state of the economy is needed. In line with the previous research, the yearly unemployment rate in the year of graduation is used as a measure of the state of the economy. Unemployment is measured as the percentage of total unemployed over the total labor force. This is the main independent variable. The unemployment rate will be used of the year where the observation received their highest educational degree. Data on the unemployment rates are available in the Central Planning Agency database (CPB, 2012). The variable is labeled: *unemployment*. The data on the Unemployment rate is available from the start of 1970.

Based upon the theory, it is also important to take the gender of the observation, the ethnical background, the sector in which they are employed, and the age at graduation into account. All these variables are available in the labor supply panel as questions and defined below. The gender of the observation is measured by a dummy variable with the values of zero and one for either female or male. The expectation here is that unemployment is higher under male workers, which means that male workers will have lower wages. The variable is labeled: *gender*.

The ethnical background will be measured by a dummy variable as well. It is valued either zero or one for being either born in the Netherlands or elsewhere. The expectation is that the unemployment and wages are lower for foreign workers. The variable is labeled: *foreign*.

The sector in which people are employed will be measured by a dummy for the different sectors in which they are working. These are based upon the Standard Business Grouping (SBI) -code division of 1993. The expectation here is that there will be differences in wages depending on the sector in which the observation is employed, whereas it is expected that the highest wages should lie in the sectors of economics, health, and law. For every sector a dummy is included, with sector 1 being the reference sector. The variable is labeled: *sector employed*.

The age at graduation is based upon the year in which the observation received his or her highest educational degree. The difference between this year and the year in which the observation is born results in the age at graduation. This variable gives an indication whether people started working immediately, or whether they continued to study. If the observation is young at the moment of graduation it tells that the observation started working quickly after graduation, and vice versa for an older person.. The expectation is that young graduates will have lower wages in a recession. They will have more difficulty in finding a job, and will therefore need to settle for a lower wage. The variable is labeled: *age at graduation*

Another main independent variable is the experience of the observation. This is measured by the amount of years the observation is employed in his or her job. This is based upon the question when the observation started working at the current job. The experience is calculated by taking the difference between the year the questionnaire is held and the year the observation started working. This variable is thus based upon the labor supply panel. The variable is labeled: *experience*.

There is no direct measure available in the labor supply panel for the intelligence or ability of the workers. This can therefore thus not be included in the same way as the other research did. Since the measure of skill does seem to be of importance, another measure will be used: the highest level of education received. This is available as a question in the labor supply panel and will be measured as a dummy for the different levels of education. These levels are based upon the Standard Education Grouping (SOI) of 2003 and range from 1 (lower school) until 6 (university degree). Level two (middle school) is the reference category in the analysis. The variable is labeled: *education level*.<sup>5</sup>

Combining all the variables of interest described above results in the following general model to use:

$$\log(\text{wage}) = a + b1 * \text{Unemployment} + b2 * \text{Experience} + b3 * \text{gender} + b4 * \text{age at graduation} + b5 * \text{foreign} + b6 * \text{parttime} + b7 * \text{education level} + b8 * \text{sector employed} + \epsilon.$$
<sup>6</sup>

In this model, the sign of b1 is the main relation of interest. This measures the initial effect of graduating in times of a recession on a graduate's wage. The first step will be to model only the independent variable to the unemployment to get the relation between recession and wages. After this it will be expanded to include the experience and the education level, as that will resemble the model used by Kahn the most. Next to this the control variables will be included as well, such as the sector employed, ethnicity, gender, and age at graduation. With this regression analysis the goal will be to find out whether there is a relation between graduating in a recession and the wages later on in the observations' life.

Besides this general model and the alternative variables, interaction effects will be included to link variables. With this it can see whether there are differences for the effects of graduating in a recession for experience and the level of education. This helps to answer the secondary hypothesis.

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<sup>5</sup> Level 1 as the highest educational level is not available in the dataset, therefore level 2 is the lowest level.

<sup>6</sup> Reduced form, sector employed & educational degree will be split out for the dummies in the regression analysis.

The first one is the interaction term for experience. With more experience, the observation should have a higher wage. But according to theory, there will be differences between experience and wages in a recession and in normal economical growth. For the interaction term, the unemployment rate is linked with the experience by multiplying them with each other. This regression is based upon the model described above, but expanded with the interaction effect of unemployment and experience. This gives the following model to identify:

$$\log(\text{wage}) = a + b1 * \text{Unemployment} + b2 * \text{Experience} + b3 * \text{Unemployment} * \text{Experience} + b4 * \text{gender} + b5 * \text{age at graduation} + b6 * \text{foreign} + b7 * \text{parttime} + b8 * \text{education level} + b9 * \text{sector employed} + \epsilon.^7$$

This means that b3 now gives how the effect of graduating in a recession changes depending on the experience of the observation. The effect of the interaction term can be analyzed by comparing the coefficients of the interaction term, b3, with the coefficients of unemployment and experience, b1, and b2.

The other interaction effects included deal with the link between the unemployment and the highest educational level achieved. This links the skill of the worker with the state of the economy. This interaction effect will thus show whether there are wage differences for graduating in a recession, depending on the education received. As stated in the theory, there could be differences in the ease of finding a job for graduates depending on the level of education they received. The analysis of this will be done by linking the scaled variable for the education level with the unemployment. This gives the following model to identify:

$$\log(\text{wage}) = a + b1 * \text{Unemployment} + b2 * \text{Educational level} + b3 * \text{Unemployment} * \text{Educational level} + b4 * \text{Experience} + b5 * \text{gender} + b6 * \text{age at graduation} + b7 * \text{foreign} + b8 * \text{parttime} + b9 * \text{sector employed} + \epsilon.^8$$

This means that b3 now gives the differences in the wage effect depending on the education level achieved. The coefficient will be compared with the coefficients for the dummies of the educational level and the unemployment rate, b1 and b2 in this (reduced) model.

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<sup>7</sup> Reduced form, sector employed & educational degree will be split out for the dummies in the regression analysis.

<sup>8</sup> idem

## Extensions on the model

To see whether the conclusions and findings of the main model are valid, some alternative measures for the variables will be used. This will help to see whether the general findings for the main question hold for alternative measures, or whether these findings might differ depending on the specification used.

The first check will be done by using an alternative dependant variable. Instead of the wages the average hours worked in a week will be used as dependant variable, as this measures the effect on the labor supply. The reasoning behind the use of the hours worked per week is that graduates might want to work more to offset their lower wage, which they might have due to the fact that they graduated during a recession. This is available in the labor supply panel, and is labeled *hours worked*, and measures the average hours worked weekly. Of course a distinction needs to be made based on the contract a worker has. Measuring the dependant variable based on the amount of work in a period is in line with the research from Kahn (2010).

A possible downside of using unemployment as an indicator is that it can be hard to distinguish between the different effects of unemployment. The reason for this is that there might be sector specific unemployment, or different rates of unemployment per ethnic groups. To control for this, interaction effects will be used for this. These are the interaction effects between the unemployment rate at graduation and the gender, and an interaction effect for the unemployment at graduation with the nationality. These suggestions are in line with the research from Kondo (2008)

An alternative measure for the main independent variable will be used as well. Two alternative measures have been selected for this. Both are based upon the growth of the GDP, as the growth of the GDP measures the current state of the economy of the selected year. The first measure uses the percentage of GDP growth (in percentages). Data on this is available in the Central Bureau of Statistics (CBS) database, from the start of 1970. This variable is labeled *GDP*.

The second alternative measure will be a dummy variable for the state of the economy, by combining data on the GDP growth with the unemployment rates. Here, the definition is used that there is a recession when there was a period of either zero or negative economical growth, in combination with a (relative) large unemployment rate. By combining the unemployment rate with the GDP growth, the lagged effect of the effect on the labor market can be taken into account as well. The dummy variable is labeled: *recession*, which has a value of one if there is a recession, and a value of zero if otherwise.<sup>9</sup>

There might also be differences between the types of recessions included in the dataset, such as length or intensity. This is related to the reasoning that it may be worse to graduate when the recession is worse (longer/less GDP growth, more unemployment). To check for this, the dummy of the recession will be linked with the variables for the GDP and the unemployment rate as an interaction term. This interaction term will show how the intensity of the unemployment or GDP rate affects wages. This analysis is done by multiplying the unemployment rate with the dummy and including them as an interaction term. The coefficient from the interaction term will be compared with the coefficients from recession and unemployment rate.

It is possible that the current analysis does not correct for switching, as the measure of experience is based on the starting year of the current job. Therefore alternative measures for experience need to be used. The measure for this will be based on the differences in years between now and the moment the observation started their first job after full time education, as this is the best alternative available question. This variable is labeled *experience (alternative)*. A possible downside of this measure is there might be a relation between the age at graduation and the current age. However, this measure should be more accurate than measure used by Kahn in her research. Kahn (2010) used the differences in years between graduation and 2008 as the so-called potential experience, and did not use the starting date of the first job. The measure used by Kahn will be included in the robustness check as well, to see whether there are differences. This is done by using the difference between the graduation year and 2008, the year the questions have been answered by the panel. (Kahn, 2010) This variable is labeled *experience (Kahn)*.

In theory it is possible that foreign observations graduated outside the Netherlands. To see whether this matters, the regressions will be run over native observations only.

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<sup>9</sup> The data description in the next chapter sets the unemployment rate against the GDP growth and shows what years are labeled as a recession.

The final interesting thing to investigate is what happens when unemployment is used as a dependant variable. With this, the effect of graduating in a recession on the chances of being unemployed later on in your career can be seen. For this, the current state of employment will be used as a dependant variable. In the questionnaire, the employment status of the observation is available, measuring whether the observation is currently working, looking for a job, or not looking for a job. This question is rewritten to a dummy variable, with the value 1 for when the observation is unemployed and looking for a job, and 0 if otherwise. The rest of the model used will stay the same, maintaining the unemployment rate as the main independent variable. Not all control variables can be included in this model, as not everybody is employed. This means that it will not make sense to correct for employment specific variables, such as the sector employed, experience, or the dummy for part time workers. Since the dependant variable is a dummy variable, a logit regression will be used here instead of the regular ordinary least squared used in the other analyses.

### **Differences with other research**

The model of this research is based upon the models from the previous literature and the Mincer equation. Opposite to other research there has no distinction been made for regional unemployment as there are only twelve provinces in the Netherlands, compared to the 50 states in America. Also, where the other papers only focus on college degree graduates, this research used a dummy for the different levels of education on a scale up to the six different levels of education, as there is plenty of data available on this in the questionnaire used.

Furthermore, multiple specifications are used to measure the effects of graduating in a recession. Besides the unemployment, the GDP and a dummy variable for whether the year was a recession have been used. Therefore this research captures a broader view compared to the research written by Kahn, whereas Kahn was able to split her research for region specific effects. (Kahn, 2010)

Comparing this research the research from Oreopoulos, it can be stated that Oreopoulos focused more on the job mobility, and the effects that happen within a firm (Oreopoulos, von Wachter, & Heisz, 2012). This research however is focused on the macroeconomic effects.

In the next section, the data on the variables and models described above is explained in more detail.



## Data description

In this part the data used is discussed. The first part will describe the selection of the data and the changes made to them, the rest of this section will describe how the data looks and what the first conclusions based on that can be.

### The dataset

From the labor supply panel dataset, questions have been used and transformed to variables, as described in the methodology. A summary of the used questions and corresponding numbers in the questionnaire are given in Table 14 in the appendix. All the variables described in the methodology result in the list of variables as stated in Table 15 in the appendix. When all the data is combined in one dataset, it results in a total of 5137 observations. Since there is some data missing from the questionnaire, some corrections to the data have to be made. There is no data on unemployment and GDP growth from before 1970, hence all the observations who graduated before 1970 are dropped. The same holds for the observations for which there is no year of graduation available. These are dropped as well, as it is not possible to say something about the relation between graduation and a recession. This will bias the results if they are not included. Furthermore, observations which are unemployed are not included as their income will bias the data and outcome. This leaves us with in a dataset of 3330 observations in total.

### Observation specific data

With the dataset above, it is possible to give an overview of the observations in the dataset. The first step will zoom in on observation specific characteristics. This covers their age, gender, education, how many hours they are working (part or fulltime), where they are from, how many they are earning per month and per hour, and their age at graduation. The GDP and Unemployment at the year of graduation have also been included here. These are shown in Table 1. It can be seen that the division is quite equal between male and female observations in the dataset, as the average lies around 0.5. The age at the moment the questionnaire has been held (in 2008) lies on average around 41. This means that the average observation is born around 1967. The average age at graduation thus lies around twenty. The largest part of the observations are born in the Netherlands. Of the 3330 observations there are about 95 persons who are born outside the Netherlands. The observations are divided quite evenly between working part- and fulltime.<sup>10</sup>

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<sup>10</sup>If we look at the division between male and female workers we can see that there are more part-time female workers compared to part-time male workers. This can be seen by comparing the average of the dummy for working part-time. The female has an average of 0.783 compared to 0.217 for the male.

