Stockholm School of Economics

Department of Economics

Bachelor's Thesis

The Shortage of Specialist Nurses in Sweden

Abstract

The Swedish National Board of Health and Welfare reported in 2010 that there is a continuous shortage of specialist nurses in Sweden. The shortage of specialist nurses has arised parallel to the implementation of an individual wage system designed to enhance and benefit experience and specialization. This study seeks to clarify what the monetary payoff is for becoming a specialist nurse in order to investigate if there is a possible connection between shortage and low monetary payoffs. The results show that there is a low wage premium for specialists and that the specialization areas with the lowest wage premium correspond to those suffering from the largest shortages. This finding is important as it indicates that monetary incentives affect the shortage and also since it reveals shortcomings to the individual wage system. An explanation why the wage premiums are low is suggested to be the possibility of monopsony power in the labor market for nurses.

Key words: Nurse Shortage, Individual Wage System, Nurse Labor Supply, Monopsony

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1. Introduction

1.1 Problem Area

In late January 2010, The National Board of Health and Welfare in Sweden released a report stating that the total number of specialist nurses continue to fall in spite of an increasing demand and in spite of an increase in the number of both graduated nurses and graduated specialist nurses (The National Board of Health and Welfare in Sweden, 2010). Interestingly enough, the continuous shortage of specialist nurses has arised parallel to the implementation of an individual wage system designed to enhance and benefit experience and specialization. This thesis will investigate the shortage of specialist nurses, focusing on the individual wage system and the monetary payoff of becoming a specialist nurse.

The individual wage system has since its implementation in 1989 gone through several steps before evolving into the present structure, where the executive and the individual nurse through a dialogue model together discuss the annual wage increase. There is to be a positive connection between wage level, motivation and result. The aim of the individual wage system, as stated in the general agreement from 2008[1] is to create an increased wage differentiation, based on knowledge, competence, experience and result, resulting in a higher potential for increased wages.

In the public debate regarding shortage of specialist nurses, different reasons for why there is a decrease in numbers are brought forward. One argument is related to the insecurity as to whether they will actually have the increased responsibility that is implied when being a specialist. Another argument mentioned is that the alternative cost is too high. Most specializations require a certain amount of work experience from the nurse. As a result, the nurse will have to go back to school when already established on the labor market, losing the current salary during the period of study. The third and most substantial argument brought forward in the debate is the insecurity the individual nurse face regarding the wage level as a specialist. There seem to be uncertainty whether as a specialist, the nurse will get a high enough increase in wage compared to the wage earned as a nurse (Krabbe, 2010).

In the literature, focusing on reasons for shortages, several explanations for why shortages of nurses occur are examined. One line of researchers, focusing on nurse labor supply, finds small relationship between wage level and the shortage of nurses (Shields, 2004). However, more recent studies find contrary to previous results that there is a positive relationship between wage level and the decision to both enter and remain in the nursing profession (Kankaanranta and Rissanen, 2007 and 2008). Another line of researchers focuses on the characteristics of the nurse labor market. Link and Landon (1975) and Sullivan (1989) find that the market for nurses is a clear example of monopsony. Since in such a market the employer tends to hold back wages there is small monetary incentive for individuals to enter into the nursing profession. A shortage will prevail, as employers will only budget for positions at a low wage level. Unions are found to function as a countervailing force to

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[1] The general agreement from 2008 is between the organizations The Swedish Association of Local Authorities, Pacta and The Public Employees' Negotiation Council, representing health care unions.

monopsony (Falch and Strøm, 2006) and so are also the decentralizing aspects of the individual wage system (Calmfors and Richardsson, 2004). As the individual wage system includes a dialogue model, research on different types of bargaining is relevant. Research on individual negotiation focusing on the impact on wage level and general outcome of negotiations find that women are less likely to initiate and benefit from negotiations (Babcock et al., 2006 and Stuhlmacher and Walters, 1999). However, there are other studies finding that women are better off in an individual wage system using a dialogue model (Granqvist and Regnér, 2004).

This thesis will focus on the third argument brought forward in the debate; the insecurity as to whether nurses will receive a high enough salary as a specialist. The aim is to evaluate the profitability of becoming a specialist nurse and thus to clarify if the individual wage system is working as intended. We furthermore aim to clarify if there could be a relationship between the profitability of specializing and the shortage of specialist nurses, by investigating the wage premium for thirteen different specializations[2] and comparing this with the categories that suffer the largest shortages. Could it be that nurses refrain from specializing because the premium of doing so is simply too small?

The aim of the study is firstly interesting from a political point of view. As the trend moves toward increased usage of individual wages in the public sector and there is a strong credence to its ability to increase wages, it is important to examine how the system works in practice. The aim is further motivated as there seem to be no recent economic research on the actual monetary profitability of working as a specialist nurse and how it affects the current shortage. Most previous studies use American data and focus on the shortage of nurses, not specialist nurses. The implications may be different, as the supply of specialist nurses is highly dependent on the number of nurses and not solely on whether or not individuals choose to enter the nursing profession. Finally, it is important to investigate the shortage of specialist nurses since the demand is likely to increase in the coming years, implicating a risk of a larger shortage. The intention is to reach the aim of the thesis by answering the following research questions:

1. *a. Does experience and specialist education have a positive effect on nurses' wages?*
   b. If yes, how long does it take in order for a specialist education to pay off?

2. *Do the specializations in which the increase in wage is the smallest correspond to those with the largest shortages?*

Moreover, by showing actual wage effects of specializing we hope to add to the debate regarding why there is a shortage of nurses and the implications of an individual wage system on this particular employment group.

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[2] As defined in this thesis: includes eleven existing specializations and two separate degrees for midwives and radiographic nurses.

1.2 Scope of Research and Definitions

The study investigates the individual wage system and the shortage of specialist nurses. The data sample used to answer the research questions is collected by The Swedish Association of Health Professionals, the largest union for nurses and is delimited to the year 2008. The sample covers employees in the public health care sector, more specifically nurses, specialist nurses, radiographic nurses and midwives employed either by municipality or by county council. No consideration is taken into account regarding content of the education; the main factor for defining specialists in this thesis is length of education. A non-specialist nurse, completing the nursing program consisting of three years, is in this thesis labeled *nurse*. A specialist nurse is defined as a nurse with a specialist education of on average one year and will be labeled *specialist nurse*. Midwives and radiographic nurses are separate degrees and not defined as specialists by The Higher Education Ordinance (1993:100). However, for the sake of the performed study in this thesis, they will here be defined as specialists. Two central terms used in this study are *need* and *shortage*. When a need is not fulfilled there is a shortage. It is assumed that the need reported by The Swedish Association of Health Professionals reflects the shortage reported by the National Board of Health and Welfare. The term *competence* used in the individual wage system will be interpreted as including education and experience.

1.3 Outline of the Thesis

The thesis is organized as follows. Section two describes the previous research on different models of explanation for why shortages of nurses occur and research on bargaining. The last part of the section holds the research hypotheses of the thesis. Section three describes the specialization areas, the individual wage system and the need and shortage of specialist nurses. Furthermore, the empirical data sample and the statistical method used for testing the hypotheses are also presented.

In the fourth section, the results are presented together with an analysis of the findings, relating to the theoretical framework. This is followed by a discussion of further implications of the results. In the last section, the concluding remarks are presented together with a discussion of the methods used in the thesis and suggestions for further research.

2. Previous Research

2.1 The Classic Supply and Demand Model

A description of the classic supply and demand model is given in Calmfors and Richardson (2004) and illustrated in *Figure 1* and *Figure 2* below. The wage on each submarket is set where supply equals demand. If demand increases relative to the total supply, a demand surplus will be generated. When faced with each other's competition for the supply of labor, employers will offer higher wages resulting in a total increase of wage levels until a new equilibrium wage level is reached. If the relative supply of labor is to exceed demand, a supply surplus arises in which the workers will be faced with a decreased wage level. The wage level will continue to decrease until a new equilibrium where supply equals demand is reached.
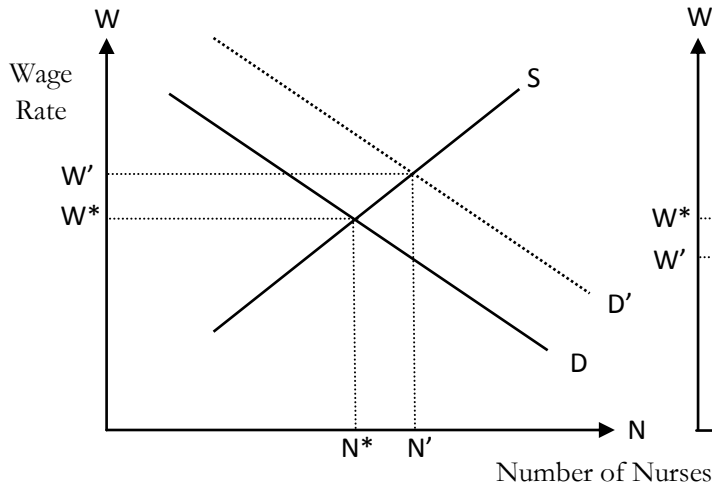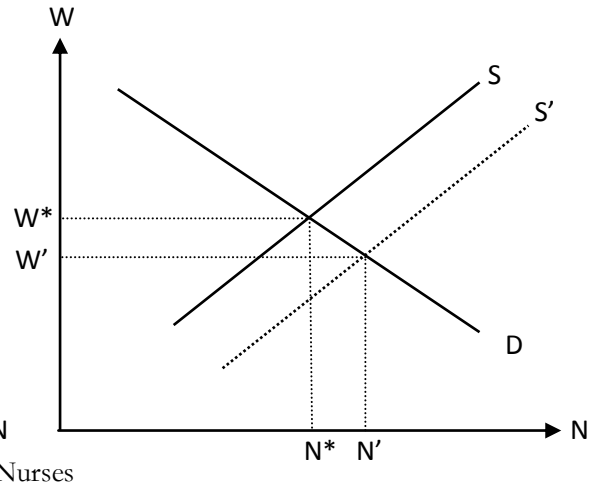
Figure 1: An Increase in Demand   *Figure 2*: An Increase in Supply

W

Wage
Rate

S

W'
W*

D'

D

N* N'

N

W

S

S'

W*
W'

D

N* N'

N

Number of Nurses

W* is the equilibrium wage, corresponding to N* where the number available nurses equals the demanded amount. Imagine that the demand for nurses increases as in *Figure 1,* causing an outward shift of the demand curve, represented by D'. Wages will increase to W', attracting N' number of nurses. *Figure 2* represents an increase in the supply of nurses. The increase in supply will cause an outward shift in the supply curve to S', corresponding to N' number of nurses and a decreased wage level of W' (Perloff, 2004).

