Municipal unemployment and municipal typologies as predictors of disability pension in Norway.

Analytical framework and results of a multilevel analysis.

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Abstract

BACKGROUND: Internationally, Norway is a welfare society with unique social security benefits. The increased health care expenditures that are not expected to decrease in the coming decades are presenting Norway and the other Nordic countries with major fiscal challenges. Disability pensioning (DP) is one of the benefits in which the Nordic countries have a high utilization rate compared to other European countries. Previous research has found geographic variation in the utilization of DP in Norway. Further information on the predictors of this geographic variation is therefore needed in order to better understand the underlying mechanisms of DP.

OBJECTIVE: (i) To investigate municipal unemployment and municipal typologies as predictors of geographic variation in DP utilization in order to better understand contextual mechanisms of DP, and (ii) to describe the Norwegian welfare system with its relatively generous social security benefits with regards to DP and unemployment.

METHOD: A multi-level random intercept logistic regression model is used in order to study the effects of some of the area-level predictors on DP. Data on the entire Norwegian population from the historical event database “FD-Trygd” has been combined with aggregated data on municipal characteristics of all the 430 municipalities from the Norwegian social science data services’ (NSD) regional database.

RESULTS: The area-level predictor that explained most of the between-municipality variation in DP, was municipal unemployment. From bivariate analysis the results show that municipalities characterized by having high unemployment rates had about 1% higher DP rates compared to municipalities with low unemployment rates.

CONCLUSION: The study finds geographic variation in DP. Both individual factors such as age and education, and municipal-level factors such as industry affiliation and centrality affect DP utilisation. The study suggests that the municipal-level factor which influences Dp the most, is municipal unemployment.
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Leif Jostein Reime

Oslo, November 2011
Declarations

Some of the data used in this publication are based on the Norwegian Social Science Data Services (NSD) local database. NSD is responsible neither for the data analysis nor for the interpretation done in this study.

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# Table of Contents

Part 1: Introduction, Background, Methods, Results and Discussion ........................................... 1  
1 Introduction .................................................................................................................................. 1  
    1.1 Purpose ................................................................................................................................. 2  
    1.2 Structure............................................................................................................................... 2  
2 Background and Analytical Framework ....................................................................................... 4  
    2.1 The Norwegian Welfare State ............................................................................................... 4  
    2.2 A Historical Review of Disability Pensioning in Norway ...................................................... 6  
        2.2.1 Accident Insurance and Law on Disability ................................................................. 6  
        2.2.2 National Insurance Act................................................................................................. 6  
        2.2.3 2011 New Proposal for Disability Benefits and Old Age Pensions for the Disabled (Prop. 130 L) .................................................................................................................. 8  
    2.3 Disability Pension and Unemployment in Norway, Numbers and Facts ...................... 10  
    2.4 Common Characteristics of a DP Recipient ......................................................................... 12  
    2.5 The Pull- and Push Model as an Analytical Framework for Studying Causes of DP ........ 14  
        2.5.1 The Pull Model on the Causes of DP ........................................................................... 14  
        2.5.2 The Push Model on Causes of DP ................................................................................ 16  
        2.5.3 The Pull- and Push Model; Two Sides of the Same Coin? ........................................ 16  
3 Data and Methods....................................................................................................................... 18  
    3.1 Choice of Methods and Design ............................................................................................ 18  
    3.2 Data ....................................................................................................................................... 19  
    3.3 Analysis ................................................................................................................................. 20  
4 Results ......................................................................................................................................... 25  
5 Discussion .................................................................................................................................... 26  
    5.1 Structural Aspects of the Labour Market in the Pull- and Push Models Perspective ........ 26  
    5.2 Attitudes towards DP ............................................................................................................ 28
5.3 Strengths and weaknesses

5.3.1 Data

5.3.2 Statistical model

5.3.3 Generalisability

5.3.4 Limitations

6 Conclusion

Literature

Part 2 Geographic variation in unemployment and Disability Pension

7 Article: Municipal unemployment and municipal typologies as predictors of disability pension in Norway: A multilevel analysis.

References

List of Figures & Tables

Figure 1. Recipients of DP, per age group, total population and gender specific (Data source: NAV, 2011).

Figure 2. Unemployed in % of the workforce. Yearly average per August 2011 (Data source: NAV, 2011).

Figure 3. Unemployment rates the past ten years in Norway as a whole and some selected counties (Data source: NAV, 2011).

Table I. Frequency of independent variables (vertical percent) and incidence (horizontal percent) of new disability pensions in the period 1998–2004 among inhabitants in Norway aged 30–55 years in 1997.

Table II. Number of municipalities in Norway (435 in total) within each of the explanatory municipal variables (percent).

Table III. Fixed part model. Age-adjusted gender specific odds ratios for disability pension in 2004 (95% confidence intervals) in the population of Norway between 30–55 years of age not having a disability pension in 1997, across individual (model II), municipal predictors (model III) and both individual and municipal predictors (model IV) in two-level logistic regressions.

Table IV. Random part model. Municipal-level variance, intra-municipal correlation and explained variance for different models.
## Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
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<tr>
<td>OECD</td>
<td>Organization for Economic Co-Operation and Development</td>
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<tr>
<td>DP</td>
<td>Disability Pension</td>
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<td>NAV</td>
<td>Norwegian Labour and Welfare Administration</td>
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<tr>
<td>GP</td>
<td>General Practitioner</td>
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<tr>
<td>SJPH</td>
<td>Scandinavian Journal of Public Health</td>
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<tr>
<td>SSB</td>
<td>Statistics Norway (Statistisk SentralByrå)</td>
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<tr>
<td>NSD</td>
<td>Norwegian Social Science Data Services (Norsk Samfunnsvitenskapelig Datatjeneste)</td>
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</table>
1 Introduction

For the past several years, Norway has been ranked as one of the top best countries of residence by the United Nations Development Program (Human development report, 2010). The ranking is based on a population’s income, education level and life expectancy. When comparing Norway to other European countries, Norway has a historical and current low unemployment rate (OECD, 2009). Internationally, Norway is considered to be a welfare society with unique social security benefits. The right to sick leave, to be ensured a minimum of income to sustain a respectable life standard when out of work, or the right to be compensated with sufficient income when the earning ability is permanently impaired are important features of this industrialized welfare society (Seip, 1981). Persons in need of social assistance and benefits most often must do so due to health issues.

In Norway, several of the country’s benefits have health issues as a direct criterion. Disability pension (DP) is one example, where an eligible individual’s earning ability must be permanently impaired by at least 50% due to illness, injury or defect (National Insurance Act, 1997). DP is the benefit in focus of this thesis, and is therefore used in most of the examples.