Looking at the hours worked we can see that the average observation works around 31 hours a week.<sup>11</sup> The average net wage lies around €1600,- on a monthly average<sup>12</sup>. (CBS, Centraal Bureau Statistiek, 2012) Looking at the educational degree it can be seen that most of the observations lie in category four, which corresponds with a HAVO, VWO, or MBO degree. This is split out later on in more detail. Note that the GDP and Unemployment Rate have 41 observations because it covers one observation per year in the dataset.

Variable	Observations	Average	Standard Deviaton	Median	Minimum	Maximum
Age	3599	40.988	11.999	43.00	16	66
Age graduation	3269	20.243	3.465	20.00	12	42
Educational degree	3596	4.284	0.986	4.00	2	6
Gender	3599	0.499	0.500	0.00	0	1
GDP Growth	41	2.530	1.576	2.70	-1.283	6
Hours Worked	3328	31.778	13.422	36.00	0	90
Nationality	3328	0.028	0.164	0.00	0	1
Net wage Month	3330	1604.129	896.703	1565.21	40	10000
Net wage Hourly	3097	13.663	9.915	12.22	1	230.208
Parttime	3328	0.491	0.500	0.00	0	1
Unemployment	41	4.427	1.778	4.36	1	8.254

**Table 1: Descriptive statistics observations**

The next step will be to zoom in on the link between the unemployment and the wages. This is shown in Figure 1 where the unemployment rate of the graduation year has been set out against the monthly wage. From this it can be seen that there seems to be a lot of wage clustering around the unemployment rate. This is valid since every observation who graduated in the same year has the same unemployment rate. The graph shows that there are very little differences in the unemployment rate when the income of the observation lies below 4000 euro's. The fitted curve tells that the income seems to be higher when the observation graduated in times of high unemployment. This is opposite of what was expected for the wages of people who graduate during a recession (high unemployment).

<sup>11</sup>If we only include full-timers the average hours worked a week are 39.5. For part-timers this lies around 22.4 hours worked.

<sup>12</sup> For full time workers this lies around €2020,-. This is a bit higher than the modal net income per month in 2008, which was €1811, - for full time workers. (CBS Statline, 2012)

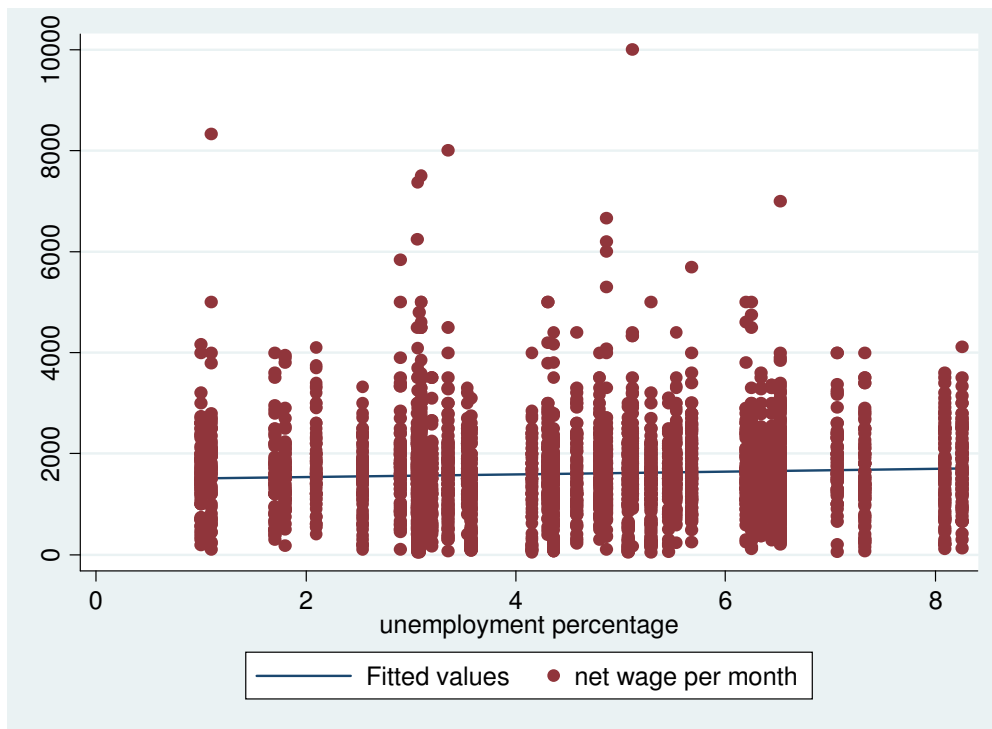


Figure 1: Scatter Plot unemployment vs. net wage

As a comparison, the hourly wage against the unemployment rate have been plotted as well, which is shown in Figure 2. From this the same conclusions can be drawn compared to the net monthly wage. Note that the positive relation between unemployment and wages is less clear in this figure compared to the net wages per month. Furthermore, the highest hourly wages seem to be given around an unemployment percentage of two percent. As a comparison the GDP has been set out against the wages in Figure 3. Here the hypothesis does seem to hold: people who graduate in a recession (negative GDP) seem to have a lower wage compared to people who graduate when there is economical growth, and the wages are higher for a positive GDP. This can be seen by looking at the fitted values in the graph. The difference with the relation from the unemployment rate might be explained by the fact that there could be a lagged effect of unemployment, as explained in the theory. A check has been done for the wages of people who more than twenty hours a week, which is shown in Figure 8 in the appendix. The same conclusions hold compared to Figure 3, and the highest wages seem to lie around a GDP growth percentage of two to four percent.

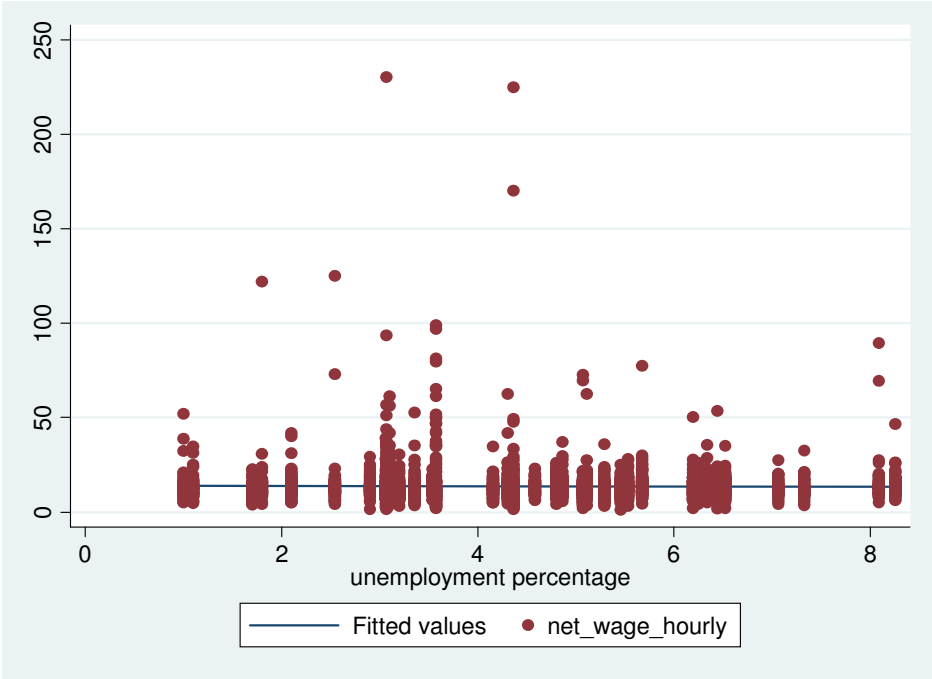


Figure 2: Hourly wage vs. Unemployment

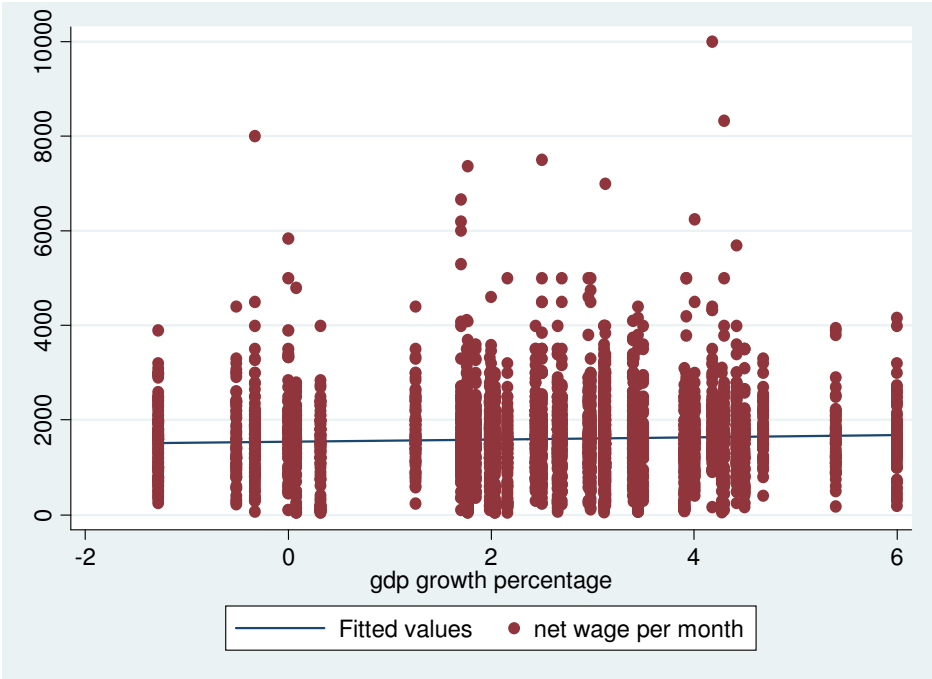


Figure 3: Scatter Plot GDP vs. Wages

The next step is to look at the differences in wages amongst the different educational degrees. In Table 2 the average wages have been set out for the different educational degrees on a scale of one to six. As can be seen from the table, there are no observations in the dataset that only have a preschool degree. Similar to the conclusions from the summary statistics, most people have a HAVO, VWO, or a MBO degree in the dataset. As expected, the highest wages are earned by the highest educational degree, the WO. (university degree) The average hourly wage have been included as well, and is shown in Table 3. It can be concluded that hourly wages are increasing with the educational degree. From both these tables it is concluded that there are differences in wages, ranked by the educational degree.

SOI Code	Degree	Observations	Average Net Monthly Wage	Standard deviation
1	preschool	0	n.a.	n.a.
2	lower school	78	562.838	653.023
3	Vmbo Mavo	592	1277.531	746.491
4	MBO HAVO VWO	1305	1379.747	722.570
5	HBO	933	1870.210	914.932
6	WO	419	2368.137	1081.920

Table 2: Monthly Wage per degree

SOI Code	Degree	Observations	Average Net Hourly Wage	Standard deviation
1	preschool	0	n.a.	n.a.
2	lower school	78	9.556	6.225
3	Vmbo Mavo	592	11.542	8.324
4	MBO HAVO VWO	1305	12.441	6.980
5	HBO	933	14.402	6.144
6	WO	419	18.957	3.241

Table 3: Hourly Wage per degree

Another important factor is the experience. In Figure 4 the experience has been plotted versus the net wage per month. From this it can be seen that more experience will result in a higher wage. However it does not mean per se that the highest wages are earned by people with the most experience. There are some observations with little experience which earn one of the highest wages. As a check the measure for experience used by Kahn is plotted as well, which is shown in Figure 7 in the appendix. In this figure there is a slightly smoother distribution, but the relation between experience and wages remains the same. The experience versus the hourly wage of people working more than twenty hours a week has also been checked. This is shown in Figure 8 in the appendix, where the same measure for experience has been used as in Figure 4. The same relation seems to hold, but the observations are closer to the fitted values.