Blanchflower and Oswald (1990) are among the researchers who have tested the connection between wage level and supply and demand by relating the wage level to unemployment. The authors find evidence of a wage curve, where unemployment acts to depress wages. The slope of the wage curve is negative on low levels of unemployment but becomes horizontal at relatively high levels of unemployment. As Calmfors and Richardson (2004) points out, estimations of the connection between unemployment and wage level have generated varied results, but the general conclusion is that variance in unemployment will have an effect on real wages and that increased unemployment will have a decreasing effect on wages.

A study of the Swedish health care labor market presented in Calmfors and Richardson (2004) confirms the classic theory. Examining the county council sector as a whole, they find that during the high unemployment for nurses in 1992-95, the relative increase in wages was lower than for other employment groups. When the unemployment rate[3] sank during the second half of the 1990's, the relative wages increased. The unemployment rate for nurses decreased during the ten-year period between 1992 and 2002, and has also been relatively lower than for other groups in the economy (Calmfors and Richardson, 2004).

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[3] Unemployment rate is defined in the study defined as the number of people being registered as unemployed at The Swedish Public Employment Service.

2.2 Nurse Labor Supply

There has been a substantial amount of studies on nurse labor supply. Shields (2004) summarize the most important papers written before 2004. The conclusion is that there is a severe shortage of nurses in the western world, demonstrated both in a higher vacancy level and an increase in turnover rate. The shortage of nurses is a consequence of changes in both the demand and the supply side of the nurse labor market. On the supply side demographic factors such as ageing are considered to have an effect, for example through increased retiring rate and fewer students in the education programs for nurses. The supply has also been affected by the increase in career possibilities for women in most western societies. This line of research shows a weak relationship between nurses' wages and nurses' labor supply. The conclusion is that wage tends to be inelastic for nurses, implying that very large wage increases would be needed in order for there to be any effect at all on the nurse labor supply. The primarily attractiveness for nurses lies in the intrinsic rewards of the profession, not the monetary.

Most studies focusing on labor supply of nurses are from the U.S., however one of the more recent studies is Norwegian, conducted by Askildsen et al. (2003). Unlike the other studies that are discussed by Shields (2004), it is found that the wage elasticity is 0,201. A 10 percent increase in nurses' wages would lead to a 2,01 percent increase in nurse labor supply. According to the authors, increases in wage level may have some success in diminishing the shortage of nurses, but it would be too costly.

In even more recent studies, performed on Finnish data by Kankaanranta and Rissanen (2007), it is investigated how elements related to wage, work, job satisfaction/dissatisfaction, workplace and demographics influence nurses' intention to leave their job in the health care sector. The authors find that several non-monetary factors affect nurses' intention to leave their jobs. However, they also draw the conclusion that an increased wage level can have both short and long term effects on recruitment and willingness to stay in the nursing profession. In their next study in 2008, they further develop their line of reasoning and find that nurses' response to wage variations is ambiguous and will depend on relative income and substitution effects. They find wage elasticity to be higher than reported by Askildsen et al. (2003) and even though it is still quite small, the effect on hours supplied is reported to be significant. The authors conclude that wage along with non-monetary factors will matter for nurse labor supply.

2.3 The Demand for Nurses

There is a general notion that there is an increase in demand for nurses as the proportion of ageing population is growing (Statistics Sweden, 2008). Other reasons for increase in demand are advances in medical practice and higher public expectations of the health care system (Kankaaranta and Rissanen, 2007). Parallel with the overall increase in demand for nurses, there is an increase in demand for specialist nurses. As the Swedish health care system is becoming more and more specialized and qualified to handle difficult cases, there is an increased need for specialist knowledge among nurses (The Swedish National Agency for Higher Education, 2010).

Monopsony

One explanation for what is described as a constant shortage of nurses is the market power characterizing employers in the market for nurses (Yett, 1970). The market for nurses has been described as a typical example of monopsony and ideal for investigating firms' power to set wage levels (Sullivan 1989). A monopsony is a market that theoretically only has one buyer, the firm. Owing to the then imperfect competition, the firm faces an upward sloping supply curve for workers and is thus able to at its optimum level of employment pay wages that are below the relevant marginal product (Folland et al., 2007). Monopsony is found in markets where specialized skills are required and close alternative occupations are few. Limited geographical mobility among the workforce can also allow identification of monopsonistic power for the firm (Link and Landon, 1975).

The model of monopsony is illustrated in *Figure 4*, using the hospital as the only employer for nurses. The hospital's demand curve, D, represents the marginal revenue product for nurses employed at that hospital. Under monopsony, the supply curve does not represent the marginal labor cost, MLC, to the hospital, as would have been the case in a competitive market. Under competition, the hospital would hire N_d nurses at wage W^1.

Figure 3: Model of Monopsony
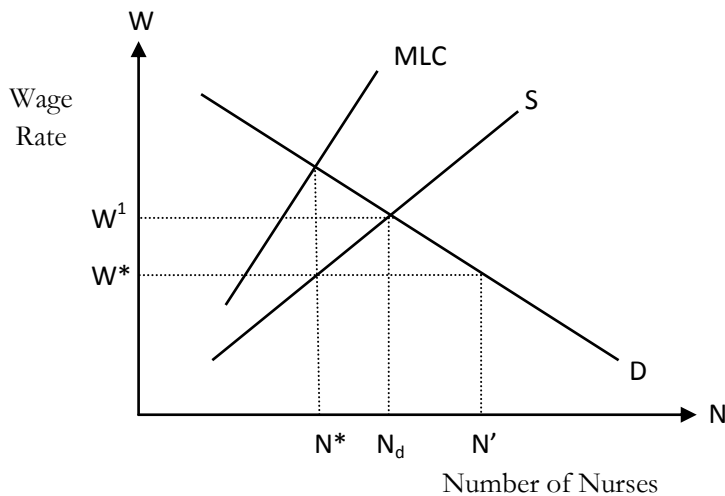
As the supply curve is upward sloping, the marginal labor cost incurred for hiring an extra nurse is not just the wage it pays; it also induces the extra wage it must pay all its current nurses. As a result, the MLC curve will lie above S, the supply curve. When the hospital is profit maximizing, it would find it profitable to hire an additional nurse as long as the marginal revenue product (D) exceeds MLC. As long as the demand curve lies above MLC, it will always pay to hire an additional nurse. The firm is profit maximizing when D is equal to MLC, with N^* employed nurses paid the equilibrium wage W^*, found on the corresponding point on the supply curve. At the wage, W^*, the hospital would be willing to hire N' nurses and may budget for these nurses and then report a shortage of $N'-N^*$ nurses (Link and Landon, 1975). The shortage reported is a result of the

hospital's desire to hire nurses at the current wage level and thus has limited meaning in the case of how large the actual shortage is. However, if the number of unfilled positions would rise rapidly, it suggests and increasing relative scarcity of nurses (Fallon et al., 2007).

The model for oligopsony is similar to the one of monopsony and is characterized by a small number of buyers, instead of just one buyer. Even if the buyers do not cooperate in setting wage levels, the individual buyer is still so large that it can be said to have monopsonistic power on its submarket (Richardson and Calmfors, 2004). As Link and Landon (1975) show, the effect on wages in an oligopsony is equivalent to the effect on wages in a monopsony.

In the case of the Swedish market, Calmfors and Richardson (2004) suggest the possibility of monopsonistic power even though the public sector does not have an explicit aim of profit maximizing. The incentives for the employer to hold back wages is still present as there is a trade-off between producing as many health care services as possible while keeping costs (and thus taxes) as low as possible. The authors discuss the development in the Swedish market, moving from centralized wage agreements during the 1970's towards the individual wage system. A result of the individual wage system is a more decentralized wage formation process. This implies that the possibility of monopsonistic power for the county councils is smaller since the bargaining power for the individual nurse is stronger when there is an opportunity to move to other county councils where wages are higher. The conclusion is that the change from a centralized to an individual wage formation process is a result of an attempt to both encourage higher efficiency in the health care sector and to induce a higher relative wage level for nurses.

2.4 Wage Negotiation and Bargaining

Unions

Traditional wage bargaining models assume that without union bargaining power, the outcome wage will be the equilibrium wage reached in a competitive market. Unionization will tend to set wages above the market equilibrium, resulting in a lower degree of employment and ultimately involuntary unemployment (Calmfors and Richardson, 2004). However the case is slightly different in a monopsonistic market. Link and Landon (1975) find that unionization is associated with considerable increases in the level of initial salary for nurses and it is found that unionization seems to be a strong countervailing force to monopsony power.

Falch and Strøm (2006) integrate the model of wage bargaining and the model of monopsony in order to analyze how changes in bargaining power changes the outcome of the bargaining. Using the monopsony wage outcome as reference point they develop a model of wage bargaining in a firm facing an upward sloping labor supply curve. The result is that when the bargaining power is in the hands of the firm, as the case is under monopsony, employment will first increase, then stay constant and finally decrease. Bargaining power in the hands of unions may generate an efficient outcome as "medium" powerful unions create a wage level outcome that is equal to the wage level

equilibrium generated in a competitive market. The authors' conclusion is that the efficiency equilibrium occurs for a range of different bargaining powers between the two parties.

Individual Bargaining

Granqvist and Regnér (2004) highlight the trend moving towards individual systems and away from central agreements in both the private and public sector in Sweden. In their study they investigate the effect of a wage dialogue on individuals' wages. The overall result shows a positive relationship between wage dialogue and monthly salary for women, but not for men. However the conclusion differs somewhat when investigating different sectors. For women in the state sector there is a negative relationship, while in municipality sector there is a positive relationship. There is no mention of the county council sector. All individuals in the performed study are union members, giving them a bargaining support which the authors suggests may have a positive influence on the individual negotiations.

Stuhlmacher and Walters (1999) performed a meta-analysis of 21 studies on individual negotiation. Compiling the objective settlement outcomes obtained by men and women in the negotiations they found a clear trend. Overall, men negotiated better outcomes than women. Kray and Thompson (2005) came to the same conclusion after performing a literature survey. Moreover, Babcock et al. (2006) performed a large survey showing that men seem to have a higher propensity to initiate negotiations. In the performed study the men were found to have more recently initiated a negotiation and they were also found to believe that they would soon do so again.