Compared to the other European countries, the Nordic countries all have a high level of DP utilization among their citizens (NOU, 2000:27). This causes fiscal challenges as general health improvements increases longevity; young adults start their working life later due to lengthy education; and an increasing rate of the population receive government benefits as their main source of income. The historically high utilization and steadily increasing utilization of disability benefits combined with a high number of recipients prevail, despite the general improvements in public health indicators. This has made DP a source of great political concern in the Nordic welfare states (Stone, 1984; Høgelund, 2003).

In Norway it is observed that there are differences in DP utilization between the different counties and municipalities within counties (Bragstad et al, 2000, Krokstad et al, 2002). If it is true that geographic variation in the allocation of a social security benefit supports the hypothesis that similar cases are systematically treated differently by the Norwegian
Labour and Welfare Administration (NAV), it contradicts the equal treatment principle which is at the basis of the social security legislation. However, it is important to assume that this is not the case and that variations are caused by conditions over which NAV has no reign. This thesis will seek to explore and highlight some conditions that may help explain these geographic variations.

1.1 Purpose

The purpose of the thesis is to explore whether municipal unemployment rates and municipal typologies in Norway may explain some of the geographic variation in individual disability pensioning in order to better understand contextual mechanisms of disability pension (DP). The thesis will also seek to describe the Norwegian DP within a welfare system that has relatively generous social security benefits.

The research question has been: do municipal unemployment rates and municipal typologies in Norway explain some of the geographical variation in individual disability pensioning?

The working hypothesis is that municipalities with high unemployment rates will have the characteristics of restricted local employment conditions and few available jobs, which in turn increases the number of DP recipients.

1.2 Structure

The thesis consists of two parts. The first part, chapters 1-6, opens with an introduction and presentation of the Norwegian welfare state. Chapter 2 describes the historical, present and future framework of disability pensions in Norway. The chapter includes a short presentation of numbers and facts on DP and unemployment rates in Norway before it discusses what characterizes a Norwegian disability pensioner. Chapter 2.6 describes the Pull- and Push model as an analytical framework for studying causes of disability pensioning. Chapter 3 describes the data, methods and analysis that are the basis of the paper. Chapter 4 presents some results and the discussion can be found in Chapter 5. The thesis is concluded in chapter 6.
The second part of the thesis includes an article submitted to the Scandinavian Journal of Public Health (SJPH). A presentation of the variables used in the analysis together with most of the results will be given in the article.
2 Background and Analytical Framework

In this thesis, concepts and methods from social epidemiology are applied to explore the relationship between geographic variation in disability pension (DP) and characteristics of Norwegian municipalities. Krokstad (2004, p. 19) describes social epidemiology as

_Social epidemiology moves beyond a preoccupation with behavioural and other individual risk factors to examine the social context in which they occur and, even more importantly, identifies and describes a range of social conditions that appear to influence a broad range of health outcomes_ (Krokstad, 2004, p. 19).

Social epidemiology combines methods from a variety of disciplines: sociology, economics and political science (Krokstad, 2004). This chapter will therefore give a short description of the Norwegian welfare state: disability pensioning in Norway: unemployment in Norway, and characteristics of a Norwegian disability recipient in order to put the thesis in a social context. The chapter concludes with an introduction of the Pull- and Push models as an analytical framework.

2.1 The Norwegian Welfare State

The Norwegian welfare state is of great importance in that it redistributes wealth, creates jobs, provides a social safety net, education, social services and a variety of health care services to its population (Halvorsen and Stjernø, 2008, p. 32, 41). The Norwegian welfare state is founded on adherence to ideas of equality, justice, solidarity and social integration. Norway is often categorized as a social democratic welfare regime, which is characterized by a governmental commitment to ensure full employment; universal and relatively generous social security schemes; a comprehensive family policy that promotes gender equality; a fundamental and universal minimum pension supplemented by income depending additional pensions which is based on the individual’s previous employment participation; extensive public and social services; and finally that welfare is primarily based on taxation (Halvorsen and Stjernø, 2008, p. 9). Except for the supplement of a mere 4% of the surplus from Norway’s significant petroleum revenues, the Norwegian welfare state is funded primarily through general taxation (Frønes & Kjølsrød, 2005, p. 184).
The term “social democratic welfare regime” is derived from the Nordic countries, where these types of welfare regimes exist and where social democracy has been the dominant force behind the social reforms that gave rise to the welfare state (Esping-Andersen, 1990, p. 26-27). It is therefore often referred to as the Nordic model. This social democratic way of thought differs from the corporatist type found in Germany, France and some other European countries and the liberal type found in the UK and the USA.

Key elements in social democratic welfare regimes are universalism and de-commodification of labour demands and social rights (Esping-Andersen, 1990, p. 21-27). In these regimes labour is a commodity provided in the free market, but social rights make it possible to survive decently without working. In this context, de-commodification serves as an expression to clarify that services are provided on the basis of rights, which dictates that every person shall have a living regardless of the market. Universalism is that these rights apply to everyone.

One of the most prominent features of the social democratic welfare regime is the correlation between welfare and work (Esping-Andersen, 1990, p. 28). The welfare regime is committed to achieving and maintaining full employment, while at the same time it is also dependent on achieving just that. On the one side we have the right to work and the right to income protection. On the other side we can see that the costs of maintaining the principles of solidarity, universality and de-commodity within the welfare system makes it necessary to minimize social problems and to maximize state revenue. This is achieved by ensuring that a high number of the population is employed and that as few as possible depend on social benefits.

Ivar Frønes and Lise Kjølsrud (2005) argues that an oil-rich Norway has had a higher growth in welfare services than other countries, including the Nordic neighbours, since the 1980s. The social democratic, or Nordic welfare regimes, have become service intensive while the corporatist and liberal may be described as transfer intensive. The Nordic welfare regimes are also government rooted in the sense that public institutions finance, facilitate and deliver benefits at a higher level than private organisations (Frønes & Kjølsrød, 2005, p. 187-188).
2.2 A Historical Review of Disability Pensioning in Norway

This chapter will present some of the trends in the evolvement of insurance benefits for the disabled, starting with the Law on Assistance to the Blind and Crippled of 1936 throughout to the proposed reform of May 2011.

2.2.1 Accident Insurance and Law on Disability

Until 1936, accident insurance was the only disability benefit in Norway. The scheme was limited to certain occupational groups with a high risk of accidents, and where the one condition was that the beneficiary had been injured in a work related accident (Seip, 1994).

In 1936, The Law on Assistance to the Blind and Crippled was introduced. This law included individuals with severe and enduring disabilities and was replaced by a general law on disability in 1961.