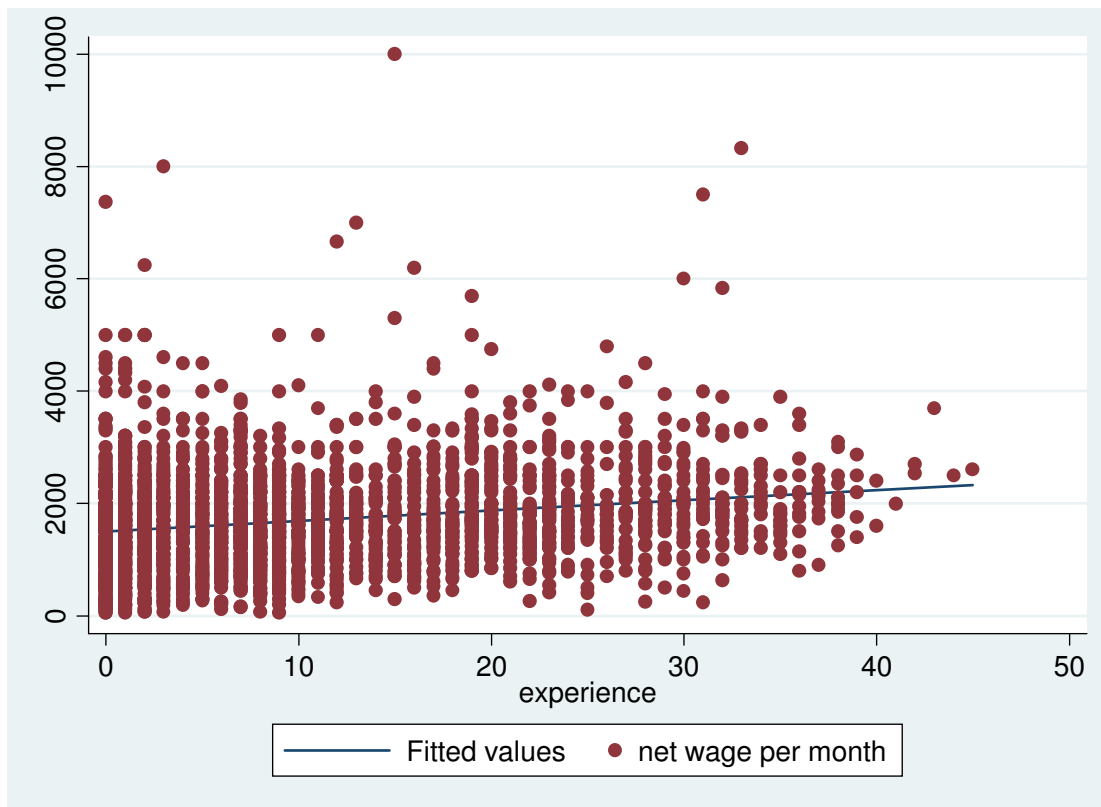


Figure 4: Scatter Plot Experience vs. Wage

## Macro economical data

Finally, it is also important to know when there was a recession. As explained in the methodology, this will be based on data on the unemployment rate and the GDP growth, collected from the Central Bureau of Statistics database in the Netherlands, also known as Statline. The unemployment rates and the GDP growth have been set out over time, to see where the unemployment is the largest or the GDP growth the lowest. This is shown in Figure 5.

The first curve of interest in the figure is the unemployment rate. As can be seen, the unemployment rate has three spikes, at the years 1983, 1994, and 2005. Interesting to note here is that the unemployment has been rising from 1970 until 1983. These findings will need to be combined with the GDP curve to be able to say something about whether the Netherlands were actually in a recession in those years. The second curve is thus the GDP growth over time. If there is a drop or a negative GDP growth, there might be a recession. As can be seen in Figure 5, there are four major drops. These are around the years 1975, 1982, 2002, and 2009. There are no long periods of negative GDP growth.

The final step of Figure 5 is to combine the findings on the curves. If the GDP growth is low, the unemployment rate should be high, and the year could be labeled as a recession. The figure clearly shows the lagged effect of a recession on the labor market, as reflected in the GDP growth. This means that it is important to take years around the actual graduation into account. The years of interests are the years 1983-1985, 1992-1996, and 2002-2006. In these years the unemployment rate is high and the GDP growth low or negative. This means that these three periods could be labeled as a recession. Next to this we also have the period after 1975 where the GDP growth is zero and the unemployment keeps rising. To avoid the using of large periods, the data is split for the single years of 1975 and 1977, and the period of 1980-1984. This means that a dummy has been created if the year of graduation lies in the range of the years 1975, 1977, 1980-1984 1992-1996, or 2002-2006.

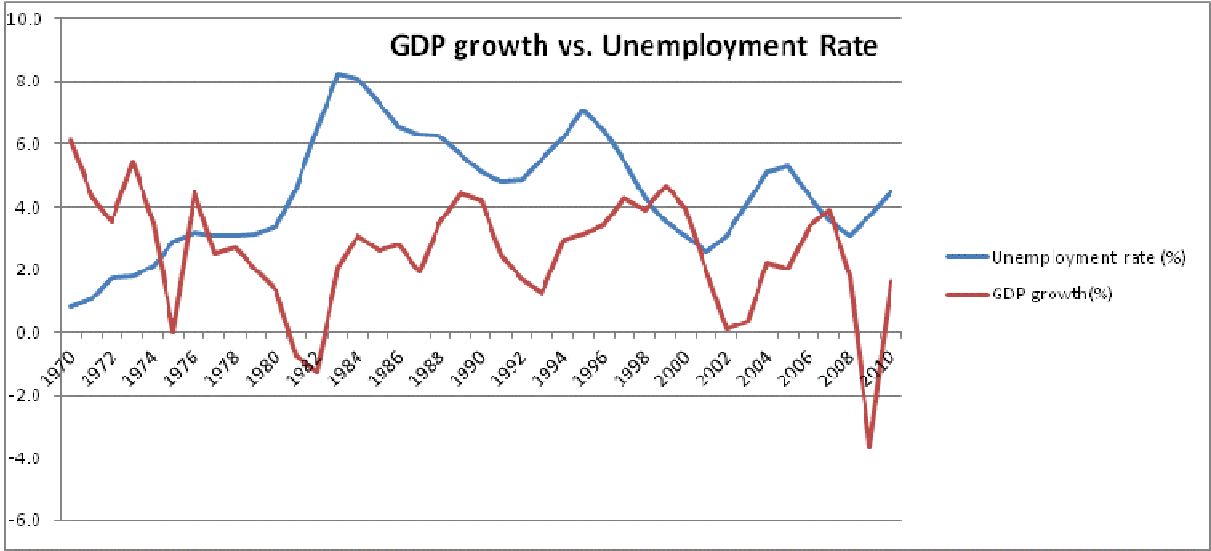


Figure 5: GDP growth vs. Unemployment rate

This section has described what the data looks like. The important conclusion drawn from this is that there is an indication of a recession in the years of 1975-1985, 1992-1996, and 2002-2006. There are also indications that there will not be proof of the hypothesis when unemployment is used as a measure for a recession. The results for the GDP growth do seem to support the hypothesis. But no relation or actual conclusions can be drawn from this section yet. An actual regression analysis needs to be used, which will be done in the next section where the results are discussed.

## Discussion of results

In this part the results of the regression analysis will be discussed. The first part deals with the main model, whereas the second part will deal with extensions and robustness checks on the model. The last section briefly summarizes the findings of our analysis. This section discusses the results of the main model and how it should be specified. The first part will focus on the main model, which helps to answer the first hypothesis. The interaction effects with unemployment is also discussed in this section, as it helps to answer the second hypothesis.

### Analysis of the main model

The main relation of interest is between unemployment and the wages. The results for this main model can be found in Table 4. The regressions are on a log-level base, as the wage is in logarithms, but the rest of the variables are absolute numbers. As stated before, only observations which are currently working are included. Coefficients with standard errors in parentheses are reported, with the corresponding significance marked by the asterisks. The first column in Table 4 shows the regression without any control variables, the plain relation between the net wages and the unemployment rate at graduation. From this it can be concluded that there is a statistical significant positive relation at a 1% significance level. This means that an increase in the unemployment rate at the graduation year results in a higher wage.

Of course the model needs to be expanded with control variables to see whether this holds and to reduce the noise in the model. The results for the main model are shown in the second column of Table 4. The main conclusion that can be drawn from this model is that the relation between the unemployment and the wages disappears, as the coefficient is only +0.001, which can be neglected. However, the variable for unemployment is not significant in this specification. This means that there is no evidence for a relation between unemployment and wages, and the first hypothesis cannot be confirmed based on this model.

The effect of the control variables of the model are also of interest. There is a statistically significant positive relation between the wages and experience, the gender, the age at graduation, and the highest educational degree received, all at a 1% significance level. This means that the net monthly wage will be higher when there is an increase in experience, *ceteris paribus*. The dummy for gender tells that the net monthly wage is higher for male workers compared to female workers. From the age at graduation it can be concluded that an increase in the age at graduation increases the net wage, *ceteris paribus*. This means that it helps to be older when you graduate. This might be until a certain age when the age at graduation is too high. This age barrier is not of interest for this research.



The highest educational degree received tells that the wages are higher when the observation has a higher educational degree, compared to people who have only finished the lower school. This effect seems to be increasing with the educational degree received, as the coefficients keeps rising with the degree, and is thus the strongest for people with a university degree. There is a negative relation found between part time workers and wages, which implies that the net monthly wages are higher for full time workers. Of course all these relations are ceteris paribus. There is also no significant relation found for the dummy for foreign workers, nor for the sector employed. All the dummies for the sectors employed are not significant and are therefore not reported in the table. The relations found for the control variables are thus in line with what was expected based upon the theory.

	<b>Dependent Variable =&gt;</b>	<i>Log(net monthly wage)</i>	<i>Log(net monthly wage)</i>
<b>Independent Variable</b>			
<i>Constant</i>	Coefficient	7.033***	6.564***
	(standard deviation)	(0.036)	(0.114)
<i>Unemployment</i>	Coefficient	0.031***	0.001
	(standard deviation)	(0.007)	(0.004)
<i>Experience</i>	Coefficient	xxx	0.009***
	(standard deviation)	xxx	(0.001)
<i>Male?</i>	Coefficient	xxx	0.172***
	(standard deviation)	xxx	(0.020)
<i>Foreign?</i>	Coefficient	xxx	-0.026
	(standard deviation)	xxx	(0.044)
<i>Age at Graduation</i>	Coefficient	xxx	0.003***
	(standard deviation)	xxx	(0.001)
<i>Parttime?</i>	Coefficient	xxx	-0.435
	(standard deviation)	xxx	(0.020)
Highest Educational Degree			
<i>level = 3 (VMBO/LBO/MAVO)</i>	Coefficient	xxx	0.388***
	(standard deviation)	xxx	(0.075)
<i>level = 4 (MBO/Havo/Vwo)</i>	Coefficient	xxx	0.538***
	(standard deviation)	xxx	(0.074)
<i>level = 5 (HBO)</i>	Coefficient	xxx	0.779***
	(standard deviation)	xxx	(0.075)
<i>level = 6 (WO)</i>	Coefficient	xxx	0.977***
	(standard deviation)	xxx	(0.077)
<i>Sector dummies included?</i>		No	Yes
Regression Method:		Ordinary Least Squares	Ordinary Least Squares
Total observations:		3330	2824
<b>R-squared</b>		0.005	0.500
<b>Adjusted R-squared</b>		0.005	0.496
* = significant at a 10% level			
** = significant at a 5% level			
*** = significant at a 1% level			

Table 4: Main Model Regressions

To see whether this model is correctly specified or has room for improvement, the residuals are investigated. From the regression of the model in the second row of Table 4 (the main model), the residuals have been created and scattered against the fitted values to see whether the model might be faulty specified. This scatter plot is shown in Figure 9 in the appendix. From this it can be seen that the residuals are located around the zero value of the y axis, but there is a downward area in the bottom left corner. Since most of the residuals are concentrated around zero, these few observations should not be problematic. Looking at the histogram of the residuals in Figure 10 in the appendix tells us that the residuals are close to a normal distribution. It might be possible that different results will be found when the specification of variables is changed, for example by using logarithms. However, this will not make very much sense as there are no other large tails in the variables. The unemployment rate ranges between zero and ten, and the age at graduation between 12 and 60. The wages have a much larger scale, with maximum wages around €4000 - €5000, which made sense to reduce with the use of logarithms as was described in the theory and methodology.

### **Analysis of the interaction effects**

The next part will look at the second hypothesis to investigate whether the results differs with experience or the educational degree received through the use of interaction terms. These interactions effect are shown in Table 5. The first column shows the main model as a reference. The second column shows the interaction effect for unemployment with experience. The interaction term shows a negative relation, but it is not significant in this specification. The rest of the significances and relations of the variables does not differ with the main model. In the fourth column both interaction terms are shown. In this model there is a statistically significant relation at a 10% significance level. This means that an increase in experience will make the interaction term even more negative, implying a larger negative wage effect.

It can thus be concluded that the effect of unemployment is stronger for graduates with more experience. Intuitively this makes sense, as graduates with more experience might need to give up a larger part of their wage relative to graduates with less experience when the unemployment rate is higher when they (need to) find a new job. However, one should be careful in applying this finding, as the coefficients are close and not significant in both specifications.

The third column shows the main model with the interaction effect for the educational degree. The interaction effect is significant in this specification at a 1% significance level, and shows a positive relation with the wages. Unemployment itself has a significant negative relation at a 1% significance level. For the interaction term it can thus be stated that it is beneficial to have a higher educational degree, because the negative wage effect of unemployment should be felt only for people with a lower education. When the educational degree is five or higher (HBO or WO), the positive coefficients for the educational degree are higher than the negative coefficient of unemployment.<sup>13</sup> This means that the negative relation between the unemployment rate at graduation and the wages are only negative for graduates who do not have a HBO or WO degree, according to this specification.