Further experiments conducted on gender differences in negotiations show similar results. Small et al. (2007) carry out an experiment where men and women are instructed to play a word game in exchange for cash where the sum is negotiable. It is found that women are less likely to initiate negotiations. Bowles et al. (2007) perform an experiment where the participants are told that they will be interviewed for a job. They are then instructed to answer how likely it is that they will try to negotiate for higher salary. In this experiment as well, women are less likely to negotiate. Hederos Eriksson and Sandberg (2009) execute an experiment where participants are asked to do a world puzzle with a possible reward that in the end can be bargained up to a higher level. The conclusion of the experiment is again that men are more willing to negotiate.

3. Hypotheses

According to the previous research regarding incentives for nurses to enter and continue on in the nursing profession, wage level matters together with other non-monetary factors. A high or low wage level can thus theoretically affect the shortage of nurses. In the individual wage system, the individual plays a much larger role in the wage settlement process, through the dialogue model. As previous research on negotiations and bargaining show that women are less likely to initiate and be economically successful in negotiations, it is likely that an employment group highly dominated by women will not benefit economically through a dialogue model. The first hypothesis is thus that there will only be a small effect of experience and specialist education on wages.

Classic economic theory shows that when there is a shortage of labor supply, the relative wages will increase in order to attract more workers. However the market for nurses can be seen as monopsonistic, and as such the employers have a larger power to hold back wage levels than in a perfect competitive market. Monopsonistic power can be counteracted through the decentralization that an individual wage system implies. Our proposition is that in the case for specialist nurses, this has to some extent not occurred, as there is a continuous shortage even though the individual wage system allows for nurses to individually demand higher wages. The second hypothesis thus is that the specializations with the largest shortages also will have the smallest wage increases compared to nurses and that there is a possibility that the individual wage system may not function properly.

4. Empirics

4.1 What is a Specialist Nurse?

In order to become a nurse, authorized by The National Board of Health and Welfare, a three year basic education must be completed. To be able to become a specialist nurse, the nurse must first be a nurse and then complete at least one additional year of education. A certain amount of work experience is also required; this is dependent on which specialization the nurse is to pursue. The large majority of specializations (three quarters) require one year of work experience, the other specializations require between six months and two years of work experience. There are twenty-six different institutions in Sweden with the right to issue a degree for specialist nurses. The total number of students registered within a specialist education increased during the period of 2001 to 2008, as did the number of graduated students (The Swedish National Agency for Higher Education, 2010). There are eleven different orientation areas for specializations, below listed followed by the Swedish name in brackets:

- *Anesthesia* (Anestesi sjukvård)
- *Intensive Care* (Intensivvård)
- *Operation Care* (Operationssjukvård)
- *Ambulance Care* (Ambulanssjukvård)
- *Surgery* (Kirurgisk vård)
- *Medical Care* (Medicinsk vård)
- *Oncology* (Onkologisk vård)
- *Health Care for Children and Youth* (Hälso- och sjukvård för barn och ungdomar)
- *Psychiatric Care* (Psykiatrisk vård)
- *Geriatric Care* (Vård av äldre)
- *District Nursing* (Distriktssköterska)

There are two educations that are considered to give a separate degree; Midwife (Barnmorska) and Radiographic nurse (Röntgensjuksköterska). A Midwife education program is six months longer than the above listed specializations. A Radiographic nurse education program is three years long as a whole.

4.2 The Individual Wage System

According to the general agreement from 2008, the individual wage system's intended function is to spur on the individual wage increases. As the aim is to reach a positive relationship between wage, motivation and result it is important that the individual's result is linked to his or her wage development.

Prior to the introduction of the individual wage system, nurses' wages was decided upon in a central agreement including all county councils in Sweden. The system had different wage levels ranging from one to ten (later increased to thirteen). These were based on two criteria, experience in number of years and type of employment. It was a criticized system as the average wage level was considered to be too low. Moreover, the possibility for additional wage improvement was soon exhausted as the individual nurse reached the highest wage level quite fast. Looking at the trend in the private sector, The Swedish Association of Health Professionals observed that there was a positive relationship between wage differentiation and overall increased wages and consequently they made it an ambition to implement a greater variation in nurses' wages (Krabbe, 2010).

The implementation of the individual system started in 1989 when the central system was brought to a close (Ryman, 2007). In the 1995 wage negotiations, there was an extensive dissatisfaction over the general wage level. After a seven-week strike an agreement was reached. The employers would strive towards a positive relationship between wage, motivation and result. The wages were to be individual and differentiated and dependent on the nurse's contribution to the workplace. New criteria such as responsibility, level of complexity, authorization and performance were introduced.

A new agreement was formed in 2000. Mutual values for development of the workplaces were decided upon in a policy document. The overall development of the organization and the competence of the nurse were to have a positive effect on the individual wage development. Furthermore, the wage dialogue model was introduced (Ryman, 2007).

As stated by the 2008 general agreement, the dialogue model is divided into two parts. The employer first conducts a wage review and suggests the wage for the individual, based on criteria previously known to both employer and individual. When performing the wage review, the employer is to prioritize work areas where there is a need for specialist nurses, midwives and radiographic nurses. When the employer suggests the wage, the individual has the opportunity to bring forward the own appreciation of what the wage should be and why. The employer takes this into account and after a certain period of time the individual is informed what the new wage will be.

The guidelines to the dialogue model are set in a national general agreement. It is today locally optional whether to use the wage dialogue model or not. Each county council may decide to implement the dialogue model or to use the more traditional negotiation model, where the employer and the local department of The Swedish Association of Health Professionals are the negotiation

parties (Krabbe, 2010). 19 out of 20 responding county councils used the dialogue model for the majority of their employees in 2008.[4]

4.3 Need and Shortage of Nurses

According to The National Board of Health and Welfare the market for nurses is in balance, but the county councils find it difficult to hire specialist nurses. The amount of employed specialist nurses is decreasing even though the number of graduated specialist nurses and the total amount of nurses continues to increase. In the January 2010 report from The National Board of Health and Welfare, both need and shortage are described as relative terms. Need depends on the target that is set in order to secure the quality of the health care. Shortage on the other hand is defined as the difficulty in hiring labor to vacant positions. A shortage exists when the need for nurses, the demand, is larger than the supply. The board reports that the demand is increasing while the amount of nurses with a specialist degree has shrunk from 65 percent to 50 percent (The National Board of Health and Welfare, 2010).

The Swedish Association of Health Professionals investigated the need for specialist nurses through a survey sent out to all municipalities and county councils. The municipalities and county councils were asked to grade how urgent they perceived the need to be, using a five-grade scale. 240 out of the 291 municipalities and 16 out of the 21 county councils answered. In the municipalities the most urgent need was found for specialists in geriatric care, psychiatric care and in district nursing. For the county councils the need was found to be most urgent for specialists in operation care, intensive care and psychiatric care. There was also a substantial need for specialists in anesthesia, health care for children and youth, oncology, geriatric care and in district nursing. The Swedish Association of Health Professionals concludes that there is overall a special need for specialists in operation care, intensive care, psychiatric care, health care for children and youth, oncology, district nursing and geriatric care (The Swedish Association of Health Professionals, 2007).

In a 2009 report by The National Board of Health and Welfare, focusing on specialist nurses, it is shown that the amount of specialist nurses employed within the health care sector has decreased by 11 percent over the twelve-year period from 1995 to 2007. The number of specialists in operation care, medical care, and surgery and psychiatric care has decreased. The amount of radiographic nurses working in the health care sector has also diminished, by 20 percent for the period (The National Board of Health and Welfare, 2009). In the later 2010 report, the board states that the demand for midwives is slightly higher than the supply. The supply of midwives has increased during the last years; however it is expected to decrease as there is a large group approaching retirement (The National Board of Health and Welfare, 2010).

Future demand for health care in Sweden is expected to increase, especially after 2020 when then number of people over 80 years of age will be very high. According to forecasts made by Statistics

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[4] A short query was sent out by the authors to the 21 different regional councils asking them whether they had implemented the dialogue model in 2008, the year of the data sample. 20 out of 21 responded, and of the 20 regional councils, 19 had used the dialogue model. In Appendix 1 the query can be found.

Sweden, the amount of graduated nurses will in 2030 increase by 20 percent, while the demand will rise by 40 percent. No forecast is made specifically about the future supply and demand of specialist nurses (Statistics Sweden, 2009).

5. Data Collection and Statistical Method

5.1 The Data Set

In order to fulfill the quantitative research a cross-sectional data set with 73 305 observations has been used. The data received by The Swedish Association of Health Professionals has been taken from a system called AID created by different unions and associations[5] together with The Swedish Association of Local Authorities and Regions. It gathers work identifications for individuals in all municipalities and county councils and has been developed in order to enable analyzes of wage setting. The data is from the year 2008 and all nurses in the sample, divided into 18 different categories, are union members. The data states identification number, type of nurse, gender, age, year of graduation, employment sector and county council. Regardless of whether employment sector is municipality or county council, all observations can be derived from one of the 21 county councils.

Two OLS regressions will be performed. In both regressions, some adjustments to the data have been made. 12 observations had stated graduation year 2009 or 2010. These observations have been excluded, as they are individuals that for some reason have stated a later year than 2008 as year of graduation even though the data set shows specialist nurses and nurses already employed in 2008. Moreover, all nurses with executive positions have been excluded from the sample, as these observations are likely to generate a bias in the results as they as executives earn a higher wage, irrespective of specialization.

In the first regression, used to answer the first research question, the categories ambulance care, geriatric care, medicine/surgery and psychiatric care has been excluded because of problems with measurement. There is a possibility that individuals in these categories are labeled specialists when they in reality are not. Radiographic nurses have also been excluded since these nurses have a separate degree not including an additional year of education. In the second regression, used to answer the second research question, all 16 categories are included and separately controlled for since the wage return for all different specializations are of interest. However, measurement problems should be taken into account when analyzing the results.

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[5] AkademikerAlliansen, Swedish Municipal Workers' Union, Public Employees' Negotiation Council and Pacta.