The disability insurance of 1961 included all persons of working age and was not economically means tested. The benefit was at the same level as old age insurance and was independent of previous income. In order to be entitled DP after the Disability Law a person would have to display a presence of serious and permanent, objectively registerable symptoms of illness, injury or defect. This meant that a person’s subjective statement of symptoms had to be demonstrated through medical testing. In the beginning, the requirement of “seriously and objectively detectable disease” was strictly applied and many people were denied benefits as they did not meet the medical entrance criteria. In time, a certain liberalization of the practice became evident, and individual circumstances were taken into account (Kjønnstad, 1992).

2.2.2 National Insurance Act

In 1967, The Law on Disability was followed by the National Insurance Act (Seip, 1994). The main features of this legislation are still valid. With the introduction of the National Insurance Act, DP was made income-dependent, while those without previous income were secured a minimum benefit. The disability term was re-examined and previous conditions of objectively registerable symptoms and the disease being of a certain severity
was omitted. The condition that the disability had to be due to illness, injury or defect was kept.

Omitting the conditions of objectively registerable and severity led to a significant expansion in the concept of disability. Among other things, mental health problems were now covered by the new law. Conditions such as alcoholism and drug abuse, however, were still not approved as a criterion for DP. During the 1970- and 80s there was a gradual expansion of the concept of medical disease, and following a court ruling in 1976, alcoholism was considered a disease entitling DP. The rapid growth of the number of registered new disability pensioners in the period was probably due to a more liberal application of the medical entrance conditions (Midré, 1990; NOU, 2007: 4).

After the rapid increase of DPs through the 70s and 80s as a result of the concept of disease, the medical requirements for receiving social benefits were tightened at the beginning of the 90s.

The medical and legal conflict between disease and conditions relating to difficult life situations was considered problematic and an amendment in 1991 led to a restriction in the requirements of a causal relationship between a medical condition and reduced work- or income capacity. The requirements towards illness, injury or impairment were made statutory. No diagnosis was omitted, but for disorders with no objective diagnostic findings, the medical terms of disability was only met if there was a broad professional agreement in each case (RTV, 1999). This last condition of a broad professional agreement was repealed after a court ruling in 1994 and an amendment that followed in 1995. It was articulated that social and economic problems did not entitle a DP.

In 2001, a cooperation agreement on a more inclusive working life was signed. This brought the concept of functional ability on the agenda and in 2005, it was specified in the disability regulations that a person would have to present documentation regarding the ability to function from a doctor or another professional.
2.2.3 2011 New Proposal for Disability Benefits and Old Age Pensions for the Disabled (Prop. 130 L).

On January 1, 2011 Norway implemented a new old-age pensions reform. The previous old-age pension scheme was causing growing economical challenges due to the weak growth in the occupationally active population; high average pension amounts and increased longevity. However, the new pension reform made keeping the acting disability pensions scheme problematic. This section of proposed regulations is introduced to give a complete background of historical, current and future regulations in order to emphasize the importance of DP spending in Norway. Because of problems with the acting scheme, the current government has proposed a new disability reform, Prop. 130 L. This is a proposal for new disability benefits and old-age pensions to DP recipients. The new proposed reform states that emphasis will be put on the connection between income lost due to the reduced capacity to work and the size of the DP (Government, 2011; author’s translation).

Main characteristics of Prop 130 L:

- DP in the future is meant to act as compensation for the loss of income as measured by income in the last years before disability occurs. It is proposed that the highest performing three of the five years before disability occurs are to be taken into account, limited up to six times the base amount “G” (As of May 2011 G=79,216 NOK and 6G=475,296 NOK).

- DP is to be taxed as income.

- DP is proposed to be set at 66 % of previous income, and the benefit shall be adjusted annually in line with the increase in the base amount.

- New disability pensioners will be introduced to a new and flexible system of combining disability and work. The current system of re-evaluation of the degree of disability and the one year waiting period before one may take up employment ceases. A system where one may work with a limit up to 0.4 times the base amount without reduction in the DP has been proposed. The degree of disability shall not be adjusted even if earned income exceeds the limit.
• DP recipients will annually earn pension rights as if they were still at work. Earnings will be based on income lost.

The Norwegian Minister of Labour, Hanne Bjurstrøm, answered the question of why the government has proposed a new reform if the current scheme already is working:

It’s a simple reason. The general public health problems have changed in half a century. The demands towards being healthy and the pace of working life are causing some individuals to not fully cope. Altogether this has resulted in that more individuals are partially dependent on DP and partially able to work in reduced positions. Norway needs a new system that meets the challenge of having more people that can, and who will, combine welfare and work depending on their own health situation. The old system was based on a rigid outlook on humanity where people either are completely healthy or completely unable to work. With the new DP, the disability recipients will have the same economic basis of security like before but attempting to work will be easier. This new system will be designed in such a way that ensures that people can combine welfare and work. (Ministry of Labour, 2011. Post in the newspaper VG, author’s translation)

Because of the major changes proposed in DP regulations, the Government is aiming for full implementation of the amendments by 2015. This will allow the Norwegian Labour and Welfare Administration (NAV) sufficient time to prepare for the introduction of the regulations.
2.3 Disability Pension and Unemployment in Norway, Numbers and Facts

On June 30, 2011, there were 302,766 recipients of disability pension in Norway. This is the equivalent to 9.5% of the population (NAV, 2011). Of these 302,766, 172,091 were female and 130,675 were male. There is a steep gradient according to age, with most of the recipients being in the ages 55-67 (Figure 1).

![Norwegian recipients of DP, per age group, total population and gender specific.](image)

Figure 1. Recipients of DP, per age group, total population and gender specific (Data source: NAV, 2011).

The National budget for 2011 proposed to allocate 56.1 billion NOK towards DP in 2011 (National Budget, 2011).

The average number of unemployed people in Norway by the end of August 2011 was 72,367. This is the equivalent to 2.8% of the workforce. Of these 2.8%, 40.4% were female and 59.65 were male. Unemployment follows the opposite gradient of DP, with more unemployed in the younger population (Figure 2).
There is much variation between the Norwegian counties when comes to unemployment rates. The unemployment rate in the northern most county of Finnmark is close to double that of the south-east county of Akershus (Figure 3).

On the basis of this geographic variation in unemployment rates one can assume a hypothesis that geographic variation in DP and unemployment is correlated.
Claiming DP

As previously mentioned there are some requirements that have to be met in order to receive a DP. This is regulated by the National Insurance Act. The main requirements are: that an individual’s capacity to earn an income must be reduced by at least 50%; one must be between the ages of 18-67 years; one must be a member of the Norwegian National Insurance scheme, and the person’s disability has to be due to illness, injury or defect (NAV, 2011).