This means that for the second hypothesis it can be stated that the effects are negative for graduates without an HBO or WO degree. In the fourth column the interaction effect with experience is also included, and in that case it can be stated that the negative relation between unemployment and wages are only for people who do not have a HBO, HBO, or WO degree.<sup>14</sup> This is thus a slight change compared to the third column, but the main conclusion remains that a negative wage effect is not present for every educational degree.

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<sup>13</sup> Interaction effect has coefficient of 0.015;  $0.015 * 4 = 0.06$ ; smaller than the 0.064 of unemployment, meaning that there still is a negative effect. If the degree = 5;  $0.015 * 5 = 0.075$  which is larger than 0.064, meaning that it has outweighed the negative effect.

<sup>14</sup> Interaction effect has coefficient of 0.015;  $0.015 * 4 = 0.060$ , larger than the 0.056 of the unemployment.

	Dependent Variable =>	Log(net monthly wage)	Log(net monthly wage)	Log(net monthly wage)	Log(net monthly wage)
<b>Independent Variable</b>					
<i>Constant</i>	Coefficient	6.564***	6.636***	6.708***	6.675***
	(standard deviation)	(0.114)	(0.115)	(0.121)	(0.122)
<i>Unemployment</i>	Coefficient	0.001	0.008	-0.064***	-0.056***
	(standard deviation)	(0.004)	(0.006)	(0.019)	(0.020)
<i>Experience</i>	Coefficient	0.009***	0.012***	0.009***	0.012***
	(standard deviation)	(0.001)	(0.002)	(0.001)	(0.002)
<i>Unemployment * Experience</i>	Coefficient	xxx	-0.001	xxx	-0.001*
	(standard deviation)	xxx	(0.000)	xxx	(0.000)
<i>Unemployment * Educational Degree</i>	Coefficient	xxx	xxx	0.015***	0.015***
	(standard deviation)	xxx	xxx	(0.040)	(0.004)
<i>Male?</i>	Coefficient	0.172***	0.172***	0.171***	0.170***
	(standard deviation)	(0.020)	(0.020)	(0.020)	(0.020)
<i>Foreign?</i>	Coefficient	-0.026	-0.027	-0.022	-0.023
	(standard deviation)	(0.044)	(0.044)	(0.044)	(0.044)
<i>Age at Graduation</i>	Coefficient	0.003***	0.003***	0.003***	0.003***
	(standard deviation)	(0.001)	(0.001)	(0.001)	(0.001)
<i>Parttime?</i>	Coefficient	-0.435	-0.435***	-0.437***	-0.438***
	(standard deviation)	(0.020)	(0.020)	(0.020)	(0.020)
Highest Educational Degree					
<i>level = 3 (VMBO/LBO/MAVO)</i>	Coefficient	0.388***	0.384***	0.319***	0.315***
	(standard deviation)	(0.075)	(0.075)	(0.077)	(0.077)
<i>level = 4 (MBO/Havo/Vwo)</i>	Coefficient	0.538***	0.535***	0.409***	0.404***
	(standard deviation)	(0.074)	(0.074)	(0.083)	(0.083)
<i>level = 5 (HBO)</i>	Coefficient	0.779***	0.777***	0.578***	0.573**
	(standard deviation)	(0.075)	(0.075)	(0.095)	(0.095)
<i>level = 6 (WO)</i>	Coefficient	0.977***	0.974***	0.702***	0.696***
	(standard deviation)	(0.077)	(0.077)	(0.111)	(0.111)
<i>Sector dummies included?</i>		Yes	Yes	Yes	Yes
Regression Method:		Ordinary Least Squares	Ordinary Least Squares	Ordinary Least Squares	Ordinary Least Squares
Total observations:		2824	2824	2824	2824
<b>R-squared</b>		0.500	0.500	0.502	0.502
<b>Adjusted R-squared</b>		0.496	0.496	0.498	0.498
* = significant at a 10% level					
** = significant at a 5% level					
*** = significant at a 1% level					

Table 5: Interaction effects for main model

From Table 5, no clear conclusions could be drawn on the differences in educational degree. Therefore the regression will be split out in more detail by running separate regressions per education degree. This means that only observations with the corresponding educational level are included in each model. This means that it is no longer possible to include the interaction term between the educational degree and the unemployment, as there is only one category present for the educational degree. This is not a problem, as the differences in the coefficients of unemployment amongst the different models should give the different effects for education. The interaction term between experience and unemployment can and will be included here. The results for this are shown in Table 6 where the first column shows the model where no distinction has been made for the educational degree. The other columns show the different outcomes for the different types of education. The second column shows the model for graduates with only a middle school degree, Since there are only 30 observations here, the results from this regression are not valid nor of interest. The other models do have enough observations.

Looking at the differences across the models in the columns three to six, it can be seen that the variable of unemployment is significant and negative for graduates with a VMBO degree. Graduates with only a VMBO degree thus suffer from the negative wage effects. For the MBO, HBO, and WO degrees, the unemployment is positive, but only significant for the MBO degree. This means that graduates with a MBO degree only might thus actually benefit from a higher unemployment rate. An explanation for this might be that MBO-level jobs are needed more than HBO or WO jobs in a recession. From the table it can thus be concluded that there are clear differences in the effect of a recession on the wages between the types of graduates, but that it is not always a significant/causal relation. The negative effects of graduating in a recession do not seem to exist for MBO/HBO/WO graduates, but do exist for everything below these categories.

Finally, looking at the interaction term of experience across the models it can be seen that the coefficient is close to zero for all degrees. This means that an increase in experience will have a small effect on the wages of graduates in a recession regardless of the education level. Experience itself does seem to have a positive effect on the wages of the graduates for all the categories. The difference in the size of the coefficient of experience between the different education levels is small. As stated before the effect of experience was found to be cancelled out when it is linked with the state of the economy.

	<b>Dependent Variable =&gt;</b>	<i>Log(net monthly wage)</i>	<i>Log(net monthly wage)</i>	<i>Log(net monthly wage)</i>
<b>Independent Variable</b>		Main Model	Middle school	VMBO/LBO/MAVO
<i>Constant</i>	Coefficient	6.902***	9.079***	7.249***
	(standard deviation)	(0.097)	(1.653)	(0.198)
<i>Unemployment</i>	Coefficient	0.014**	-0.400*	-0.037***
	(standard deviation)	(0.002)	(0.216)	(0.014)
<i>Experience</i>	Coefficient	0.010***	-0.069	0.010***
	(standard deviation)	(0.002)	(0.067)	(0.004)
<i>Unemployment * Experience</i>	Coefficient	0.000	0.040*	0.001
	(standard deviation)	(0.000)	(0.020)	(0.001)
<i>Male?</i>	Coefficient	0.175***	-0.191	0.172***
	(standard deviation)	(0.022)	(0.517)	(0.066)
<i>Foreign?</i>	Coefficient	-0.014	-0.434	-0.054
	(standard deviation)	(0.047)	(0.663)	(0.143)
<i>Age at Graduation</i>	Coefficient	0.011***	-0.010	0.007**
	(standard deviation)	(0.001)	(0.024)	(0.003)
<i>Parttime?</i>	Coefficient	-0.445***	-0.883	-0.538***
	(standard deviation)	(0.021)	(0.606)	(0.063)
<i>Sector dummies included?</i>		Yes	Yes	Yes
Regression Method:		Ordinary Least Squares	Ordinary Least Squares	Ordinary Least Squares
Total observations:		2827	30	494
<b>R-squared</b>		0.410	0.583	0.499
<b>Adjusted R-squared</b>		0.407	0.193	0.482
* = significant at a 10% level				
** = significant at a 5 % level				
*** = significant a a 1% level				

Independent Variable	Dependent Variable =>	Log(net monthly wage)		
		MBO/Havo/Vwo	HBO	WO
<i>Constant</i>	Coefficient	6.991***	6.412***	7.923***
	(standard deviation)	(0.128)	(0.253)	(0.286)
<i>Unemployment</i>	Coefficient	0.027***	0.017	0.008
	(standard deviation)	(0.010)	(0.011)	(0.019)
<i>Experience</i>	Coefficient	0.017***	0.005	0.010*
	(standard deviation)	(0.003)	(0.003)	(0.006)
<i>Unemployment * Experience</i>	Coefficient	-0.001**	0.000	0.000
	(standard deviation)	(0.001)	(0.001)	(0.001)
<i>Male?</i>	Coefficient	0.160***	0.149***	0.201***
	(standard deviation)	(0.033)	(0.032)	(0.047)
<i>Foreign?</i>	Coefficient	0.017	0.021	-0.262**
	(standard deviation)	(0.073)	(0.066)	(0.105)
<i>Age at Graduation</i>	Coefficient	0.004***	0.002*	-0.006*
	(standard deviation)	(0.002)	(0.001)	(0.003)
<i>Parttime?</i>	Coefficient	-0.524***	-0.327***	-0.300***
	(standard deviation)	(0.032)	(0.031)	(0.045)
<i>Sector dummies included?</i>		Yes	Yes	Yes
Regression Method:		Ordinary Least Squares	Ordinary Least Squares	Ordinary Least Squares
Total observations:		1113	832	355
<b>R-squared</b>		0.453	0.400	0.364
<b>Adjusted R-squared</b>		0.445	0.388	0.334
* = significant at a 10% level				
** = significant at a 5% level				
*** = significant at a 1% level				

Table 6: Interaction effect split for educational degrees

This first part thus tells us that there is a positive relation between unemployment and wages in a log-level relation, which is not significant in the main model. The control variables are found to be in line with the expectations. The fact that there is no relation for the unemployment rate means that the first hypothesis can be rejected for the main model. Furthermore it was found that the effect of graduating in a recession is only negative for the low-educated people. Experiences does not decrease the effect of graduating in a recession on wages. With respect to the second hypothesis it is found that there are different wage effects depending on education and experience, which are negative for experience, and negative for people with a low education. Looking at this in more detail showed that there is no significant effect for graduates with a MBO or higher degree. This shows that there is evidence of a relation, but that this is still very ambiguous. These findings will be extended with expansions and robustness checks below in the hope to find definitive proof.

### **Expansions on the model**

This section deals with checks and expansions on the model. The first check will be on what happens when a comparable alternative dependent variable is used instead of the net monthly wage. If the hours worked are higher for graduates in a recession this could be evidence that they try to work more to offset their lower wage. This means that the hours worked will be used as a dependant variable. The regressions for this are done in the same way as with the other models, and shown in Table 7. The first two columns represent the restricted model and the unrestricted model. The relation between unemployment and the hours worked is positive and significant at a 1% significance level in the restricted model. When this is expanded to the main model in the second column it can be seen that the positive relation remains, but it is no longer a significant relation. For the control variables, the relations remain the same as when the net wage is used as a dependent variable. The main model results might be slightly biased due to the part time workers, who will always work less than full timers. Therefore the third column shows the model with hours worked as a dependant variable when only full time workers are included. Here a signification positive relation between the hours worked and the unemployment rate is found at a 5% significance level. This means that people who graduated during a high unemployment rates will work on average more hours a week nowadays. For the level of education it can be stated that high educated people (HBO or WO) work more hours a week compared to people with a lower degree.

From these three specifications it can thus be concluded that there could be a positive relation between unemployment rate and the hours worked. This is in line with the expectations: graduates need to work more hours a week when the economy at graduation was bad because they earn less and consumption goods might become more expensive. This thus gives proof to the first hypothesis.