5.2 Sample Description

Table 1: Description of sample – Regression 1

	Mean	Median	Std.dev	Min	Max
Age	45	45	10, 89	21	69
Wage	25 227	25 400	2869.98	17 022	46 685
Experience	17	16	11, 93	0	47
	Number of Observations			**Share of Sample**	
Female	47 818			93, 6 %	
Male	3 285			6, 4 %	
Specialist	26 046			49, 0 %	
Non-specialist	25 057			51, 0 %	
County councils	46 957			91, 9 %	
Municipality	4 146			8, 1 %	
Whole sample	**51 103**			**100%**	

Table 2: Description of sample – Regression 2

	Mean	Median	Std.dev	Min	Max
Age	45	45	10, 89	21	70
Wage	25 132	25 200	2812, 49	17 022	46 685
Experience	17	16	11, 92	0	47
	Number of Observations			**Share of Sample**	
Female	64 368			91, 8 %	
Male	5 752			8, 2 %	
Specialist	45 063			64, 3 %	
Non-specialist	25 057			35, 7 %	
County councils	57 957			82, 7 %	
Municipality	12 163			17, 3 %	
Whole sample	**70 120**			**100%**	

5.3 OLS Regressions

In the study, OLS regressions are used in order to answer the research questions. The dependent variable is wage, defined as monthly salary. This variable will be presented in two functional forms in order to make the results as clear as possible for the reader. The first form will be logarithmic, *log-level*, where the coefficients are seen as percentage effect on the dependent variable; second a *level-level* version will be carried out in order to see the effect in monetary terms. Independent variables are specialist, experience (defined as years since graduation), gender, employment sector and county council. All these variables are factors that can be argued to have an effect on wage level and should thus be controlled for. A square variable of experience, experience^2, will also be controlled for in order to allow for a non-linear effect of experience. It can be argued that ability will have an effect on wage as well. However, because of the difficulty in identifying a good estimation of ability to control for, ability is expected to be part of the error term.

The first regression, using *Non-specialist* as base line for specialists and *Stockholm* as county council baseline, can be written as follows:

$$
\begin{aligned}
(\log)Wage = {}& \beta_0 + \beta_1 \times Specialist + \beta_2 \times Exper + \beta_3 \times Exper2 + \beta_4 \times Female + \beta_5 \times Sector \\
& + \beta_6 \times Blekinge + \beta_7 \times Dalarna + \beta_8 \times Gotland + \beta_9 \times G\ddot{a}vleborg + \beta_{10} \\
& \times Halland + \beta_{11} \times J\ddot{a}mtland + \beta_{12} \times J\ddot{o}nk\ddot{o}ping + \beta_{13} \times Kalmar + \beta_{14} \\
& \times Kronoberg + \beta_{15} \times Norrbotten + \beta_{16} \times Sk\mathring{a}ne + \beta_{17} \times S\ddot{o}dermanland + \beta_{18} \\
& \times Uppsala + \beta_{19} \times V\ddot{a}rmland + \beta_{20} \times V\ddot{a}sterbotten + \beta_{21} \times V\ddot{a}sternorrland \\
& + \beta_{22} \times V\ddot{a}stmanland + \beta_{23} \times V\ddot{a}stra\ G\ddot{o}taland + \beta_{24} \times \ddot{O}rebro + \beta_{25} \\
& \times \ddot{O}sterg\ddot{o}tland + u_i
\end{aligned}
$$

In the second regression, instead of a single specialist dummy variable, a dummy variable for each of the different specialists is included, using non-specialist and Stockholm as baseline.

$$
\begin{aligned}
(\log)Wage = {}& \beta_0 + \beta_1 \times Exper + \beta_2 \times Exper2 + \beta_3 \times Female + \beta_4 \times Sector + \beta_5 \\
& \times Ambulance\ Care + \beta_6 \times Anesthesia + \beta_7 \times Company\ Nurse + \beta_8 \\
& \times District\ Nursing + \beta_9 \times Geriatric\ Care + \beta_{10} \times Intensive\ Care + \beta_{11} \\
& \times Medicine/Surgery + \beta_{12} \times Midwife, care + \beta_{13} \times Midwife, counseling + \beta_{14} \\
& \times Nurse, children + \beta_{15} \times Operation\ Care + \beta_{16} \times Psychiatric\ Care + \beta_{17} \\
& \times Radiographic\ Nurse + \beta_{18} \times School\ Nurse + \beta_{19} \times Specialist, other + \beta_{20} \\
& \times Specialist, special\ function + \beta_{21} \times Blekinge + \beta_{22} \times Dalarna + \beta_{23} \\
& \times Gotland + \beta_{24} \times G\ddot{a}vleborg + \beta_{25} \times Halland + \beta_{26} \times J\ddot{a}mtland + \beta_{27} \\
& \times J\ddot{o}nk\ddot{o}ping + \beta_{28} \times Kalmar + \beta_{29} \times Kronoberg + \beta_{30} \times Norrbotten + \beta_{31} \\
& \times Sk\mathring{a}ne + \beta_{32} \times S\ddot{o}dermanland + \beta_{33} \times Uppsala + \beta_{34} \times V\ddot{a}rmland + \beta_{35} \\
& \times V\ddot{a}sterbotten + \beta_{36} \times V\ddot{a}sternorrland + \beta_{37} \times V\ddot{a}stmanland + \beta_{38} \\
& \times V\ddot{a}straG\ddot{o}taland + \beta_{39} \times \ddot{O}rebro + \beta_{40} \times \ddot{O}sterg\ddot{o}tland + u_i
\end{aligned}
$$

The variables used in the regressions are defined as described in the below *Table 3,* and *Table 4* below shows the specialization variables relation to the different specialist educations.

Table 3: **Description of Variables**

Variable Name	Description
Wage	The wage as monthly salary
Specialist	A dummy variable that take the form of 1 if the observation is a specialist nurse and 0 if it is a non-specialist nurse
Exper	Measuring experience in years since graduation
Exper2	A square variable for experience, exper^2
Female	A dummy variable that is 1 if the observation is female and 0 if it is male
Sector	A dummy variable that is 1 if it is a county council and 0 if it is a municipality
Non-specialist	A dummy variable that is 1 if the observation is a nurse and 0 if it is a specialist
1 variable for each of the 16 specialists	A dummy variable that is 1 if it is a specific type of specialist and 0 if it is a nurse
1 variable for each of the 21 county councils	A dummy variable that is 1 if it is a specific county council and 0 if it is municipality

Table 4: **Relationship Between Specialists and Data Set Specialization**

Education	Data Set Specialization*
Anesthesia	Anesthesia
Intensive care	Intensive Care
Operation Care	Operation Care
Ambulance Care	Ambulance Care
Surgery	Medicine/Surgery**
Medical Care	Specialist/special function, Medicine/Surgery
Oncology	Specialist/other
Health Care for Children and Youth	Nurse children, School nurse
Psychiatric Care	Psychiatric Care
Geriatric Care	Geriatric Care
District Nursing	District Nursing
Midwife	Midwife care, Midwife, counseling
Radiographic Nurse	Radiographic Nurse

* Data set specialization *Company Nurse* can have different types of specialist educations and is therefore not specified under a certain education. ****** Data set specialization medicine/surgery is considered to include specialists in both Surgery and Medical Care.

5.4 The Payoff of Specialist Education

In order to investigate the amount of time it takes for a specialist education to pay off, measured in number of years, calculations on income has been made. The calculations show the present value of the aggregated income for a nurse and a specialist nurse.

The entry wage for a regular nurse is calculated as the average of the wages for nurses in the sample with one or less than one year of experience. This wage is then multiplied with 12 to get the yearly

wage. An assumption of no real wage increases is made, thus the wage increases with inflation. The income for the specialist nurse the first year will constitute of a student loan of 54440 and a student grant of 26 960, in total 81 400 SEK. The student loan is paid back in yearly amortizations and there are also rent payments of the loan. Year two, the specialist will earn the salary of a nurse with one or less than one year in experience multiplied with the average wage premium of being a specialist nurse. In order to derive the present value of the aggregated income a discount factor of 0,03 have been chosen. This is the assumed growth rate in the economy, the rate at which money would increase if invested. The income from each year is multiplied with $\frac{1}{1,03^k}$, where k is the number of years; $k = 1, 2, 3, ..., k$

In summary, the assumptions of the calculation are the following: there is no real wage increase, the student loan and grant are based on the loan and grant of 2010 from CSN, the rent payment on the loan are assumed to be the same as the growth rate of the economy of three percent, the loan are assumed to be amortized with yearly payments over 20 years. A reasonable assumption considering that the maximum time according to the rules by CSN is 25 years. The discount factor is the assumed growth rate of the economy. Further, the nurse is expected to have finished the nursing education right after the high school graduation and she is anticipated to work one year as a nurse before starting her specialist education, implying that she is 24 when graduating as specialist. We assume that nurses retire at the age of 65.

The same calculation will also be performed for different types of specialists, changing only the average wage increase of that particular specialization. Finally, a sensitivity analysis will be made.

5.5 Ensuring the Reliability of the Results

Testing for Heteroskedasticity

When performing an OLS regression it is assumed that the fifth Gauss-Markov assumption for homoskedasticity holds; that the error terms has a constant variance given any value of the independent variables. If the assumption fails there is a presence of heteroskedasticity, implying that the error terms are correlated with the independent variables. This must be adjusted for as the OLS estimators otherwise would be biased. Consequently, it is useful to test for the presence of heteroskedasticity. In accordance with Woolridge (2009) a special case of the White test is performed for the two regressions, as the degrees of freedom (df) is large in both.

H_0: *The variance of the error term is homoskedastic*
H_1: *The variance of the error term is not homoskedastic*

When running the special case of the White test, the residuals, $\hat{u}$ and the squared residuals, $\hat{u}^2$ are saved. The fitted values of the independent variables, $\hat{y}$ and the squared fitted values, $\hat{y}^2$ are also saved. Testing for heteroskedasticity can then be done by estimating the equation:

$$\hat{u}^2 = \delta_0 + \delta_1 \hat{y} + \delta_2 \hat{y}^2 + v_i$$

The heteroskedasticity test is performed on both level-level OLS regressions in the thesis, as they contain a different number of observations. For the first one, the special White test generates an F-statistic of 48,53 and a very low p-value (p<0,0000). The null hypothesis can be rejected at the 1 percent significance level. For the second regression, the special White test generates an F-statistic of 332,87 and as the p-value again is very low (p<0,000), the null hypothesis can again be rejected at the 1 percent significance level. As the null hypothesis is rejected in both cases, there is possibly heteroskedasticity present in the regressions. In order to adjust for this, the standard errors are computed robust. This method of adjustment is appropriate as the sample can be considered to be large.

Multicollinearity

A high degree of linear relationship between two or more independent variables in an OLS regression can lead to large variances for the slope estimators which lessens the preciseness of the estimators. Multicollinearity occurs when there is high but not perfect collinearity between two or more independent variables (Wooldridge, 2009). A correlation matrix has been computed to ensure that the variables are not highly correlated. The matrix shows that the variables for age and experience have a strong correlation and age is therefore excluded from the regressions.