The individual person is responsible to put forward a claim for benefits from NAV. Employees at the local NAV office or the individual’s general practitioner (GP) may act as an advisor in the process but should not act on behalf of the patient. The GP has no decision-making authority when applying for social security benefits. The person who puts forth the claim shall provide the information necessary, and if required let themselves be examined by a physician. NAV is the ruling authority deciding whether a benefit is granted or not. The claim shall be processed without undue delay, and grounds for rejection shall be given. The decision may be appealed to NAV’s appeals unit in each county, and this decision may again be appealed to the social security court, “Trygderetten”.

2.4 Common Characteristics of a DP Recipient

Historically, there has been a predominance of females among disability pensioners, and without the exception of the mid 1980s there has been a continuous growth in the proportion of female recipients.

From 1980 to 2006 this proportion increased from 5.6% to 7.6%, however, since the year 2000 it appears that the distribution between females and males has stabilised (NOU, 2007:4). There was a decline in first-time registered female DP recipients at the beginning of the 1990s which is thought to be caused by a tightening of the medical criteria for DP in 1991. In this tightening of medical practice there was special focus on the so-called “diffuse disorders”, disorders in which woman are over represented (NOU, 2007:4).

Population health, in most cases, deteriorates with age. This largely explains why the percentage of DP recipients is much higher among older age groups than among younger groups. In 2006, the average age of DP recipients was 53.8 years. Still, there are some
conflicting findings; the age groups below 55 years of age have had an increase in DP percentages since 1990. This increase has, among other factors, been attributed to the high number of post-war children coming of age (Krokstad et al, 2002). In the age groups of 55 years of age and above, females follow the same trend as those under 55 years of age, but males in the same age group showed a lower proportion of DP in 2006 than in 1990 (NOU 2007:4).

As many other health related issues, DP has a strong correlation with socioeconomic status (SES). According to Krokstad et al (2002) there is a significant increase in the risk of DP with decreasing SES. A commonly used proxy for SES is education, and the probability of getting a DP also decreases with an individuals education level (Dahl, 2007; Bruusgaard et al, 2010). First-time recipients of DP generally hold a lower educational level than the population at large for all age groups, and the proportion first-time DPs is highest among people with primary school as their highest education. Krokstad et al (2002) calculated the population attributable risk, which is what percentage of first-time DPs who had not been on DP if they had as little risk of DP as those with high education. They arrived at 46% of new registered female and 52% of new registered male DPs. Furthermore, the group with primary school as their highest education has lower income and generally fewer years in the labour market than the population at large (Dahl, 2007).

Low income as a risk factor of DP has been proven by several researchers (Krokstad et al, 2002; Gjesdal et al, 2005; Valset et al, 2007). Income is also a predictor of SES and according to the NOU of 2007:4, first-time recipients of DP in 2005 had less accumulated pension points than the population at large. The difference is greatest in the age group 30-49 years, where a relatively large proportion of the DP recipients have less than two pension points on average, referring that they have had an annual income of less than 180,000 NOK. About 7% of the DP recipients received a higher income with DP than they had as employed (Fevang & Røed, 2006).

The three industries counting the highest number of DP recipients are the health-and social services sector; the retail sector and the manufacture industry (NAV, 2011). Considering first-time DP recipients as a percentage of employed in each industry by the first half of 2010 it is found that the transport sector, agriculture, forestry and fishing were the industries with the highest number of DPs (NAV, 2011). Little control over their own work
situation and physically strenuous work has also been identified as non-medical risk factors of DPs (Krokstad et al, 2002).

Musculoskeletal disorders, mental and behavioural disorders are the diagnosis groups with the highest percentage of DP recipients. In 2009, approximately two of three recipients where in these diagnostic groups, which is a trend that has been relatively consistent for some time (NAV, 2011).

2.5 The Pull- and Push Model as an Analytical Framework for Studying Causes of DP

In the literature on the transition to early retirement in general, and on DP in particular, a distinction is usually drawn between two main theoretical approaches (Kolberg, 1991; Dahl & Midtsundstad, 1994; Hansen, 1998; Mykletun, 2000; Stattin, 2005). These go under the names of the Pull or Attraction Model and the Push or Exclusion Model. The terms Pull- and Push model will be used here as these are most commonly used. Beyond this, it should be stressed that attempting to explain what causes should determine disability benefits is a complex matter.

The key features of the two models are that the withdrawal from the labour market is based either on individual choice (Pull) or as a result of exposure to structural and environmental factors (Push) (Stattin, 2005). The two models are in the perspective of epidemiology and health sciences regarded as influential. The chapter starts by looking at the Pull model, which has largely been perceived as the economists’ approach, for then to look at the Push model, which has often been described as the sociologist’s perspective.

2.5.1 The Pull Model on the Causes of DP

Economic theory is based on the assumption that man is a rational player. Put to the point, the Pull Model assumes that people have access to and have the understanding of relevant information and that they weigh the advantages and disadvantages to maximize their own benefit (Ehrenberg et al, 2003). With this background, moral hazard may explain some of the paradoxical developments of disability benefits, the paradox being an increase in DP recipients despite improvements in public health indicators. The basic idea is that people
voluntarily leave the labour market because the benefit alternative is perceived as equal or more gainful compared to work, and the transition from employment to benefits is in this perspective a rational choice (Ehrenberg et al, 2003, Stattin, 2005). Pull factors operate on an individual level and refer to the incentive/disincentive tradeoffs within disability programmes (Stattin, 2005).

The financial remuneration from the disability schemes are a crucial and decisive factor. The Pull theory may argue that people are “pulled” out of the labour market due to, what the Organisation for Economic Co-operation and Development (OECD) has pointed out, Norway’s relatively generous benefit programmes (Stattin, 2005; OECD, 2006). The OECD also suggests that Norway must reduce benefits in order to slow down the increase of disability beneficiaries. The relevance of this argument may be difficult to determine, but comparative research shows a clear correlation between the countries with high benefit levels having more people receiving disability benefits, as opposed to those that do not (Prinz, 2003).

In Norway, the GPs role as a gatekeeper is greatly challenged in the Pull model, as the GPs role must hold a balance between the roles of advocate to the patient and the role of gatekeeper on behalf of society (Wahlstrom et al, 2004). Although the decision of granting disability benefits is not part of the GPs responsibilities, their advice is emphasised to a large extent (Söderberg, 2005). Therefore, the GPs find these decisions both difficult and unpleasant, and their assessments are shown to vary from case to case (Getz and Westin, 1995).