Independent Variable	Dependent Variable =>	Hours Worked	Hours Worked	Hours Worked
			Everybody	Full timers only
Constant	Coefficient	29.924***	28.661***	32.227***
	(standard deviation)	(0.634)	(2.535)	(3.129)
Unemployment	Coefficient	0.407***	0.104	0.257**
	(standard deviation)	(0.130)	(0.092)	(0.122)
Experience	Coefficient	xxx	0.056***	0.061***
	(standard deviation)	xxx	(0.017)	(0.022)
Male?	Coefficient	xxx	5.355***	4.811***
	(standard deviation)	xxx	(0.000)	(0.563)
Foreign?	Coefficient	xxx	0.001	-1.731
	(standard deviation)	xxx	(0.958)	(1.233)
Age at Graduation	Coefficient	xxx	0.0475**	0.016
	(standard deviation)	xxx	(0.021)	(0.029)
Parttime?	Coefficient	xxx	-11.119***	xxx
	(standard deviation)	xxx	(0.429)	xxx
Highest Educational Degree				
level = 3 (VMBO/LBO/MAVO)	Coefficient	xxx	3.437**	2.877
	(standard deviation)	xxx	(1.721)	(2.121)
level = 4 (MBO/Havo/Vwo)	Coefficient	xxx	3.843**	2.981
	(standard deviation)	xxx	(1.700)	(1.555)
level = 5 (HBO)	Coefficient	xxx	6.096***	4.080*
	(standard deviation)	xxx	(1.727)	(2.133)
level = 6 (WO)	Coefficient	xxx	7.841***	5.519**
	(standard deviation)	xxx	(1.766)	(2.180)
Sector dummies included?		No	Yes	Yes
Regression Method:		Ordinary Least Squares	Ordinary Least Squares	Ordinary Least Squares
Total observations:		3328	2823	1586
R-squared		0.003	0.484	0.121
Adjusted R-squared		0.003	0.480	0.110
* = significant at a 10% level				
** = significant at a 5 % level				
*** = significant at a 1% level				

Table 7: Hours worked as dependant variable

The next check deals with the inclusion of interaction terms for gender and nationality. The results for these are shown in Table 8. The first column shows the main model from the initial analysis. The second column shows the model with the interaction effect for the unemployment and nationality. This is not a significant relation, which means that we cannot make a differentiation for the effect between foreign and native workers. The third column shows the interaction effect between unemployment and the gender. As can be seen there is a positive relation between the interaction effects and the wages. The variable for unemployment is negative but not significant. Based on the interaction effects we can state that when the unemployment rate is high, male workers will earn more wages. As depicted in the theory, this could be caused by female workers becoming a stay at home-mother, or starting to work part-time. This means that the effect of graduating in a recession is weaker for male workers, and stronger for mothers.

	Dependent Variable =>	Log(net monthly wage)	Log(net monthly wage)	Log(net monthly wage)
<b>Independent Variable</b>				
<i>Constant</i>	Coefficient	6.564***	6.565***	6.601***
	(standard deviation)	(0.114)	(0.114)	(0.115)
<i>Unemployment</i>	Coefficient	0.001	0.000	-0.008
	(standard deviation)	(0.004)	(0.004)	(0.006)
<i>Experience</i>	Coefficient	0.009***	0.009***	0.009***
	(standard deviation)	(0.001)	(0.001)	(0.001)
<i>Male?</i>	Coefficient	0.172***	0.172***	0.099**
	(standard deviation)	(0.020)	(0.020)	(0.042)
<i>Foreign?</i>	Coefficient	-0.026	-0.058	-0.028
	(standard deviation)	(0.044)	(0.118)	(0.044)
<i>Unemployment * Foreign?</i>	Coefficient	xxx	0.008	xxx
	(standard deviation)	xxx	(0.026)	xxx
<i>Unemployment * Male?</i>	Coefficient	xxx	xxx	0.016**
	(standard deviation)	xxx	xxx	(0.008)
<i>Age at Graduation</i>	Coefficient	0.003***	0.003***	0.003***
	(standard deviation)	(0.001)	(0.001)	(0.001)
<i>Parttime?</i>	Coefficient	-0.435	-0.435***	-0.432***
	(standard deviation)	(0.020)	(0.020)	(0.020)
Highest Educational Degree				
<i>level = 3 (VMBO/LBO/MAVO)</i>	Coefficient	0.388***	0.387***	0.386***
	(standard deviation)	(0.075)	(0.075)	(0.075)
<i>level = 4 (MBO/Havo/Vwo)</i>	Coefficient	0.538***	0.538***	0.537***
	(standard deviation)	(0.074)	(0.074)	(0.074)
<i>level = 5 (HBO)</i>	Coefficient	0.779***	0.779***	0.777***
	(standard deviation)	(0.075)	(0.075)	(0.075)
<i>level = 6 (WO)</i>	Coefficient	0.977***	0.977***	0.976***
	(standard deviation)	(0.077)	(0.077)	(0.078)
<i>Sector dummies included?</i>		Yes	Yes	Yes
Regression Method:		Ordinary Least Squares	Ordinary Least Squares	Ordinary Least Squares
Total observations:		2824	2824	2824
<b>R-squared</b>		0.500	0.500	0.500
<b>Adjusted R-squared</b>		0.496	0.496	0.497
* = significant at a 10% level				
** = significant at a 5 % level				
*** = significant at a 1% level				

Table 8: Interaction effects nationality and gender

Interesting will be to see what happens when another measure for the unemployment is used, as the significance of unemployment differs over the models used. This is thus the next robustness check, where GDP growth will be used. A positive relation is expected here as more GDP growth should result in higher wages. Table 9 shows the results for this regression. The unrestricted model in the first column shows a significant positive relation at a one percent significance level between the GDP growth rate and the net wage, which is in line with the predictions. When the model is expanded with the control variables as shown in the second column of Table 9, it can be seen that the positive relation between GDP growth and the net wage holds at a ten percent significance level. This means that it can be confirmed that a higher (or lower) gdp growth at graduation results in a higher (or lower) net monthly wage later on in your life. The use of GDP thus gives further evidence for the fact that the first hypothesis is actually true. The control variables are all significant here, again with the exception for the dummies for the nationality and the sector employed. The relations between the control variables and the dependent variable are the same compared to the ones found in the main model.

As a check for the secondary hypothesis, the interaction terms with GDP instead of unemployment have been included. These relations are not significant, regardless whether either one or both of the interaction variables are included. It is also analyzed when the model is distinguished between low-educated and high-educated graduates, in the same way as done with the main model in

Table 6. Again there is no significant relation found for the variables of interest, which further confirms the earlier findings. The findings for these interaction terms are therefore not reported.

The use of GDP thus gives evidence proving hypothesis one. As hypothesis one is also found to be true under the use of hours worked as a dependant variable, it becomes more likely that there should be negative wage effects for graduates who graduated during a recession. The use of GDP does not clarify the findings on hypothesis two, but does strengthens the finding that the negative wage effects do not exist for high educated graduates.

	Dependent Variable =>	Log(net monthly wage)	Log(net monthly wage)
<b>Independent Variable</b>			
<i>Constant</i>	Coefficient	7.097***	6.545***
	(standard deviation)	(0.025)	(0.113)
<i>GDP</i>	Coefficient	0.029***	0.008*
	(standard deviation)	(0.008)	(0.005)
<i>Experience</i>	Coefficient	xxx	0.009***
	(standard deviation)	xxx	(0.001)
<i>Male?</i>	Coefficient	xxx	0.173***
	(standard deviation)	xxx	(0.020)
<i>Foreign?</i>	Coefficient	xxx	-0.026
	(standard deviation)	xxx	(0.044)
<i>Age at Graduation</i>	Coefficient	xxx	0.003***
	(standard deviation)	xxx	(0.001)
<i>Parttime?</i>	Coefficient	xxx	-0.4347***
	(standard deviation)	xxx	(0.020)
Highest Educational Degree			
<i>level = 3 (VMBO/LBO/MAVO)</i>	Coefficient	xxx	0.385***
	(standard deviation)	xxx	(0.075)
<i>level = 4 (MBO/Havo/Vwo)</i>	Coefficient	xxx	0.537***
	(standard deviation)	xxx	(0.074)
<i>level = 5 (HBO)</i>	Coefficient	xxx	0.777***
	(standard deviation)	xxx	(0.075)
<i>level = 6 (WO)</i>	Coefficient	xxx	0.974***
	(standard deviation)	xxx	(0.077)
<i>Sector dummies included?</i>		No	Yes
Regression Method:		Ordinary Least Squares	Ordinary Least Squares
Total observations:		3330	2824
<b>R-squared</b>		0.004	0.500
<b>Adjusted R-squared</b>		0.003	0.497
* = significant at a 10% level			
** = significant at a 5 % level			
*** = significant at a 1% level			

**Table 9: Regression with GDP instead of Unemployment**

The next replacement for the main independent variable is the dummy for the recession as a measure for the state of the economy. The GDP rate and the unemployment rate are also included as a variable as the recession dummy is based upon the combination of data on unemployment and the gdp growth<sup>15</sup>. The results for this recession are shown in Table 10. The first column shows the main model as a reference. The second column shows the main model with unemployment as main independent variable and a dummy variable for whether the year was defined as a recession. In this specification the unemployment and the dummy are not significant. This implies that the first hypothesis is not true. The control variables have the same relations and significances as in the main model.

<sup>15</sup> The correlation between these variables: GDP<->Recession: -0.550 ; GDP<->Unemployment -0.162; Unemployment<->Recession: 0.345. No multicollinearity should be present and the inclusion of these variables should be statistically valid.

The third column shows the model with GDP instead of the unemployment rate and the dummy for a recession included. It can be seen that there is a significant positive relation between the dummy for a recession and the wages at a 1% significance level. This means that when the year in which the observation graduated was a recession year, his or her net monthly wage nowadays is higher than people who did not graduate in a recession. Interesting is the coefficient for the dummy, as this tells us that that on average the monthly wages are 3.5% lower for people who graduates during a recession compared to those who did not, *ceteris paribus*.

From this robustness check it can thus be concluded that for the GDP a positive relation (not always significant) has been found, implying that a higher GDP rate at graduation implies that the net wage will be higher. For the dummy of a recession, a positive relation is found as well, implying that the net wage will be higher during a recession. These two effects thus offset each other: if there is a recession, the GDP should be lower, and it is found that the wages will be higher. However in this model it is found that when GDP increases, the wages will be higher as well, implying that the wages always seem to increase, either based on the GDP or on the recession dummy. To see whether an effect dominates, the use of an interaction term between the dummy and the measures for the recession is needed.

It has also been tried to include the interaction terms for education and experience in these models. These are not significant for the combination of GDP and the interaction terms, and are therefore not reported. For the model with the recession dummy and the unemployment rate, the interaction term for schooling is significant, but split out for low-educated and high-educated no differences are found. This is similar to the main findings, and therefore not reported as it does not seem relevant.

	Dependent Variable =>	Log(net monthly wage)	Log(net monthly wage)	Log(net monthly wage)
<b>Independent Variable</b>				
Constant	Coefficient	6.564***	6.562***	6.545***
	(standard deviation)	(0.114)	(0.114)	(0.113)
Recession?	Coefficient	xxx	0.009	0.036*
	(standard deviation)	xxx	(0.016)	(0.019)
Unemployment	Coefficient	0.001	0.000	xxx
	(standard deviation)	(0.004)	(0.004)	xxx
GDP	Coefficient	xxx	xxx	0.015**
	(standard deviation)	xxx	xxx	(0.006)
Experience	Coefficient	0.009***	0.009***	0.009***
	(standard deviation)	(0.001)	(0.001)	(0.001)
Male?	Coefficient	0.172***	0.173***	0.174***
	(standard deviation)	(0.020)	(0.020)	(0.020)
Foreign?	Coefficient	-0.026	-0.025	-0.023
	(standard deviation)	(0.044)	(0.043)	(0.044)
Age at Graduation	Coefficient	0.003***	0.003***	0.003***
	(standard deviation)	(0.001)	(0.001)	(0.001)
Parttime?	Coefficient	-0.435	-0.434***	-0.433***
	(standard deviation)	(0.020)	(0.020)	(0.020)
Highest Educational Degree				
level = 3 (VMBO/LBO/MAVO)	Coefficient	0.388***	0.390***	0.390***
	(standard deviation)	(0.075)	(0.075)	(0.075)
level = 4 (MBO/Havo/Vwo)	Coefficient	0.538****	0.540***	0.541***
	(standard deviation)	(0.074)	(0.074)	(0.074)
level = 5 (HBO)	Coefficient	0.779***	0.781***	0.781***
	(standard deviation)	(0.075)	(0.076)	(0.075)
level = 6 (WO)	Coefficient	0.977***	0.979***	0.978***
	(standard deviation)	(0.077)	(0.078)	(0.077)
Sector dummies included?		Yes	Yes	Yes
Regression Method:		Ordinary Least Squares	Ordinary Least Squares	Ordinary Least Squares
Total observations:		2824	2824	2824
<b>R-squared</b>		0.500	0.500	0.501
<b>Adjusted R-squared</b>		0.496	0.496	0.497
* = significant at a 10% level				
** = significant at a 5 % level				
*** = significant at a 1% level				

Table 10: Regression with recession dummies

As mentioned above, an interaction term between the dummy for recession and unemployment/GDP has been created to look at the relation into more detail. With this interaction term, the differences in the effect of the unemployment rate/GDP dependant on the dummy variable for a recession can be seen. The results for this interaction is shown in Table 11.

The first column shows the model with GDP and the dummy for the recession without the interaction term, which is thus the same model as in Table 10. The second column is the column of interest here and shows the model with the interaction term. The interaction term for the recession with GDP is significant and shows a negative relation at a 5% significance level. This interaction term implies that the negative effect of graduating in a recession (when the dummy for recession = 1) increases with the GDP rate. In other words the net wage is lower for people who graduate during a recession compared to those who did not. This difference decreases even further depending on the GDP growth in the regression. This would imply that the wages are the highest during a recession when the GDP growth is the lowest. Graduating during a bad recession will thus result in a higher wage later on, relative to graduating during a less bad recession.