Table 5: **Correlation Matrix**

	Specialist	Exper	Exper2	Age	Female	Sector
Specialist	1.0000					
Exper	0.3795	1.0000				
Exper2	0.3188	0.9622	1.0000			
Age	0.3116	**0.8371**	**0.7981**	1.0000		
Female	0.0618	0.0944	0.0893	0.0656	1.0000	
Sector	0.2352	0.1659	0.1509	0.1639	0.0408	1.0000

Outliers

The presence of outliers in the data sample can bias the coefficients of the regressions, and should therefore be excluded. In order to investigate the presence of potential outliers the distribution of wages is illustrated below in a histogram and a box plot. The larger sample of 70 120 observations is used as very few of the highest and lowest values are removed when applying the smaller sample for regression 1. *Figure 5* demonstrates the wage distribution. The line illustrates the normal distribution and it can be seen that the sample to a large extent follows this distribution.

Figure 4: Histogram for the Distribution of Wages

Below, in *Figure 6* a box plot of the distribution of wages is presented. The box plot is divided by the median (25 200 SEK) in the middle of the shaded box. The end lines of the box represent the 1st quartile (23 200 SEK) and the 3rd quartile (26 950 SEK). Further out on the sides there are two vertical lines representing the lower and upper one percent of the wages. The lowest one percent of the sample represent those that have a wage below 19 355 SEK and the upper one percent those that have a wage of more than 32 200 SEK. 80 percent of the sample lies in the range 21 250-28 500 SEK.

Figure 5: Box Plot for the Distribution of Wages
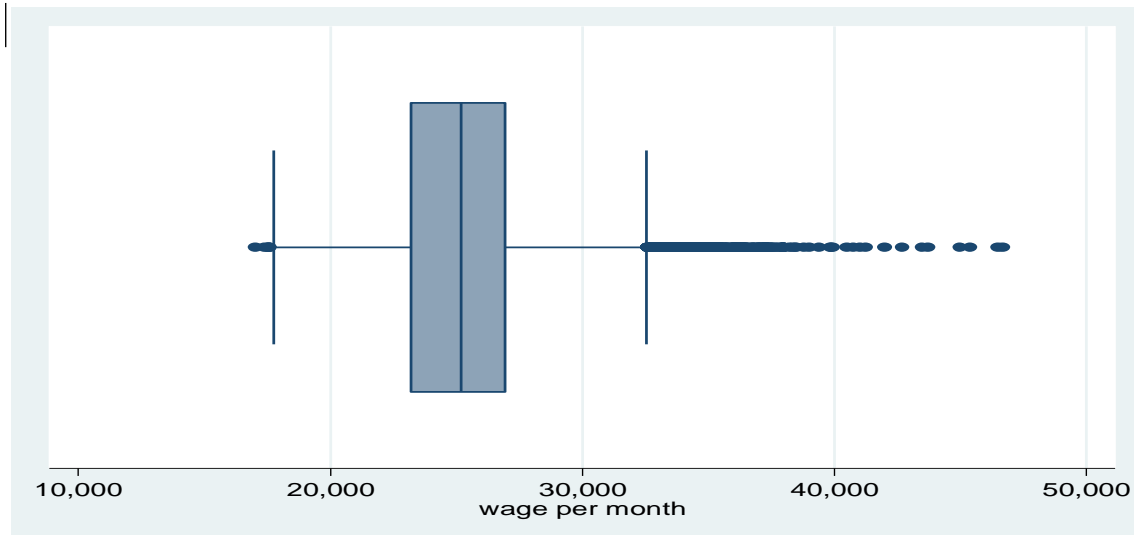
The sample is not considered to have any outliers even though some observations have wages high above the majority. The 12 highest observations show wages between 40 000-46 685 SEK. It could be argued that these observations should be excluded, however doing so may be seen as a way to push the hypotheses of the thesis forward. 10 of these 12 observations are specialists and to take

them away would lead to a lower wage level for specialists compared to when they are included. The average wage for nurses would also decrease, but the effect would be smaller.

The lowest 19 values lie in the range 17 022-18 000 SEK and are thus not as far away from the median as the highest values. Of these 19 only two are specialists (medicine/surgery), which seems reasonable since this category of specialists can include nurses without specialist education. To take these 19 observations away would also benefit the hypotheses since specialists would get lower average wages relative nurses.

6. Results

6.1 First Research Question

Regression 1

The first regression is performed to help answer the first research question, whether experience and specialization has a positive effect on nurses' wages. *Table 6* presents the estimated coefficients with respect to wage. The log-level coefficients represent the percentage return to wage, and the level-level coefficients represent the linear return to wage.

***Table 6:* Results regression 1**

	Coefficients (log-level)	Std. Error	P>t	Coefficients (level-level) *
Intercept	9.99834	.001708	<0.001	22190.05
Specialist	.0621469	.0007315	<0.001	1569.11
Exper	.0151659	.0001007	<0.001	357.93
Exper2	-.0002555	2.51e-06	<0.001	-5.88
Female	-.0194679	.0013334	<0.001	-500.28
Sector	-.0086435	.0012273	<0.001	-250.71
Blekinge	-.0520282	.0018683	<0.001	-1402.70
Dalarna	-.0321723	.0017765	<0.001	-933.02
Gotland	-.0451892	.0050291	<0.001	-1268.20
Gävle	-.0217936	.0019076	<0.001	-647.46
Halland	-.0553276	.0018727	<0.001	-1538.86
Jämtland	.0186334	.0021787	<0.001	404.57
Jönköping	-.0004075	.0017592	<0.817	-98.66
Kalmar	-.0581347	.0018571	<0.001	-1583.64
Kronoberg	-.0653162	.0021238	<0.001	-1735.91
Norrbotten	-.0683042	.0018294	<0.001	-1866.25
Skåne	-.0448465	.0015468	<0.001	-1204.77
Södermanland	-.0528002	.0020655	<0.001	-1403.08
Uppsala	-.0194874	.0019604	<0.001	-544.10
Värmland	-.0218544	.0017811	<0.001	-639.13
Västerbotten	-.0129786	.0015036	<0.001	-419.83

Västernorrland	-.0169555	.0016452	<0.001	-539.83
Västmanland	-.0607389	.0021503	<0.001	-1555.30
Västra Götaland	-.0324052	.0012199	<0.001	-902.09
Örebro	-.0508156	.0015708	<0.001	-1398.23
Östergötland	-.0463972	.0016753	<0.001	-1255.18

Number of observations: 51 103   F (25, 51077)= 3604.86   Prob > F= 0.0000 R^2= 0.6383

* For full level-level results, see Appendix 2.

All variables except Jönköping are significant. The reason for that is probably that it shows high similarity to the baseline variable, Stockholm. The regression has an R^2 value of 0,6383 which can be interpreted as to what extent the independent variables explain the dependent variable wage. Hence, being a specialist gives on average 6 percent higher monthly salary. Female nurses have on average 1,9 percent lower wage than male nurses. Working in a municipality generates on average 0,8 percent less in income. The coefficients for each of the county councils show how much higher or lower return the county council has compared to Stockholm. Only Jämtland shows a higher payoff. In monetary terms it can be concluded that being a specialist generates on average 1 569 SEK more in monthly salary. Women earn 500 SEK less than men. Being employed by a municipality will generate a 250 SEK lover wage than working for a county council. Exper2 is negative implying that the return to experience is slightly decreasing. The first year of experience generates a 1,5 percent higher wage. The return from additional years of experience can be seen in F*igure 7*. The y axis represents the change in wage in percent and the x axis represents experience in number of years. Without introducing Exper2 the percentage effect of being a specialist are instead 7,5 percent and for having one more year of education it is 0,5 percent.

Figure 6: **The Return to Wage from Experience in Regression 1**
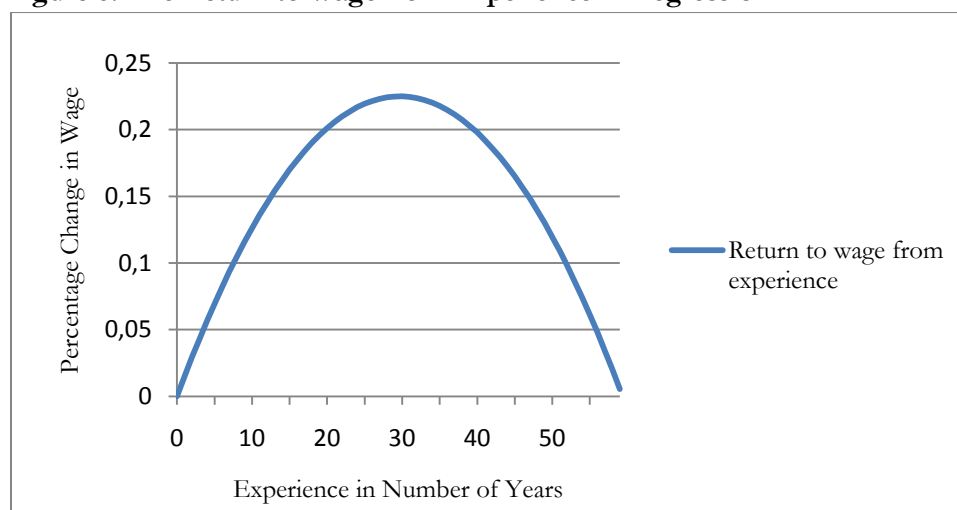
Return on Education

The result of the calculation, presented below in *Table 7,* demonstrates that it will on average take 19 years before a specialist nurse will has a higher aggregated income than a nurse. If the nurse is 24 years old when she starts working as a specialist and 65 when retiring, the calculation shows that she will have 2,30 percent more in aggregated income at the retirement day. For the specialists with the lowest return on education the aggregate income will never be higher than that of a nurse. They would have been economically better off not to specialize. For the specializations with the highest return to education it will take 12 to 13 years before the aggregate income exceeds that of the nurse and at retirement they will have less than five percent higher aggregate income than nurses.

Table 7: **Results, Return on Education**

Specializations	Average improvement in wage for specialists relative nurses*	Number of years past before specialists has higher aggregate income than nurses	Specialists PV of aggregate income in relation to nurses when retiring
Medicine/Surgery	-0,50%	Non applicable	
School Nurse	0,90%	>41 After retirement	-2,78%
Geriatric Care	1,30%	>41 After retirement	-2,40%
Radiographic Nurse	3,40%	>41 After retirement	-0,39%
Specialist, other	3,60%	>41 After retirement	-0,20%
Psychiatric Care	4,00%	35	0,19%
Nurse, children	4,30%	33	0,48%
District Nursing	5,00%	26	1,15%
Ambulance Care	5,50%	23	1,63%
Specialist, special function	6,40%	18	2,49%
Midwife, counseling	7,10%	15	3,16%
Anesthesia	7,90%	13	3,93%
Operation Care	7,90%	13	3,93%
Company Nurse	8,40%	12	4,41%
Intensive Care	8,40%	12	4,41%
Midwife, care	8,80%	12	4,79%
Average specialist	**6,20%**	**19**	**2,30%**

*The origin of these figures is Regression 2, see below.
Note: For detailed result and figures used in the calculation, see *Appendix 3*.