The Pull Model also involves reasoning about the individual’s work and leisure preferences. It is difficult to claim that an individual’s decision to leave work is solely based on economic considerations. It is important to consider to what extent work is perceived as attractive in relation to other activities, such as hobbies or family activities (Stattin, 2005). If the Pull Model was to be taken into account and be followed to the fullest, DP would be seen as an actor choosing more leisure time with lower income over less leisure time and more income (Ehrenberg et al, 2003).
2.5.2 The Push Model on Causes of DP

As discussed earlier the Pull Model looks at the transition from employment to DP as a rational choice. The Push Model argues that the cause of this transition is structural and outside the employee’s control (Kolberg, 1991). The paradoxical development of DP is in the Push Model, explained by the increased demands of working life. In the Push Model, the individual makes an unwanted transition from working life towards DP (Hansen, 1998). This model is most widely used in community medicine and is by some criticised for its lack of focus on health as a confounding factor in the relationship between economic incentives and disability benefits.

The Push Model is focused on factors of working life and is concerned with the characteristics of the labour market (Westin, 1990; Stattin, 2005). The fact that people are involuntarily forced from working life is largely explained by trends in the labour market like increased competition and restructuring. These factors influence labour conditions and create a mismatch between what the labour force can provide and the characteristics of labour demands. This causes certain groups to be “pushed” out of the labour market as they do no longer meet the demands. These groups may include the elderly, the ill or individuals lacking the required education, competence and skills.

Groups that are “pushed” out of the labour market follow a strong socioeconomic gradient where the lower social classes come out worse than higher classes (Stattin, 2005). A Swedish study among others of DP argues that manual labour workers are at highest risk of DP while white-collar workers are at a lower risk of DP (Höög and Stattin, 2001; Valset et al., 2007).

2.5.3 The Pull- and Push Model; Two Sides of the Same Coin?

The Pull- and Push models have been regarded as logical contradictions. Where the Pull Model is concerned with the benefit level, entry criteria and other factors of what the social security system offers, the Push Model is concerned with labour market demands. While the first perspective focuses on the individual and its motivation, the other is oriented towards structures that are beyond the individual’s realm (Kolberg, 1991; Hansen, 1998). Typically they represent two models, each extreme in their view of the classic
actor/structure problem. Where one focuses on structural coercion and social demands, the other is more concerned with individual rationality and compulsion incentives.

It may be difficult to maintain a sharp distinction between the Pull- and Push models when moving from theoretical to empirical analysis and practical work (Christoffersen 1995, Mykletun 2000, Stattin, 2005). One of the reasons may be that many of the indicators used in quantitative studies are too coarse. One such example is the relationship between unemployment and subsequent DP. The challenge is to assess how imposed such a transition is, that is; to what extent employment is out of reach.

As Dagsvik et al (2010) points out in the portrayal of the discouraged worker effect, negative experiences in the labour market may impair the individual’s motivation to seek new employment. In this case it would be too narrow to focus on the lack of motivation as the real cause behind why the situation is what it is. For some people the Pull- and Push mechanisms can best be seen as two sides of the same coin, or as Christoffersen (1995) puts it; as two separate steps in the disability process. This leads to the thought of an individual not being either “pushed” or “pulled” from the labour market but rather being “pulled” because being “pushed”. Of course clear cut cases of both push and pull may exist, but more often the case is probably a matter of overlapping mechanisms.

The Pull- and Push Models will be utilized in part of the discussion given in Chapter 5, and they will be used in order to put the discussion in a contextual frame.
3 Data and Methods

Methods may imply a certain path towards a goal, in other words, a systematic way to examine reality. In this sense, method is a tool and a prerequisite for a researcher to gather information and gain knowledge and understanding about the real world. This chapter presents the data and analytical techniques used in the thesis. The chapter starts by going through the choice of methods and design for then to present the data used in the analysis. The chapter then proceeds with a presentation of the statistical procedures employed to analyze the data of the thesis, namely multilevel logistic regression. Advantages and limitations associated with this statistical analysis are given in the discussion in Chapter 5.

3.1 Choice of Methods and Design

To best fit the purpose of the paper the analysis is based on existing data about the Norwegian population. A quantitative approach has been chosen. In the quantitative methods the researcher gathers hard data that may be quantified in the shape of numbers (Olsson & Sørensen, 2003). Quantitative methods offer various choices of design. The data selected for this study is best analysed with a retrospective cross-sectional study design. Retrospective refers to a design where the researcher studies a problem that has manifested itself in the past (Kumar, 2005). This approach is the best fit in order to achieve what the thesis has set out to do, and as the data analysed were from the period 1997-2004. The study is also cross-sectional as it takes a cross-section of the population at one point in time.

Cross-sectional studies are characterized by a number of different characteristics that are recorded in order to study variations and correlations within a given unit (Skog, 2004). In a study based on cross-sectional data the purpose for causal analysis is to identify correlations and correlation patterns. The researcher examines whether survey units with certain characteristics also have other unexpected properties or act in certain ways. A fundamental problem in testing causal hypotheses, based on this type of data, are the problems related to the underlying variables. One may avoid this problem by using the control variable method, which means that underlying variables are accounted for by statistical methods. In order to use statistical methods to account for underlying variables, it is necessary to obtain information that makes it possible to examine whether the units are
different. With these statistical methods various subgroups that are not different in other respects, can be studied. This may be done by using table techniques, or by means of regression (Skog, 2004). In this study regression analysis has been employed in order to control for other variables.

Although controlling for many underlying factors there is always a chance that variables are overlooked because of inadequate knowledge or because of lack of information regarding the conditions that should be controlled. Limited comparability and hence spurious correlations will always be a problem in cross-sectional studies (Skog, 2004).

3.2 Data.

The data researched in this thesis consists of a combination of data from the historical event database FD-Trygd and data from the Norwegian social science data services (NSD) regional database.

FD-Trygd is a historical event database where some of the main subject areas are demography, social conditions, social security, employment, income and wealth. FD-Trygd contains information for the entire Norwegian population starting from 1992 to date. The statistical unit is the individual and information in the database consists of registrations of events in each individual's life span (www.ssb.no). The database is built on information from the following sources: registers in Statistics Norway (SSB), the Norwegian Labour and Welfare Organisation (NAV) and Taxation Authorities. The data has been de-identified for the purpose of research and access is granted through NSD. The benefit in question, DP, is presented in FD-Trygd with both the date of application (claim date) and the date of granting or denial (decision date) the benefit. In this analysis it is beneficial to consider the decision date. Further presentation of the variables and population is given in Part Two of the thesis, which includes the article submitted to SJPH.

NSD’s regional database describes geographical units such as municipalities and the number of individuals within such units (www.nsd.no). The database includes a wide range of macro statistics such as data on demography and employment, and contains information of all Norwegian municipalities from 1760 to date. Access is granted through NSD. The scope of the data is prepared and provided by other data providers than NSD, primarily SSB.
The data in FD-Trygd is de-identified for the purpose of research. The difference between anonymous data and de-identified data is the presence of a link key which may reconnect the replaced unique personal characteristics by means of a serial number. In such it is technically possible to identify individuals. De-identified data will appear as anonymous to the researcher who does not have access to the link key.