Looking at the coefficient for the variable GDP it can see that the relation between the variable for GDP and the unemployment rate is about equal, as their coefficients are almost equal.<sup>16</sup> This means that it should have little to no effect on the net monthly wages. Looking at the dummy for the recession it can be seen that when the GDP growth is about minus four percent, the negative effect of the interaction term is larger than the positive effect of the dummy for graduating in a recession.<sup>17</sup> This means that the negative effect on wages of graduating in a recession should only be present when the GDP decrease is large enough. In this specific case, four percent. The rest of the variables have the same relations as in the main model.

The interaction term for unemployment was not significant, nor was the unemployment rate or the dummy, so this specification has not been reported in the table. From this robustness check it has thus been shown that the wages seem to differ for subjects who did or did not graduate during a recession, hence giving more proof to hypothesis one. In detail, it was found that the GDP growth increases the wage differences. Furthermore there are indications that a minimum level of GDP decrease is needed before there are negative wage effects.

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<sup>16</sup> If recession = 1, coefficient dummy GDP recession = -0.03. coefficient gdp = 0.03, meaning that they cancel each other out.

<sup>17</sup> Coefficient dummy recession = 0.102; coefficient interaction term = 0.026. GDP = -4 and recession = 1. - 4\*0.026 = 0.104. Thus if the GDP decrease is more than four percent in a recession, there is a negative effect on your wages.

	Dependent Variable =>	Log(net monthly wage)	Log(net monthly wage)
<b>Independent Variable</b>			
<i>Constant</i>	Coefficient	6.545***	6.447***
	(standard deviation)	(0.113)	(0.118)
GDP * Recession	Coefficient	xxx	-0.026**
	(standard deviation)	xxx	(0.012)
<i>Recession?</i>	Coefficient	0.036*	0.102***
	(standard deviation)	(0.019)	(0.036)
<i>GDP</i>	Coefficient	0.015**	0.029***
	(standard deviation)	(0.006)	(0.009)
<i>Experience</i>	Coefficient	0.009***	0.009***
	(standard deviation)	(0.001)	(0.001)
<i>Male?</i>	Coefficient	0.174***	0.175***
	(standard deviation)	(0.020)	(0.020)
<i>Foreign?</i>	Coefficient	-0.023	-0.029
	(standard deviation)	(0.044)	(0.044)
<i>Age at Graduation</i>	Coefficient	0.003***	0.003***
	(standard deviation)	(0.001)	(0.001)
<i>Parttime?</i>	Coefficient	-0.433***	-0.433***
	(standard deviation)	(0.020)	(0.020)
Highest Educational Degree			
<i>level = 3 (VMBO/LBO/MAVO)</i>	Coefficient	0.390***	0.391***
	(standard deviation)	(0.075)	(0.075)
<i>level = 4 (MBO/Havo/Vwo)</i>	Coefficient	0.541***	0.547***
	(standard deviation)	(0.074)	(0.074)
<i>level = 5 (HBO)</i>	Coefficient	0.781***	0.786***
	(standard deviation)	(0.075)	(0.000)
<i>level = 6 (WO)</i>	Coefficient	0.978***	0.984***
	(standard deviation)	(0.077)	(0.077)
<i>Sector dummies included?</i>		Yes	Yes
Regression Method:	Ordinary Least Squares		
Total observations:		2824	2824
<b>R-squared</b>		0.501	0.502
<b>Adjusted R-squared</b>		0.497	0.498
* = significant at a 10% level			
** = significant at a 5 % level			
*** = significant at a 1% level			

Table 11: Interaction term recession dummy and GDP

The next robustness check will be on different measures of experiences: the original measure, an alternative measure, and the measure used by Kahn (2010). Kahn measured experience by using the differences between now and the year of receiving the highest educational degree, opposite to the original measure used here, where the question regarding when the graduate started working was used. The alternative measure for experience used in this research uses the differences between the age at graduation and the current age. The main model has been used for this analysis and the results for these three regressions with different measures are shown in Table 12 .



The first column is the original measure, the second column is the alternative measure, and the third column shows the experience as used by Kahn. An interesting finding is that unemployment becomes significant in the recession when we are using the measure for experience from Kahn. In that specification it is possible to say that there is a positive significant relation between the unemployment rate at the year of graduation and the net monthly wage, which is the opposite of all other findings so-far. Kahn (2010) also found a negative relation in her original research, regardless of a possible gap between graduating and working. It would imply that the net wages will be higher later on when the unemployment rate at graduation increases. The only difference with the other models lies in how experience is measured. This implies that the difference could be caused by differences in the mean or standard deviation of the variables measuring experience. However this does not hold, as the mean experience is the highest when using the alternative measure, and it has been shown that no relation was found here.<sup>18</sup> The only explanation remaining lies in the fact that the experience from Kahn was used for a different type of model, where she made use of state-specific unemployment, and also corrected for the skill of the worker. This findings shows again that there is mixed evidence on the link between wages and graduation during a recession in the Netherlands for this period. Most of the evidence found still hints towards a negative relation, but not as strong as was found by Kahn (2010).

Furthermore it can be seen that the different measures for experience are all positive and significant at a 1% significance level. The effect for an additional year of experience seems to be the highest in the Kahn measure. The control variables keep their relationship, where the age at graduation is not significant in the models with the alternative measure for experience.

Furthermore the significance of some sector dummies has changed. It was found that in the model with alternative experience, people in the health or finance earn more than in the agricultural business. For the model with the experience measure used by Kahn, people who work in Industrial, Finance, or health sectors earn more compared to the agricultural. The differences between sectors is small when we look at the size of the coefficients. The validity of this is questionable as this has not been found in the previous analysis.

This robustness check thus tells that it does not matter for the experience what measure is used, the original or the alternative. Differences with respect to the measure from Kahn are found, which shows why the findings differ: because of the way experience is measured and the different variables included. Next to this, it could be caused by country specific factors, but this has not been tested here.

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<sup>18</sup> Alternative: 22.803 (11.170); Kahn: 16.921 (11.567); Original:10.157 (9.799)

	Dependent Variable =>	Log(net monthly wage)	Log(net monthly wage)	Log(net monthly wage)
<b>Independent Variable</b>				
<i>Constant</i>	Coefficient	6.564***	6.529***	5.482***
	(standard deviation)	(0.114)	(0.114)	(0.111)
<i>Unemployment</i>	Coefficient	0.001	0.000	0.023***
	(standard deviation)	(0.004)	(0.004)	(0.005)
<i>Experience</i>	Coefficient	0.009***	xxx	xxx
	(standard deviation)	(0.001)	xxx	xxx
<i>Experience (Alternative)</i>	Coefficient	xxx	0.006***	xxx
	(standard deviation)	xxx	0.001	xxx
<i>Experience (Kahn)</i>	Coefficient	xxx	xxx	0.020***
	(standard deviation)	xxx	xxx	(0.001)
<i>Male?</i>	Coefficient	0.172***	0.191***	0.041*
	(standard deviation)	(0.020)	(0.020)	(0.022)
<i>Foreign?</i>	Coefficient	-0.026	-0.035	0.024
	(standard deviation)	(0.044)	(0.043)	(0.051)
<i>Age at Graduation</i>	Coefficient	0.003***	0.001	0.019***
	(standard deviation)	(0.001)	(0.001)	(0.001)
<i>Parttime?</i>	Coefficient	-0.435	-0.444***	-0.665***
	(standard deviation)	(0.020)	(0.020)	(0.022)
Highest Educational Degree				
<i>level = 3 (VMBO/LBO/MAVO)</i>	Coefficient	0.388***	0.382***	0.740***
	(standard deviation)	(0.075)	(0.075)	(0.061)
<i>level = 4 (MBO/Havo/Vwo)</i>	Coefficient	0.538***	0.561***	0.897***
	(standard deviation)	(0.074)	(0.074)	(0.060)
<i>level = 5 (HBO)</i>	Coefficient	0.779***	0.817***	1.179***
	(standard deviation)	(0.075)	(0.076)	(0.063)
<i>level = 6 (WO)</i>	Coefficient	0.977***	1.02***	1.397***
	(standard deviation)	(0.077)	(0.078)	(0.066)
<i>Sector dummies included?</i>		Yes	Yes	Yes
<i>Reference sector = 1 (Agriculture etc.)</i>				
<i>Sector = 3 (Industrial)</i>	Coefficient	0.059	0.076	0.169*
	(standard deviation)	(0.090)	(0.090)	(0.098)
<i>Sector = 6 (Finance)</i>	Coefficient	0.135	0.140*	0.212*
	(standard deviation)	(0.083)	(0.083)	(0.089)
<i>Sector = 9 (Health)</i>	Coefficient	0.126	0.155*	0.193**
	(standard deviation)	(0.085)	(0.085)	(0.091)
Regression Method:		Ordinary Least Squares	Ordinary Least Squares	Ordinary Least Squares
Total observations:		2824	2843	3080
<b>R-squared</b>		0.500	0.490	0.601
<b>Adjusted R-squared</b>		0.496	0.487	0.605
* = significant at a 10% level				
** = significant at a 5 % level				
*** = significant a a 1% level				

Table 12: Different measures for experience

Another check was looking whether it matters when only native graduates are included, as foreign workers might have graduated elsewhere. The results are shown in Table 16 in the appendix. The second column shows the regression with only native workers. As can be seen from the table, there are no differences in the relations, and the size of the coefficients are quite similar to the main model. This can be explained by the fact that there are only 86 observations for foreign workers compared to 2738 native workers. This shows that if there were any differences, they would be quite small, and likely not significant.

Finally, it is interesting to see what graduating in a recession does for the current chance of being employed. This means that also unemployed graduates will be included in the regression analysis. The main dependant variable will be the generated dummy for the state of employment of the graduate. The rest of the variables in the model will remain the same, with unemployment as the main independent variable to be investigated. As a check the GDP is also included instead of the unemployment rate, as we have found differences on this before. A logit regression is used here since the dependant variable is binary. The control variables which have no measure for unemployed graduates cannot be included in a logit regression. Therefore experience, sector employed, and the dummy for part-time have been excluded. The output for the logit regression is shown in Table 13.

The first column shows the model with the unemployment rate. As can be seen, the unemployment is positive, but not significant. The only significant variables in this specification are the age at graduation, and the dummies for the educational degree of MBO/HBO/WO. An increase in the age at graduation reduces the chances of being employed. This implies that it would be better to graduate early to get a job later on in your life. The chances of being employed are also higher for people with a degree of either MBO, HBO, or WO. The changes increase by getting a higher degree. The model with GDP instead of unemployment does not change any significances nor any relations found compared to the first model with unemployment rate as a main independent variable. The GDP itself is negative, but again not positive. An interaction term for experience cannot be included, and an interaction term for the education is not significant in any specifications. Differentiating this for low educated and high educated people does not show any differences in significance or relations.

In this robustness check it is found that the timing of graduation does not have a significant effect of the state (chance) of employment later on in the graduate's life, as no significant relation has been found. Kahn (2010) also did not find any strong effects of this in her analysis. Therefore it is concluded that there is no proof that the timing of graduating affects the state of employment later on. If there exists a measure for the total years of unemployment or experience in your career, the results could have been made less noisy. Unfortunately this measure does not exist in the used dataset. The only measure we have looks at the difference between the starting period of the current job and now, not at the lifetime experience.

	Dependent Variable =>	Employed? (1 = yes, 0 = no)	Employed? (1 = yes, 0 = no)
<b>Independent Variable</b>			
<i>Constant</i>	Coefficient	2.830***	3.043***
	(standard deviation)	(0.036)	(0.401)
<i>Unemployment</i>	Coefficient	0.047	xxx
	(standard deviation)	(0.054)	xxx
<i>GDP</i>	Coefficient	xxx	-0.013
	(standard deviation)	xxx	(0.060)
<i>Male?</i>	Coefficient	0.230	0.229
	(standard deviation)	(0.190)	(0.190)
<i>Foreign?</i>	Coefficient	-0.630	-0.644
	(standard deviation)	(0.434)	(0.434)
<i>Age at Graduation</i>	Coefficient	-0.022**	-0.022**
	(standard deviation)	(0.011)	(0.011)
Highest Educational Degree			
<i>level = 3 (VMBO/LBO/MAVO)</i>	Coefficient	0.627	0.636
	(standard deviation)	(0.397)	(0.404)
<i>level = 4 (MBO/Havo/Vwo)</i>	Coefficient	0.907**	0.939**
	(standard deviation)	(0.390)	(0.395)
<i>level = 5 (HBO)</i>	Coefficient	1.557***	1.586***
	(standard deviation)	(0.445)	(0.450)
<i>level = 6 (WO)</i>	Coefficient	1.626***	1.659***
	(standard deviation)	(0.527)	(0.531)
<i>Sector dummies included?</i>		Yes	Yes
Regression Method:		Logit	Ordinary Least Squares
Total observations:		4368	4368
<b>Log Likelihood</b>		-531.834	-532.189
<b>Pseudo R2</b>		0.020	0.019
* = significant at a 10% level			
** = significant at a 5% level			
*** = significant at a 1% level			

Table 13: Logit Regression for dummy employed

## **Main Findings from the analysis**

The main model showed that there is no significant relation between unemployment and graduating in a recession. There is a positive relation to the wages for the control variables of experience, gender, the age at graduation, and the educational degrees (rising with the degree received). There is a negative relation found between part time workers and the wages. No significant relation is found for the foreign workers and the sector employed. For the control variables we can state that all the (significant) relations found are in line with the expectations. Different measures for the state of the economy lead us to believe that there is mixed evidence on the relation between unemployment and graduating during a recession. With all the checks and expansions it is found that there are negative wage effect for low-educated graduates. This does not seem to differ based on the experience graduates have. This means there are long lasting negative effects, but these are only present for the low skilled. This means that we have found an answer for our main hypothesis. The next section will summarize all this and conclude the main questions.