6.3 Second Research Question

Regression 2

The second regression is used in order to answer the second research question, whether the specializations in which the increase in wage is the smallest correspond to those with the largest shortages. The coefficients from regression two is presented below in *Table 8*. Again, the log-level coefficients represent the percentage return to wage, and the level-level coefficients represent the linear return to wage.

Table 8: **Regression 2**

	Coefficients (log-level)	Std. Error	P>t	Coefficients (level-level) *
Intercept	10.00291	.0014635	<0.000	22309.44
Exper	.0145994	.0000842	<0.000	344.82
Exper2	-.000248	2.13e-06	<0.000	-5.72
Female	-.013897	.0010633	<0.000	-362.28
Sector	.0305284	.0014678	<0.000	781.07
Ambulance Care	.0550535	.0021422	<0.000	1301.42
Anesthesia	.0788165	.0014054	<0.000	1998.07
Company Nurse	.0838357	.0074833	<0.000	2195.16
District Nursing	.050432	.0010041	<0.000	1235.77
Geriatric Care	.0135178	.0016001	<0.000	272.82
Intensive Care	.0843749	.0013145	<0.000	2140.69
Medicine/Surgery	-.00477	.0012074	<0.000	-61.16
Midwife, care	.0884515	.0014607	<0.000	2274.32
Midwife, counseling	.0712919	.0017233	<0.000	1808.62
Nurse, children	.0431518	.0013366	<0.000	1052.49
Operation Care	.079076	.0014486	<0.000	1989.21
Psychiatric Care	.0401457	.0014344	<0.000	980.30
Radiographic Nurse	.034421	.0016227	<0.000	822.96
School Nurse	.0092201	.0020833	<0.000	184.67
Specialist, other	.0358735	.0020203	<0.000	883.59
Specialist, special function	.0641804	.0016469	<0.000	1668.65
Blekinge	-.0579322	.0017332	<0.000	-1562.94
Dalarna	-.0434913	.0016116	<0.000	-1221.99
Gotland	-.0766417	.0034779	<0.000	-2090.63
Gävle	-.0296165	.0017309	<0.000	-843.41
Halland	-.0579455	.0015305	<0.000	-1609.36
Jämtland	.0073743	.0019406	<0.000	101.14
Jönköping	-.0052196	.0014183	<0.000	-251.55
Kalmar	-.0614616	.0016445	<0.000	-1675.65
Kronoberg	-.0658671	.0018863	<0.000	-1764.28

Norrbotten	-.0769855	.0014786	<0.000	-2064.49
Skåne	-.0537744	.0012704	<0.000	-1430.87
Södermanland	-.0549069	.0018481	<0.000	-1470.00
Uppsala	-.0302718	.0017265	<0.000	-831.90
Värmland	-.0284768	.0016406	<0.000	-815.44
Västerbotten	-.0216297	.0013718	<0.000	-646.59
Västernorrland	-.0237274	.0015397	<0.000	-716.75
Västmanland	-.061694	.0018229	<0.000	-1604.72
Västra Götaland	-.037851	.0010984	<0.000	-1051.17
Örebro	-.0549364	.0013963	<0.000	-1510.71
Östergötland	-.0530995	.0015011	<0.000	-1430.99

Number of observations: 70 120   F (40, 70079)= 3240.63   Prob > F=0.0000 R^2= 0.6236

* For full level-level results, see Appendix 2.

All variables are significant. The regression has an R^2 value of 0,6236. When controlling for all specialist variables, including those that were dropped in the first regression, the coefficients changes slightly. Women earn on average 1,4 percent less than men (compare with 1,9 percent). Being employed by a municipality will generate a three percent higher income than working for a county council (compare with 0,8 percent less). The difference in the coefficient for sector may be explained by the introduction of the dummy variables for psychiatric care and geriatric care as municipalities mainly employ these specialists. In monetary terms, specialists in for example medicine/surgery earn 61 SEK less than nurses while midwives in care units earn 2274 SEK more than nurses. Women earn on average 362 SEK less than men. Being employed in a municipality will generate a 781 SEK higher wage than working for a county council. Just like in regression one the negative Exper2 implies that the return of experience is slightly decreasing. The effect of experience on wage can be seen in *Figure 8* below. The y axis represents the change in wage in percent and the x axis represents experience in number of years. The first additional year of experience generates a 1,4 percent increase in wage (compare with 1,5 percent in the first regression).

Figure 7: **The Return to Wage from Experience in Regression 2**
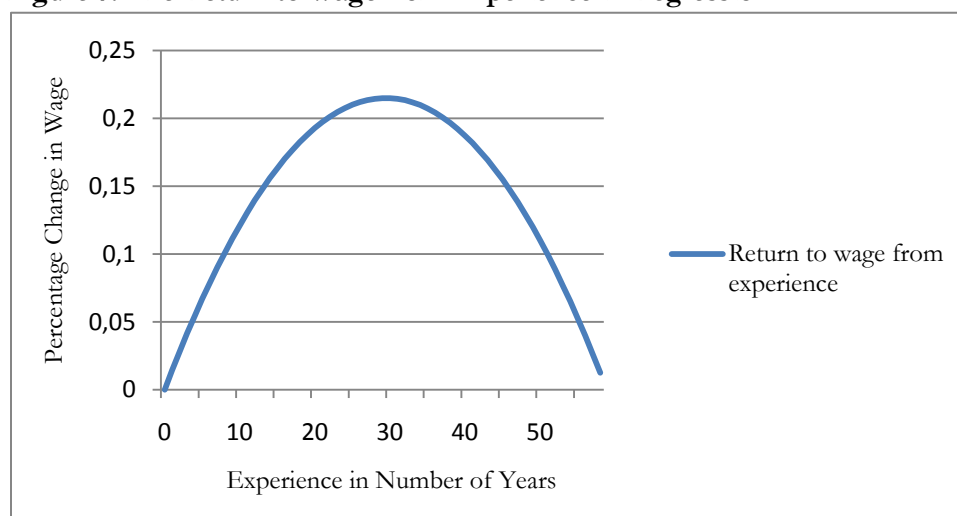
In *Table 9* below, the coefficients for return for the different specializations are listed in descending order, starting with the specialization with the smallest increase compared to nurses. The shaded lines are the specializations with a large shortage. All wage premiums lower than 6,2 percent are below average.

Table 9: **Wage Premium and Shortages**

Specialists	Wage premium	Largest Shortage
Medicine/Surgery	- 0.5%	
School Nurse	+ 0.9%	Health Care for Children and Youth
Geriatric Care	+ 1.3%	Geriatric Care
Radiographic Nurse	+ 3.4%	
Specialist, other	+ 3.6%	Oncology
Psychiatric Care	+ 4.0%	Psychiatric Care
Nurse, children	+ 4.3%	Health Care for Children and Youth
District Nursing	+ 5.0%	District Nursing
Ambulance Care	+ 5.5%	
Specialist, special function	+ 6.4%	
Midwife, counseling	+ 7.1%	
Anesthesia	+ 7.9%	
Operation Care	+ 7.9%	Operation Care
Company Nurse	+ 8.4%	
Intensive Care	+ 8.4%	Intensive Care
Midwife, care	+ 8.8%	

Specialists within medicine/surgery have the smallest increase in wage compared to nurses. The coefficient is negative, suggesting that on average, these specialists earn approximately 0,5 percent less than a nurse. Midwives working in care units have the highest increase in wage compared to nurses. These specialists earn on average 8,8 percent more. The specializations in which the shortage is largest are psychiatric care, health care for children and youth, oncology, district nursing, geriatric care, operation care and intensive care. When comparing these with the results from regression two, a pattern emerges. The specializations that suffer the largest shortages are all except for two (operation care and intensive care) in the lower bottom of the wage increase scale. Thus, it seems as though the specializations in which the increases in wage are the smallest correspond to those with the largest shortages.

7. Discussion

7.1 Analysis

The results show that there is a small monetary payoff to becoming a specialist nurse. Choosing to become and work as a specialist instead of continuing to work as a nurse has a negative or a small positive impact on the aggregate income in the long run. Recent studies recognize that nurses are sensitive to changes in wage. Considering this, the low monetary payoff could have contributed to

the shortage of specialist nurses. Interestingly enough the number of graduated nurses has not declined. One could argue that the interest in becoming a specialist nurse remains, but that the need for specialists has increased faster than the increase in graduated specialist nurses. It could also be that the monetary payoff is too low to attract enough additional nurses to employment or that the shortage is a result of specialist nurses leaving their employments as the monetary incentives to continue working or to work additional hours is too low. Still, both monetary and non-monetary factors can be said to have an effect on the shortage. It is however quite clear that, in spite the possibility of other affecting factors, the monetary incentive for nurses to specialize and to continue their work is small.

In the results from regression two it is shown that the specializations suffering from the largest shortages corresponds to those with the lowest wage increase, except from operation and intensive care. This relationship can be interpreted as a causal effect between low monetary payoff and a shortage of nurses. The interpretation would be that there is a shortage because the monetary payoff is too low. The causal effect in this direction seems more reasonable than the opposite, that the shortage has lead to lower wages. This implies that monetary factors play a significant part in nurse labor supply. The finding is not consistent with the classic supply and demand model, as an increased demand has not lead to higher wages. A possible explanation for this is that monopsonistic power is likely to prevail in the market for nurses. As stated by previous research, monopsonistic power can be counteracted in different ways. When looking at factors that offset monopsony outcomes, bargaining power is central. Unions have been found to be able to negotiate wages that would be similar to those in a competitive market and one might argue that unions then should be the only negotiating party for nurses. On the other hand, having unions as the only negotiating party, using centralized agreements, would probably be difficult for the union to maintain the desired wage differentiations for its members.