3.3 Analysis

In the analysis, the main objective has been to reveal how the relationship between local unemployment and individual DP is manifested. To achieve such an understanding, it is necessary to include several variables that may influence the relationship of which the study is concerned. For this purpose multivariate regression analysis is a widely used tool (Skog, 2004). As the dependent variable in my analysis (DP) is dichotomous, the requirements for normal linear regression are not met, as linear regression requires a metric dependent variable. In such situations, the binomial logistic regression analysis is a useful alternative.

Regression analysis is built up to find how the average value of the dependent variable varies between different values in an independent variable. When the dependent variable is dichotomous, the average corresponds to the proportion that has the value 1 (Skog, 2004, p. 353). This again corresponds to the probability that a random individual in the appropriate category has the value 1. In linear regression analysis the relationship between two variables is described by the formula for the straight line. In logistic regression the linearity assumption is not satisfied. Rather, the relationship between two variables is often represented by an S-shaped curve, which varies between 0 and 1. The S-curve indicates the likelihood that a phenomenon (Y) occurs, given values of the independent variable (X) (Tufte, 2000, p.17). The data does not only have a dichotomous dependent variable, but it also has a hierarchical structure. A multilevel analysis (or hierarchical modelling), more specifically a random intercept logistic regression model, has therefore been used. An example of a multilevel structure in the health services are physicians (level 1) that are nested in hospitals (level 2), and hospitals that are nested in regional health authorities (level 3).
**Multilevel logistic regression**

As mentioned above the data was of a hierarchical nature and as Diez-Roux (2000) puts it:

*Multilevel analysis is an analytical approach that allows the simultaneous examination of the effects of group-level and individual-level variables on individual-level outcomes while accounting for the non-independence of observations within groups* (Diez-Roux, 2000, p.171 and 2002, p.591).

This tradition of analysing data started in education, demography, and sociology, but is now also widely used in the public health field (Diez-Roux, 2000). As the data included measurements on both the individual-level (age, income, education, DP) and the group-level (municipal unemployment, centrality, industry affiliation, residential density). This method has been found to be appropriate.

As one of the key notions in social sciences is that individuals may be influenced by their social context, a multi-level analysis seemed appropriate to display the social context of the thesis. As Diez-Roux (2000, p. 172) puts it:

*Just as studies examining differences between groups may need to take into account possible differences in group composition (i.e. characteristics of the individuals within them), studies of individuals may need to take into account differences in the properties of the groups to which individuals belong* (Diez-Roux, 2000, p.172).

Multilevel analysis can be seen as a methodology that is used to approximate a situation where variation in the dependent variable at one level is explained as a function of variables defined at various levels, plus interactions within and between levels (Diez-Roux, 2000).

The research question could have been analysed by ignoring group membership and focus exclusively on inter individual variation and on individual-level attributes, or could focus exclusively on inter-group variation and on data aggregated to the group level. The latter is most commonly used when analyzing geographic variation in Norwegian DP. An example would be Bragstad et al (2000, 2007, 2008). It could be argued whether one of the above mentioned methods would be appropriate as the analysis chosen for this thesis due to the low clustering of data (intra-municipal correlation of 1.9-2.5%). However, a multilevel
analysis has been employed because this method allowed us to deal with the micro-level of individuals and the macro-level of municipalities simultaneously.

The following part will start by presenting the standard logistic regression model, which has many similarities to the multilevel model and then continue with the multilevel logistic regression model used in this study:

\[
\text{logit}(p_{ij}) = \log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_0 + \beta_1 x_i + \ldots + \beta_n x_n
\]  

(1)

where \(\beta_0\) is the model intercept, \(\beta_i\) are coefficients, and \(x_i\) are measured covariates or predictor variables (Hosmer and Lemeshow, 1989).

There are several ways to write multilevel models and for this thesis two models have been written. First as a combined model with both the individual-level and municipal-level included, secondly as a model derived through a latent variable conceptualization is specified. The latter is the model used by Stata’s command xtlogit and this analysis. The following model specifications are taken from Rabe-Hesketh & Skrondal, 2008; Snijders & Bosker, 1999 and Guo & Zhao, 2000.

Starting with the combined model shown in Guo & Zhao (2000). Consider a two-level model with a single explanatory variable. Recall the data with individuals (level 1) nested within municipalities (level 2). We observe \(y_{ij}\), a dichotomous outcome for individual \(i\) in municipality \(j\) and \(x_{ij}\), an explanatory variable at the individual level. The probability of the response being equal to one is defined as \(p_{ij} = Pr(y_{ij} = 1)\), \(p_{ij}\) is modeled by using a logit link function which follow a standard assumption that \(y_{ij}\) has a Bernouilli distribution. The combined model is then written as:

\[
\log\left[\frac{p_{ij}}{1-p_{ij}}\right] = \beta_0 + \beta_1 x_{ij} + \mu_j
\]  

(2)

where \(\mu_j\) is the random effect at level 2 also called the random intercept. The random effect is assumed to be independent and normally distributed with a mean of 0 and a variance of \(\sigma_\mu^2\), shown by \(\mu_j \sim N(0, \sigma_\mu^2)\). As mentioned, conditional on \(\mu_j\), \(y_{ij}\) is assumed to be independent. If the variance \(\sigma_\mu^2=0\), there is no random intercept, and the model reduces to the ordinary single-level logistic model, indication that there is no significant inter-
municipal variation in the outcome variable. As in the standard logistic model, $\beta_0$ is the model intercept, $\beta_i$ are coefficients, and $x_{ij}$ are measured covariates at the individual level.

The second way to write a random intercept multilevel model is derived through a latent variable conceptualization, and assumes that there exists an unobserved or latent continuous variable $y'_{ij}$ underlying $y_{ij}$. $y'_{ij}$ is not directly observed but we know, however, $y'_{ij} > 0$ if $y_{ij} = 1$ and $y'_{ij} \leq 0$ if $y_{ij} = 1$. To easier show the model I have chosen to write the random intercept multilevel model with a latent response variable, with one individual-level covariate, one area-level covariate and their interaction, this model is easily extended to more explanatory variables (Rabe-Hesketh & Skrondal, 2008; Snijders & Bosker, 1999):

$$y'_{ij} = \beta_0 + \beta_1 z_{1j} + \beta_2 x_{1ij} + \beta_3 z_{1j} x_{1ij} + \mu_j + \epsilon_{ij}$$

(3)

where the latent response model has added the individual level random effect also called level-1 residual $\epsilon_{ij}$. Individual level errors within each group are assumed to be independent and normally distributed with a mean of 0 and a variance of $\tau^2$ shown as: $\epsilon_{ij} \sim N(0, \tau^2)$. As in the previous model $\beta_0$ is the model intercept, $\beta_i$ are coefficients, $x_{ij}$ are measured covariates at the individual level, and $z_j$ which is the area-level or municipal-level covariates.