## Conclusion

In this paper the long term effects of graduating on a recession on the wages have been researched. Wages nowadays might be lower for people who graduate during a bad economy compared to people who graduated in economical growth. The reasoning behind this is that there is less demand, and the change of getting a job is reduced. The effect might be different depending on the amount of experience or schooling you have had. This has been researched before, especially by Kahn and Oreopoulos et al. (Kahn, 2010)(Oreopoulos, von Wachter, & Heisz, 2012) These papers found a negative relation between the state of the economy and the wages. This has not been researched for the Netherlands yet. This research used the following research hypotheses:

- 1) *Does graduating during a recession in the Netherlands result in lasting negative wage effects?*
- 2) *Does a different amount of experience or a different college degree result in a different wage effect for graduates in a recession?*

The theory and previous literature state that the background to the analysis should lie in the Mincer model which states that earnings are driven by experience and schooling. For analyzing the state of the economy the unemployment rate has been selected, as this is widely used as an indicator for recessions and also captures the labor market effect. This resulted in a general model with the variables named above and control variables such as the age at graduation.

For the analysis of the main model and hypothesis one it was found that there is no significant relation between the unemployment rate and the wages. This means that the main hypothesis is not true. Interesting is that in the robustness checks it turned out that using the GDP growth or a dummy for the recession do result in a significant relation, confirming that there actually seem to be negative wage effects. This might mean that the wage effects are not related to the labor market, but are related to the growth/decrease of the economy measured by the GDP.

For the second hypothesis it is found that there are long lasting negative effect for low skilled workers, but not for medium to high skilled workers. The negative effect is also stronger for people with more experience during a recession. This could be because graduates with more experience might have to give up more of their wages in settling down. In general it is found that there is a positive relation between experience and wages when it is not linked with the state of the economy.

The findings of this research are specific for the Netherlands for the period 1970 – 2008. Compared to the research from Kahn(2010) it can be concluded that the relation in the Netherlands is less present and strong compared to the USA. Looking at Oreopoulos et al. (2012), it is confirmed that the effects are less for high educated graduates. But the negative wage effect is less clear for the Netherlands when compared to Canada. This might be explained by country-specific effects, but a panel data analysis has to be done to give full disclose about this.

But what do these findings mean for the future? Should graduates stay in school or go to the job market? That seems to depend on the expectations of the economy. If the GDP decrease is large enough it might have a negative effect on the graduates wage later on, so it should be better to stay off the labor market. But experience might also be important, one might argue. In all the cases a positive significant relation between experience and wages is found. However, when linked to the unemployment rate there is a negative significant relation. This implies that people who graduated in a recession do not always benefit from obtaining more experience. This consideration between studying or working is not the main focus of this research. More research can be done on this tradeoff. The main conclusions are about the long term effects of graduating in a recession on a wage, which were not found, and when these effects are found, they are negative.

As stated before, there are some limitations to this research. The panel questionnaire is quiet extensive, but is not always exactly what you what from it. And questionnaires are not always filled out honestly. Doubtful observations have of course been removed. Another place where improvement might be possible is in the definition of a bad state of an economy. As seen in the graph of GDP and Unemployment over time in Figure 5, there is a small lag of the effect of a recession on the labor market. The use of the dummy variable corrects for this lag because it combines unemployment and GDP. A time series analysis (not possible with this dataset) might give more detail and statistical proof on unemployment, the relation, and whether there are lags in it.

The results of this research might be subject to an interesting phenomenon. Students can change the speed of their graduating with the state of the economy. If the economy is bad, graduates will wait before they graduate. Vice versa, if the economy is good they will try to graduate earlier. If this phenomenon exists in the data it might have biased the found estimates, as the unemployment rate is too low when the economy is bad. Vice versa it might be too high in economic high times. This might explain why there was no relation found between the wages and the unemployment rate.

If the above phenomenon is true, it means that part of the unemployment rate is artificial, and the government might want to act against this. In the Netherlands the government is already reducing the amount of years the government pays for education, but there are still many loopholes in the law for students to exploit. It was not possible to correct or test for this, as there is no questioning dealing with whether a graduate waited on purpose in his graduating.

It is also interesting to note that the long lasting negative wage effect is only present for low skilled workers. Further research could focus on a wider analysis of low and high skilled workers in more detail. Using the general wage level might also be interesting but this lies outside the field of interest in this research. Another interesting suggestion for future research would be to combine all the labor supply panels held over time (as it is held every two years) and compare the different results for observations over time. This allows a closer look at time effects and how long it would take for (if any) negative effects to disappear. For policy makers in the Netherlands it could be interesting to look at province-specific differences and effects, which is something Kahn did for the United states of America.

This research thus did not prove that there are long lasting negative wage effects for graduates per se in the Netherlands. It did show that a lot of research is possible in this field, as this research found many interesting findings hinting towards interesting effects and relations.



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## Appendix

Code	Question	Translation	Measured by
aa001_08	Geslacht	Gender	Male or Female
aa003_08	Geboortedatum? Jaar:	Year of Birth	Year (4-digits)
aa007e_08	In welk land bent u Geboren?	Nationality	1-7 (1 = Netherlands)
ba016_08	Wat is de hoogstvoltooide opleiding? SOI 2003 (1-digit)	Level highest education received	SOI-2003 (1-6)
ba023_08	Wanneer heeft u de hoogst voltooide opleiding beeindigd? Maand:	Month completion highest education	Month (1-12)
ba024_08	Wanneer heeft u de hoogst voltooide opleiding beeindigd? Jaar:	Year completion highest education	Year (4-digits)
ba032_08	Hoogst voltooide opleiding voltooid SOI 2003 (volledige lijst)	Highest diploma received (list of studies)	SOI-2003 complete list
ba20b_08	Wat is de hoogstvoltooide opleiding? SOI 2003 (1-digit oude indeling)	Level highest education received	levels (1-30)
ca001_08	Wat is uw huidige arbeidssituatie	Current status of employment	levels (1-7)
cb010_08	Sector bedrijf van huidige baan SBI-1993	Sector Currently Employed	Sectors complete list SBI 1993
cc003_08	Hoe oud was u toen u, na volledig dagonderwijs, voor het eerst ging werken	Age Leaving School	Age (2-digits)
db001_08	Netto loon per maand, werkenden	Net Monthly Wage	Value
db004a_08	Periode waarover loon ontvangen	Period Over Which Wage Received	Hour/Week/4 Weeks/Month/Year
db051_08	Netto loon ontvangen	Net Wage Received	Value
ea050_08	Bent u werkzaam in voltijd of deeltijd?	Full or partime	Fulltime or Parttime
ee003_08	Sector huidige baan, SBI-1993	Sector Employed	SBI division (1-10)
ef003_08	Sinds wanneer bent u werkzaam in u huidige baan? Jaar:	Started working in current job	Year (4-digits)

Table 14: Questions used from labor supply panel

Variable	Measures
Age graduation	Age at graduation (2 digits)
Born	Year Born (4 digits)
Experience	Years at work at the current job
Experience (Alternative)	Years at work since started working
Experience (Kahn)	Years at work since graduation
Fulltime	Fulltime (0) or Parttime (1)
GDP Growth	GDP Growth rate (%)
Gender	Female (0) or Male (1)
Highest education received	Highest educational degree (SOI 1-6)
Highest education received detailed	Highest educational degree (SOI 1-30)
Hours Worked	Average hours worked in a week (2 digits)
Nationality	Native (0) or Foreign (1)
Net Monthly Wage	Wage received in € in a month
Net Hourly Wage	Wage received in € per hour worked
Sector Employed	Sectors employed (1-10)
Unemployment	Unemployment rate (%)
Year of Graduation	Year of graduation (4 digits)

Table 15: List of variables used

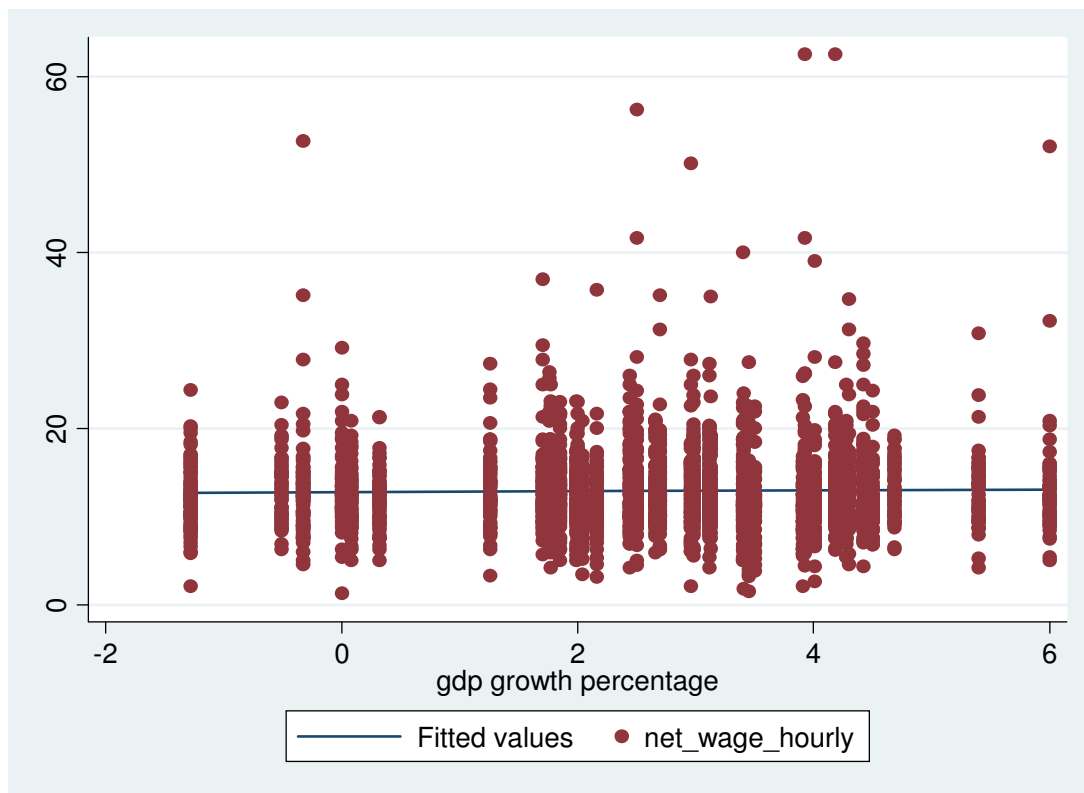


Figure 6: Hourly wages vs. GDP for people working more than twenty hours a week

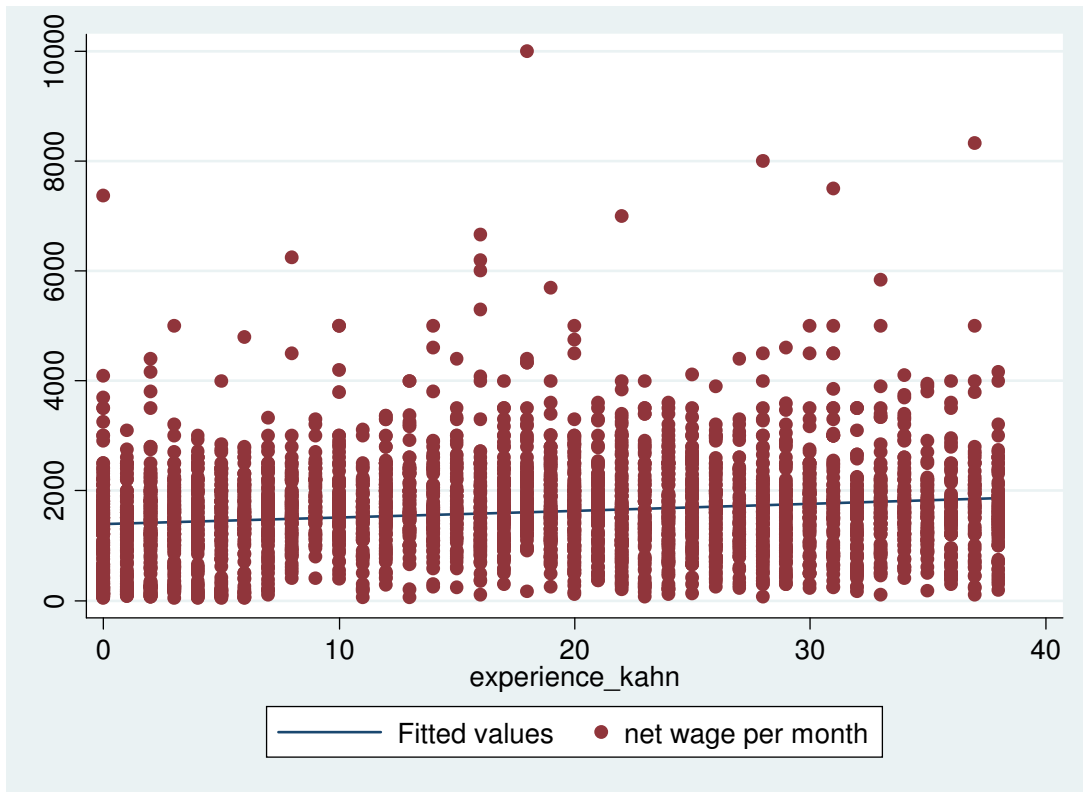


Figure 7: Wage vs. Experience (kahn)