In the individual wage system part of the bargaining responsibility is moved from the union to the individual employee. It has been argued that the decentralization of the wage formation process to the individual wage system will counteract monopsony. There should first of all be an increased efficiency in the market as the employer will have an increased possibility to allocate wage increases towards the direction of need. By rewarding those who specialize in areas in need of specialists, shortages should in the long run be reduced. Also, the decentralization has been argued to reduce monopsony power as the individual's bargaining power is increased by the opportunity to move to other employers if not satisfied with the wage increase. It can hence be argued that specialist nurses working in areas with large shortages should have the highest wages. However, as this is not seen in the results, there is reason to believe that there is monopsony power in spite of the individual wage system. If the counteraction of monopsony is conditional of individual's bargaining power and this power is low, the monopsonistic power can be argued to increase when there is an individual wage system. The bargaining power may for example be specifically low for nurses as it is a group dominated by women.

An explanation for why operation and intensive care nurses do not have as low payoff as the other specialization groups suffering from shortages may be the type of tasks carried out by these specialists. It could be that operation and intensive care nurses are working with tasks that cannot possibly be carried out by a nurse without their specific specialization. Positions in the areas of school nurses, geriatric nurses, oncology nurses, psychiatric nurses and district nurses might be filled by nurses without a specialist education. Even if it is not a preferred solution by municipalities or county councils, it would allow them to refrain from increasing wages for the actual specialists in the areas, as they may as well employ a nurse at a lower cost. The fact that the nurses labeled geriatric and psychology specialists in the data set includes nurses without specialization might support this thesis. Nurses are obviously working in the same positions as specialists in these work areas. It is however not clear that this is the case for all the specializations with the lowest wage premiums.

Experience is shown to have a positive effect on wages, which is in line with the aim of the individual wage system. Experience has the largest impact for nurses early in their careers; it may be considered obvious, as an extra year of experience probably is more notable for a nurse in her twenties than for one in her fifties. It is however still interesting that the return on experience is declining. Even though the nurse's experience never will have a negative effect on wage during her career, the effect of it will be less and less reflected on the annual wage increase. If experience is to be rewarded one might think that the impact on wages should increase.

Female nurses are shown to on average have a lower salary than male. This is first of all interesting as there are about 92 percent females in the sample and that parts of the previous research argue that the dialogue model on average will have a positive effect on women's wages. It could however be claimed that the relationship between female and male wages has improved, moving from larger differences than the 1,4 - 1,9 percent difference shown in the results. However, the difference is still present. Support can be found in previous research for arguing that the wage difference partly could be a consequence of the dialogue model. The union and county councils do not call the dialogue model a wage negotiation. However, considering the aspects of the model it can, or perhaps should, be regarded as such. In the dialogue model, just as in wage negotiations, the employee is supposed to influence the wage level by pointing at his or her specific contributions and qualifications. Studies investigating individual bargaining show that men in general negotiate better outcomes than women. Also, women are less likely to initiate negotiations which may imply that men use the dialogue model to a larger extent than women to improve their wages. This could be an explanation for why men on average have a higher income than women. It would also imply that the dialogue model may not be optimal for this employment group.

7.2 Possible Implications

There is reason to suspect that low monetary payoff has given rise to the shortage of specialist nurses. There might also be non-monetary factors affecting the shortage. We do not know if there have been any changes to the non-monetary factors for specialist nurses; however we do know that the wage system has changed. One explanation could be that the wage works as both extrinsic and intrinsic motivation. If looking at the wage as a *signal* from the employer it could in fact function as

an intrinsic motivation as well. The wage could serve as a proof of the employer's appreciation of the nurses work contribution. Before the implementation of individual wage setting for nurses the wage system was determined in central agreements and all nurses was paid according to the same regulations. Whether this implied that specialists was paid on average more than 6.2 percent we do not know as it is difficult to acquire comparable data from that time. However with respect to the apparent draw-backs of the system, it can be said to have been more transparent and easy to understand. Additional education and experience automatically generated a certain wage level and consequently wage could not be interpreted as a signal from the employer.

Hypothetically, a specialist nurse can today receive a lower salary than someone with less education and experience since components such as negotiation skills and mobility on the labor market has an effect on the wage. As a result, a nurse without specialist education might earn a wage that is higher or equal to the one earned by a specialist nurse if he or she is more skilled in wage-negotiating and/or is considered to have a high propensity to change work place. Education and experience is likely to be reflected in competence, and a more competent nurse can thus receive a lower wage than a less competent nurse. For the more competent this wage difference may be interpreted as a signal from the employer that she is not appreciated, which might have severe consequences on the intrinsic motivation for the nurse. One could further speculate whether an individual wage system is appropriate in a line of business where intrinsic motivation probably plays a large part. It could be the case that the focus on individual monetary payoff leads to a *crowding out effect* where the extrinsic motivation, money, crowds out the intrinsic motivation which in the long run would have a dire effect on the health care sector.

9. Conclusion

The findings of the thesis show support for the first hypothesis, that experience and specialist education has a small effect on wage. The wage premium for being a specialist is low, a specialist nurse will on average earn 6,2 percent more than a nurse and at retirement the aggregated income will on average be 2,3 percent higher than the nurse's. It will on average take 19 years before a specialist has higher aggregate income than a nurse and some specialists would have had a better economic outcome if they had remained as nurses. Experience has a diminishing effect on wage. Female nurses have on average a lower wage than male nurses. It seems likely that the wage dialogue model has stimulated this bias in wages in disfavor for females.

Support has also been found for the second hypothesis, that the specializations with the largest shortage correspond to those with the smallest wage premiums. This is the most important finding in the study since it shows that the lack of monetary incentives seems to have contributed to the shortage of specialists. As it is likely that the labor market for nurses is characterized by monopsony this may be a reason for why there is a small wage premium for some specialists in spite of the shortage. The individual wage system seems to stimulate a monopsony structure and thus disfavor high enough wages for specialist nurses. Another reason for why the employers can keep the wages low even though there is a shortage may be that these specialists can be replaced with nurses. The individual wage system fails on parts of its intended purpose, to reward competence through wage.

9.1 Validity and Reliability

Whether the study actually reaches the intended aim of the study could be discussed as there may be different factors affecting the conclusion, such as assumptions made by the authors or factors that are external to the study. The aim was to investigate the monetary payoff of becoming a specialist nurse in order to determine if the individual wage system actually reaches its purpose and to investigate possible implications of a non-working system. One implication is found to be an increasing shortage. Shortage may not be the only implication of the individual wage system, some of which are discussed above. It is also possible that there may be other positive and negative sides of the individual wage system; in this thesis a limitation of the scope of research has however been necessary. Furthermore, the assumption that competence implies length of education and amount of experience disregards the possibility of other factors that may result in enhanced competence.

The analysis is based on previous research where a large part is conducted on American data and an extension to the Swedish nurse labor market has been made. The interpretation of the purpose of the individual wage system is the authors own and is based on recognized sources. It may be argued that the interpretation is too narrow, but throughout the process of the thesis efforts have been made not to make assumptions about the system that could bias the conclusion. It is furthermore assumed that the size of the shortage is to be considered reliable as the survey conducted by The Swedish Association of Health Professionals is confirmed by reports of The National Board of Health and Welfare. Still, a drawback is that not all county councils and municipalities answered the survey. The Swedish Association of Health Professionals can be seen as a party of interest and consideration regarding this has been taking into account when conducting the research.

The statistical method used is based on recognized procedures and should be considered reliable. Experience has been defined as the number of years since graduation. The appropriateness of the definition can be discussed, as it is not certain that the nurse has worked every year since graduation. Still, this was the only clear-cut assumption that could be made. The effect of ability on wage is a factor that would have been desirable to control for. In the thesis it is assumed to be part of the error term as finding a variable that captures the full effect of ability is impossible. As ability is part of the error term one could suspect that the result of a 6,2 percent effect of specializing is an overestimation. Nurses that specialize are likely to have higher ability in general and would even if they did not specialize probably have a higher wage than other nurses. Length of education was used as primary identification for what a specialist nurse is. Even though the large majority of the specializations require one additional year of study, there are two areas that require a longer period of study, district nursing and midwives. District nurses study half a semester more, and midwives one semester more. In the thesis, the differences in length have been considered to have small effect on the overall result.

The conclusion is based on analysis of cross-section data covering observations form one point in time. It can be argued that panel data would have generated results that would have been better. Then again, other limitations to the data would have occurred. It would not have been possible to keep the same level of detail as the observations from 2008 are the first to be divided into all the categories presented and it is furthermore the latest available. Looking at the possibility of

measurement error in the data set, it is possible that some observations may have been wrongly registered. With this in mind, apparent measurements errors have been adjusted for and since there are no outliers and the data sample is large, the estimations ought to be considered reliable. When observing the result from regression two one drawback is that part of the specialist nurses with smallest wage premium and large shortage could include nurses without specialization. This could be one of the reasons for why medicine/surgery has a negative wage premium.

The calculations for return on education were made under certain assumptions and an analysis was performed in order to test the sensitivity of these. In the analysis different discount factors and real wage increase rates was tested on the average return for a specialist. The analysis presented in *Appendix 3*, shows that choosing a discount rate which is lower than 3 percent will lead to a higher present value of the aggregate income. This would be an argument against the presented result. Still, three percent is a recognized assumption for growth rate of the economy whereby the result can be considered applicable. Changing the real wage increase favored the result whereby this was set to zero. The result of the sensitivity analysis shows that the conclusion drawn is still viable.

What can then be said about the generality of the conclusion? Although the focus is on the public sector and all of the observations are members of the union, the conclusion should be able to be applicable when describing the situation regarding the individual wage system and the shortage of specialist nurses. There is no apparent reason for why the conclusion should differ in years to come, given that the underlying factors remain the same. The conclusion may be applicable to other employment groups showing similar characteristics, such as teachers.

10. Future Research

The thesis has resulted in answers of our research questions but also generated questions that need further research in order to be fully clarified. First of all, it would be interesting to see the effect experience and specialization have on wage by looking at the whole period for which the individual wage system has been used. Furthermore, in order to see if there has been a negative or positive effect of the system the same study could be performed on data from the time when the central system was in use. This would allow clarifying if the same pattern as found in this thesis between low wage premiums and shortage of specialists has existed irrespective of wage system. Comparing data from before and after the implementation of the wage system would also allow clarifying if the aim of wage differentiation has been accomplished.

Obtaining data from several years would allow further investigation of the effect of the wage dialogue model. By comparing county councils that have implemented the model at different times one could see how the wages have been affected. It would also be interesting to see if the gender differences have changed compared to when there was a central wage system. Further research on the intrinsic motivation for nurses focusing on the crowding-out effect could also serve to the debate on nurse shortage and implication of an individual wage system.