The multilevel logistic model provides a way of assessing the degree of municipal-level clustering in the outcome variable. The degree of clustering is measured by the intraclass correlation (ICC) or as used in the article, intra-municipal correlation and is written as:

$$\rho = \sigma^2_{\mu}/(\sigma^2_{\mu} + \sigma^2_{\epsilon})$$

(4)

where $\sigma^2_{\mu}$ denotes municipal-level variance and $\sigma^2_{\epsilon}$ denotes individual-level variance, where $\sigma^2_{\epsilon} = \pi^2/3$ and is the variance of the standard logistic distribution. ICC is a measure of the degree of resemblance between lower level units belonging to the same higher level cluster (Diez-Roux, 2002; p. 590). It can also be seen as a measure of the proportion of the total unexplained variance in the outcome that is between municipalities (Snijders and Bosker, 1999; Rabe-Hesketh & Skrondal, 2008).
The model also enables the possibility to measure the proportion of the total municipal-level variance in the outcome variable that is explained by predictor variables (covariates) (either individual-level or both individual- and municipal-level together) relative to a model of the same form that has fewer or no predictor variables (Merlo et al, 2003). Calculated as:

\[
\frac{\sigma_0^2 - \sigma_1^2}{\sigma_0^2} \times 100
\]

(5)

where \(\sigma_0^2\) is the municipality-level variance of the initial model and \(\sigma_1^2\) is the municipality-level variance of the adjusted models (more or all the predictors). In the article this is presented as:

\[
\left(\frac{V_0 - V_1}{V_0}\right) \times 100
\]

(6)

where \(V_0\)=municipal variance of the initial null model and \(V_1\)=municipal variance of the adjusted model. This approach allows the calculation of the extent to which the clustering in the outcome variable at municipality-level is explained by each set of predictor variables at individual- or municipality-level (Merlo et al, 2003).
4 Results

The following chapter provides a recap of the main findings of the study. The results are further elaborated in the article found in Part Two of the thesis.

Of all 1,507,192 inhabitants aged 30-55 years that are eligible for a DP in the period 1998-2004, 9.1% females and 6.7% males received DPs. Although most of the municipalities in Norway were characterized by having low unemployment rates, 11.5% of the municipalities had high female unemployment rates and 16.8% had high male unemployment, (see Methods in the article presented in Part 2 of the thesis for definitions). These municipalities had about 1% higher DP rates compared to municipalities with a low unemployment rate in the bivariate analysis.

As expected, the manual labour municipalities characterised as economies based on fishing and agriculture were among the highest in utilizing DP. It is worth mentioning that all municipalities with economies based on industry, other than those based on mixed service and industry, had lower odds of DP for males compared to the municipalities based on mixed service and industry. This is somewhat different for females where the municipalities with economies based on service and industry had higher odds than the municipalities with other characteristics.

Living in a municipality with high unemployment rate gave a 7-13% higher risk of DP when compared to living in a low unemployment municipality, adjusted for both individual and the other area-level predictors. Although the empty model gave a rather low clustering of DP within the municipalities, the full model still significantly reduced the between-municipality variation in DP. Giving some explanatory power to the model by adding more variables in the full model.
5 Discussion

This chapter will provide further discussion of the results other than the one given in the article found in Part Two of the thesis. It will also discuss the results in the perspectives of the Pull- and Push models. The discussion is divided into structural aspects of the labour market, attitudes towards DP and strengths and weaknesses of the study and its statistical analysis.

First I would like discuss the most obvious reason as to why a certain group of people seek DP more frequently than another, mainly groups being of poorer health than others. An example would be individuals with either a musculoskeletal, a mental or a behavioural disorder. These diagnostic groups are the most common among DP recipients.

In 2009, approximately two of three DP recipients were represented in these diagnostic groups. This trend has been relatively consistent for some time (NAV, 2011).

A parallel can be drawn to the study of municipalities and use municipalities as a grouping variable. However, it would be difficult to prove that the population of one municipality is of poorer health than another. In this case a challenge would be to gather adequate data to even consider examining this hypothesis. However, if it had been possible to control for individual or municipal health issues, this would give the analysis an exciting dimension.

5.1 Structural Aspects of the Labour Market in the Pull- and Push Models Perspective

The analysis finds that the area-level predictor with the greatest influence on DP was municipal unemployment. In line with previous research (Krokstad et al, 2002) where it is found that municipalities with economies characterised by manual labour, like fishing or industrial municipalities, have high number of DP recipients. In a classical Push Model perspective one may present a plausible explanation to why individuals in high unemployment municipalities have higher DP utilisation, by relating their exclusion to their position in the labour market. It is tempting to assume that municipalities with high unemployment levels are characterised by high competition for paid work. The stress caused by being in a situation where the future outlook is uncertain combined by the sectoral working environment, contributes to reducing the individual’s health more rapidly
compared to the general population. It is easy to assume that many of these individuals are employed in occupations affected by environmental strain factors such as fishing, agriculture or industry (Arbeidstilsynet, 2004). The Push Model will in this case point to a kind of exclusion that DP is intended to comprise.

There may also be other structural causes to why an individual is driven towards DP and forced out of the labour market. We could assume that individuals living in municipalities where there is high competition for employment may have problems getting a foothold in the labour market, regardless of cause. This can be even more evident in municipalities where there is lack of work for the unskilled and uneducated workforce. These issues may lead to a situation where the individuals’ economic needs makes DP a viable solution. In accordance with the Push Model, the application will then be considered as a kind of automatic consequence of the economic problems that arise as a result of labour market aspects and this may be regarded as a species of economic exclusion (Halvorsen, 1977). From the perspective of the Pull Model, this situation would rather be considered as economic attraction where the personal preferences of the individual regards a transition towards DP more gainful compared to work or lack of work, and therefore makes the rational choice of applying for one (Stattin, 2005).

The labour dimension in the analysis is represented by the variables: education level, industry affiliation, municipal unemployment and centrality. In line with existing research (Bruusgaard et al, 2010), the analysis show a strong negative correlation between education level and DP recipiency. As a pure effect of education it can be assumed that individuals with no or little education are more likely victims of economic exclusion, given that they have fewer resources to mobilize in the search for paid work in line with the Push Model.