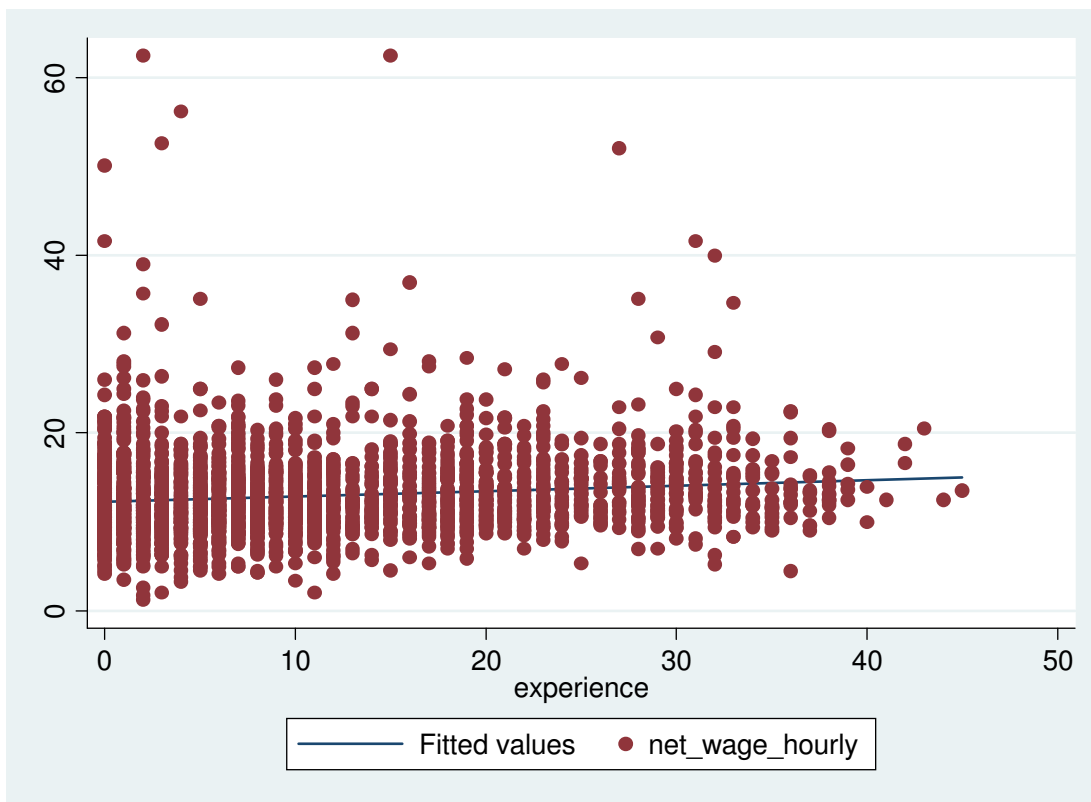


Figure 8: Hourly wages vs. Experience for people working more than 20 hours a week

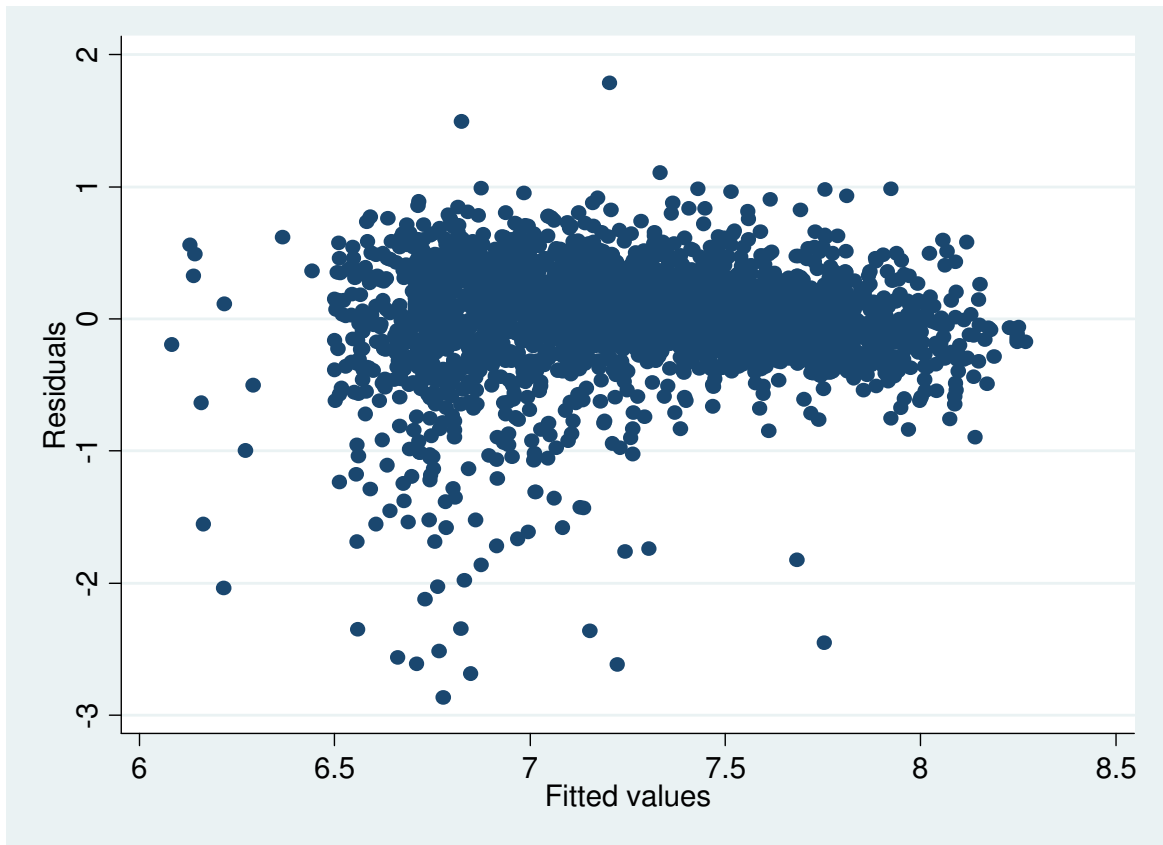


Figure 9: Residual plot main model

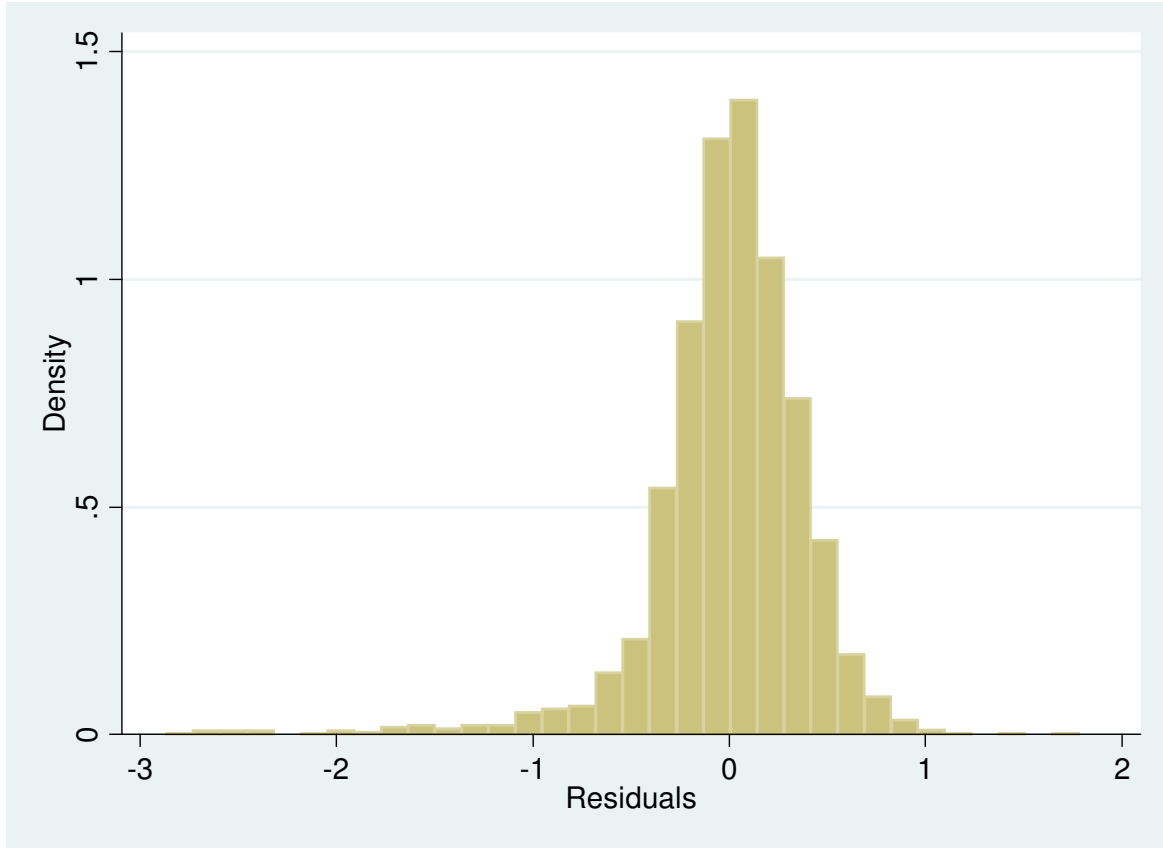


Figure 10: Histogram residuals main model

	Dependent Variable =>	Log(net monthly wage)	Log(net monthly wage)
<b>Independent Variable</b>			foreign = 0
<i>Constant</i>	Coefficient	6.564***	6.567***
	(standard deviation)	(0.114)	(0.116)
<i>Unemployment</i>	Coefficient	0.001	0.000
	(standard deviation)	(0.004)	(0.004)
<i>Experience</i>	Coefficient	0.009***	0.009***
	(standard deviation)	(0.001)	(0.001)
<i>Male?</i>	Coefficient	0.172***	0.003***
	(standard deviation)	(0.020)	(0.001)
<i>Foreign?</i>	Coefficient	-0.026	xxx
	(standard deviation)	(0.044)	xxx
<i>Age at Graduation</i>	Coefficient	0.003***	0.003***
	(standard deviation)	(0.001)	(0.001)
<i>Parttime?</i>	Coefficient	-0.435***	-0.435***
	(standard deviation)	(0.020)	(0.020)
Highest Educational Degree			
<i>level = 3 (VMBO/LBO/MAVO)</i>	Coefficient	0.388***	0.391***
	(standard deviation)	(0.075)	(0.079)
<i>level = 4 (MBO/Havo/Vwo)</i>	Coefficient	0.538***	0.539***
	(standard deviation)	(0.074)	(0.078)
<i>level = 5 (HBO)</i>	Coefficient	0.779***	0.778***
	(standard deviation)	(0.075)	(0.079)
<i>level = 6 (WO)</i>	Coefficient	0.977***	0.985***
	(standard deviation)	(0.077)	(0.081)
<i>Sector dummies included?</i>		Yes	Yes
Regression Method:		Ordinary Least Squares	Ordinary Least Squares
Total observations:		2824	2738
<b>R-squared</b>		0.500	0.501
<b>Adjusted R-squared</b>		0.496	0.497
* = significant at a 10% level			
** = significant at a 5 % level			
*** = significant at a 1% level			

Table 16: Regression for residential workers only