Studies investigating the possible monopsony of the Swedish labor market for nurses would be interesting since it to a large extent has not been done. If monopsony is found to exist this would

allow a further investigation of whether or not it has increased after the implementation of the individual wage system. Moreover, the mobility of nurses would also be interesting to study as a possible immobility may have a negative effect on their wages.

Finally, an extensive and detailed study of the amount of shortage of specialist nurses and how it develops would be of a great importance in the quest for defeating it.

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Interview

Krabbe, E-L, Association Secretary for the Swedish Association of Health Professionals, March 2010.

Appendix 1

Table 10: **Answers from the county councils**

	County Councils	Yes	No	Not answered
1	Blekinge läns landsting		no	
2	Dalarnas läns landsting	yes		
3	Gotlands	yes		
4	Gävleborgs läns landsting	yes		
5	Hallands läns landsting	yes		
6	Jämtlands läns landsting	yes		
7	Jönköpings läns landsting	yes		
8	Kalmar läns landsting	yes		
9	Kronobergs läns landsting	yes		
10	Norrbottens läns landsting	yes		
11	Skåne läns landsting	yes		
12	Stockholms läns landsting			Not answered
13	Södermanlands läns landsting	yes		
14	Uppsala läns landsting	yes		
15	Värmlands läns landsting	yes		
16	Västerbottens läns landsting	yes		
17	Västernorrlands läns landsting	yes		
18	Västmanlands läns landsting	yes		
19	Västra Götalands läns landsting	yes		
20	Örebro läns landsting	yes		
21	Östergötlands läns landsting	yes		

Appendix 2

Table 10: **Result Regression 1, level-level**

	Coefficients	Std. Error	P>t
Intercept	22190.05	43.16233	<0.000
Specialist	1569.106	19.0745	<0.000
Exper	357.926	2.544703	<0.000
Exper2	-5.8786	.0652344	<0.000
Female	-500.2845	34.21603	<0.000
Sector	-250.7135	32.70977	<0.000
Blekinge	-1402.698	47.51096	<0.000
Dalarna	-933.024	45.39475	<0.000
Gotland	-1268.2	128.827	<0.000
Gävle	-647.4589	49.94226	<0.000
Halland	-1538.86	48.67288	<0.000
Jämtland	404.5695	59.02561	<0.000
Jönköping	-98.65796	47.07021	<0.036
Kalmar	-1583.636	49.0011	<0.000
Kronoberg	-1735.908	54.92869	<0.000
Norrbotten	-1866.246	47.01061	<0.000
Skåne	-1204.772	41.05191	<0.000
Södermanland	-1403.077	51.47554	<0.000
Uppsala	-544.0966	51.60908	<0.000
Värmland	-639.1272	46.65051	<0.000
Västerbotten	-419.8273	39.12507	<0.000
Västernorrland	-539.8348	42.73908	<0.000
Västmanland	-1555.297	54.2817	<0.000
Västra Götaland	-902.092	32.2793	<0.000
Örebro	-1398.231	40.99402	<0.000
Östergötland	-1255.184	43.56747	<0.000

Number of observations: 51 103   F (25, 51077)= 3775.72   Prob > F= 0.0000 R^2= 0.6121

Table 11: Result Regression 2, level-level

	Coefficient	Std. Error	P>t
Intercept	22309.44	37.11188	<0.000
Exper	344.8236	2.126301	<0.000
Exper2	-5.722177	.0551863	<0.000
Female	-362.2778	27.48145	<0.000
Sector	781.0742	38.15524	<0.000
Ambulance Care	1301.423	53.81636	<0.000
Anesthesia	1998.07	38.43635	<0.000
Company Nurse	2195.159	202.4666	<0.000

District Nursing	1235.771	26.5203	<0.000
Geriatric Care	272.8204	41.09363	<0.000
Intensive Care	2140.687	35.44161	<0.000
Medicine/Surgery	-61.15809	29.80197	<0.040
Midwife, care	2274.323	40.85338	<0.000
Midwife, counseling	1808.618	47.29765	<0.000
Nurse, children	1052.49	34.75231	<0.000
Operation Care	1989.214	38.92919	<0.000
Psychiatric Care	980.297	37.34817	<0.000
Radiographic Nurse	822.9562	41.99782	<0.000
School Nurse	184.6713	55.1109	<0.001
Specialist, other	883.5926	51.93626	<0.000
Specialist, special function	1668.652	45.17933	<0.000
Blekinge	-1562.943	44.12173	<0.000
Dalarna	-1221.988	41.111	<0.000
Gotland	-2090.631	89.012	<0.000
Gävle	-843.4098	45.21257	<0.000
Halland	-1609.355	39.78061	<0.000
Jämtland	101.1434	52.1904	<0.053
Jönköping	-251.5473	37.58607	<0.000
Kalmar	-1675.65	43.37448	<0.000
Kronoberg	-1764.276	48.29716	<0.000
Norrbotten	-2064.486	37.77668	<0.000
Skåne	-1430.87	33.46678	<0.000
Södermanland	-1470.002	46.16996	<0.000
Uppsala	-831.8981	44.98426	<0.000
Värmland	-815.4356	42.96403	<0.000
Västerbotten	-646.5885	35.71259	<0.000
Västernorrland	-716.7548	39.88113	<0.000
Västmanland	-1604.723	46.02832	<0.000
Västra Götaland	-1051.168	29.06622	<0.000
Örebro	-1510.708	36.41309	<0.000
Östergötland	-1430.994	38.98359	<0.000

Number of observations: 70 120 $F_{(40, 70079)}$= 3070.59   Prob > F=0.0000 R^2= 0.5993

Appendix 3

Table 12 presents the present value of aggregated income, where it is shown how many years it takes before the present value of the aggregated income for a specialist nurse exceeds that of a nurse. *Table 13* presents the figures used in the calculation for return on education. The specialists' average wage premium has first been used and then the wage premium for each individual wage premium was used (see column *H*). *Table 14* presents the performed sensitivity analysis.

Table 12: **Present Value of Aggregated Income**

Years	Nurse		Specialist	Δ
19	3747106	>	3743446	-0,10%
20	3891947	<	3895700	0,10%
41	6124684	<	6265374	2,30%

Table 13: **Return on Education**

Description of Columns

A	Number of years	**G**	Present value of yearly wage, specialist
B	Yearly wage for a nurse	**H**	Average wage increase specialist
C	Annual wage increase for a nurse	**I**	The sum of remaining of loan each year
D	Present value of yearly wage, nurse	**J**	Yearly amortization on the loan
E	Annual discount factor	**K**	Interest rate to pay on the loan
F	Yearly wage for a specialist	**L**	Yearly rent payment on the loan

A	B	C	D	E	F	G	H	I	J	K	L
1	261600		253981	1,03	81400	79029	1,062	54440			
2	261600	1	246583	1,06	274008	258279	1,062	51718	2722	0,02	1088,8
3	261600	1	239401	1,09	274063	250806	1,062	48996	2722	0,02	1034,4
4	261600	1	232428	1,13	274117	243550	1,062	46274	2722	0,02	979,92
5	261600	1	225658	1,16	274172	236503	1,062	43552	2722	0,02	925,48
6	261600	1	219086	1,19	274226	229660	1,062	40830	2722	0,02	871,04
7	261600	1	212705	1,23	274281	223015	1,062	38108	2722	0,02	816,6
8	261600	1	206509	1,27	274335	216563	1,062	35386	2722	0,02	762,16
9	261600	1	200495	1,30	274389	210297	1,062	32664	2722	0,02	707,72
10	261600	1	194655	1,34	274444	204212	1,062	29942	2722	0,02	653,28
11	261600	1	188985	1,38	274498	198303	1,062	27220	2722	0,02	598,84
12	261600	1	183481	1,43	274553	192566	1,062	24498	2722	0,02	544,4
13	261600	1	178137	1,47	274607	186994	1,062	21776	2722	0,02	489,96
14	261600	1	172948	1,51	274662	181584	1,062	19054	2722	0,02	435,52
15	261600	1	167911	1,56	274716	176330	1,062	16332	2722	0,02	381,08
16	261600	1	163020	1,60	274771	171228	1,062	13610	2722	0,02	326,64
17	261600	1	158272	1,65	274825	166274	1,062	10888	2722	0,02	272,2
18	261600	1	153662	1,70	274879	161463	1,062	8166	2722	0,02	217,76
19	261600	1	149187	1,75	274934	156791	1,062	5444	2722	0,02	163,32
20	261600	1	144842	1,81	274988	152254	1,062	2722	2722	0,02	108,88

21	261600	1	140623	1,86	275043	147849	1,062	0	2722	0,02	54,44
22	261600	1	136527	1,92	277819	144992	1,062	0	0	0,02	0
23	261600	1	132551	1,97	277819	140769	1,062	0	0	0,02	0
24	261600	1	128690	2,03	277819	136669	1,062	0	0	0,02	0
25	261600	1	124942	2,09	277819	132688	1,062	0	0	0,02	0
26	261600	1	121303	2,16	277819	128823	1,062	0	0		0
27	261600	1	117769	2,22	277819	125071	1,062	0	0		0
28	261600	1	114339	2,29	277819	121428	1,062	0	0		0
29	261600	1	111009	2,36	277819	117892	1,062	0	0		0
30	261600	1	107776	2,43	277819	114458	1,062	0	0		0
31	261600	1	104637	2,50	277819	111124	1,062	0	0		0
32	261600	1	101589	2,58	277819	107887	1,062	0	0		0
33	261600	1	98630	2,65	277819	104745	1,062	0	0		0
34	261600	1	95757	2,73	277819	101694	1,062	0	0		0
35	261600	1	92968	2,81	277819	98732	1,062	0	0		0
36	261600	1	90260	2,90	277819	95857	1,062	0	0		0
37	261600	1	87632	2,99	277819	93065	1,062	0	0		0
38	261600	1	85079	3,07	277819	90354	1,062	0	0		0
39	261600	1	82601	3,17	277819	87722	1,062	0	0		0
40	261600	1	80195	3,26	277819	85167	1,062	0	0		0
41	261600	1	77859	3,36	277819	82687	1,062	0	0		0

Table 14: **Results, Sensitivity Analysis**

Discount rate	No. of yrs past before aggregate income for specialists exceeds that of nurses	Present value of aggregate income for specialists compared to nurses, at retirement
1%	16	3,31%
5%	25	1,18%

Real Wage Increase Rate	No. of yrs past before aggregate income for specialists exceeds that of nurses	Present value of aggregate income for specialists compared to nurses, at retirement
1%	23	1,88%
3%	29	0,89%
5%	48	-0,30%