In the Pull Model’s perspective, we can assume that individuals with no or little education are more likely to be oriented towards social security benefits, as they have less to lose financially and perhaps even socially in making such a transition. This again highlights the difficulties that may occur when trying to distinguish between the Push- and Pull models.

The higher utilization represented by some of the industry affiliation subgroups provides obvious conclusions. Individuals living in municipalities with economies that are characterized by high work-loads (fishery, agricultural and industrial municipalities), will
generate a higher share of the cases with legitimate needs, and hence a higher proportion of DPs (Krokstad et al, 2002).

Relocation streams would have been an interesting inclusion to the analysis. Bragstad et al (2000) show that relocation streams systematically affect the observed education levels of Norwegian counties. From this we may assume that relocation affects the composition of the population at risk of DP (the part of the population not receiving DP). This effect would manifest itself in such a way that the propensity of getting a DP is higher in municipalities with net migration than in municipalities where there is net immigration. They also propose that the proportion of individuals with physical or mental strain of work could be higher in regions with extensive depopulation (Bragstad et al, 2000). In the same paper Bragstad et al (p.83) conclude that especially in the 1980s there was a clear tendency in Norway for the DP benefit: “in a number of locations, to act as a pure early retirement scheme for companies that wanted to get rid of older employees”. They also argue that a deteriorating labour market made it difficult to move people into vocational rehabilitation programmes, while at the same time it was observed that the requirement for geographic mobility, seldom or never was considered feasible. These last comments highlights the complexity of the debate if one is “pulled” out of the labour market by forces in which the individual sees greater personal incentives by not relocating and settling with a lower income from DP, or if people are “pushed” out of the labour market on account of structural reasons.

5.2 Attitudes towards DP

The following discussion on whether the geographic differences in DP may be due to different attitudes towards a life dependent on public welfare benefits is a delicate one. This is difficult to discuss as it requires extensive data in order not to be speculative. The debate is made further complicated as it tends to overlook important structural constraints and individualized responsibility.

It has been concluded that the data analyzed for this thesis does not include sufficient measurements to analyze individual attitudes towards social security benefits or their preferences with regards to self-reliance. This makes it difficult to assess whether the observed patterns are due to preferences or attitudes. These preferences and attitudes are to a large degree shaped by experience and opportunities. This implies that people who, with
the passing of time, find their opportunities in the labour market fairly limited, eventually could develop a greater acceptance to living of social services. This option could even become a part of their own preferences. In this way, structural barriers are made invisible and transformed into individual “choice”. It is not, however, denied that attitudes may be part of the explanation, but the data examined is not sufficient to address this in an adequate manner.

Both individual attitudes and collective attitudes may affect the DP application propensity. Recent research on the effect of plant downsizing on DP has attempted to demonstrate that people who live in close proximity of each other influence each other when it comes to the acceptance of social security benefits – referred to as “utility interdependence” (Rege et al, 2007; Lindbeck, 2008). According to Rege et al (2007, p. 5) utility interdependence is

when one’s peers engage in a particular behaviour, it can potentially affect one’s own utility from engaging in that behaviour. In the context of disability participation, this interdependence could operate through at least three channels: social norms, information and leisure complementarities (Rege et al, 2007, p.5).

This dimension is not easily measured in quantitative analysis, but Rege et al (2005, 2007) tend to explain the geographic variation with regards to DP utilization in this way of thought, although they have the same data from FD-trygd as the one examined for this thesis. It is the author’s opinion that it is difficult to defend Rege’s interpretations in attributing a contagion effect followed plant downsizing to observed clusters of DP. These clusters might just as well be attributed to unemployment. If there is a high number of unemployed people in one municipality this contagion effect may occur in terms of social norms, influential attitudes and through the exchange of knowledge about rights and the application process (Bertrand et al, 2000).

5.3 Strengths and weaknesses

This chapter starts by going through some of the strengths and weaknesses of the data and then the statistical model of choice in the thesis; namely the two-level logistic random intercept model. Throughout the first part of this chapter strengths and weaknesses will be related to the concepts of validity and reliability. The chapter will be concluded with some remarks on the thesis generalisability and limitations.
5.3.1 Data

The strength of this thesis is that it contains, to the author's knowledge, one of the few multilevel prospective studies on risk of receiving a DP found in current literature. Another strength is that data are perceived as having a high degree of validity. The concept of validity seeks to answer how well the variables measure what they are meant to do (Kumar, 2005).

Validity is often divided into different types of validity. The logical link between wanting to measure granted DPs and that the data from FD-trygd provides just this, is called face validity. Face validity is favourable as the data in the thesis is taken from reliable registers in Norway, an example would be the dependent variable (DP). The validity of DP is good because all DPs in Norway are granted by NAV and included in FD-trygd. It is therefore assumed that variables taken from these registers measure what they are meant to. There is, of course, the chance that some data may be missing from some individuals as FD-trygd’s is so big and data is contributed from multiple sources across the country. In this particular study there was only a relatively small amount of missing data (8%), offering a high degree of representability.

Another key concept when assessing quality of a study is the concept of reliability. The concept of reliability seeks to explore if the quality of the research instruments, in this case the data, are good, i.e. consistent and predictable (Kumar, 2005). Reliability focuses on how reproducible the measures are on retest, which is assumed to be good in this thesis.

Another type of validity is content validity, which refers to whether or not the data and selected variables (education, municipal unemployment) are the correct variables in order to measure the latent concepts (socioeconomic status, attitudes) we are trying to measure (Kumar, 2005). The variables used in the thesis are in line with current research and content validity is therefore assumed to be good.

A third type of validity is criterion validity, and is concerned with the consistency of results presented with results from similar studies done by others or by similar study designs or methods (Kumar, 2005). As mentioned previously several of the findings are in accordance with previous research, so criterion validity is assumed to be good.
There are mainly two types of criterion validity, these are *predictive* and *concurrent* validity (Kumar, 2005). Predictive validity refers to whether or not the instrument being used predicts the outcomes it is expected to predict, and is assumed to be good. An example would be the use of industry affiliation to draw inferences if individuals are likely to be performing manual labour or not. It may easily be assumed that an individual living in a municipality which is characterised as a fishing municipality is more likely to be performing manual labour, than an individual living in a service municipality. Concurrent validity is concerned with whether scores on for example income agree with scores on other factors it is expected to be related to. In the example of income, there is expected to be a correlation between income and education.

In general the data from Norwegian registers are considered to be good. The data in this thesis should be no exception. There may of course be both human and computer errors in the linking and collecting of data. The data used in this thesis are subject to extensive tests performed by SSB and NSD, respectively, to ensure data quality.

**5.3.2 Statistical model**

An advantage of the statistical model is that multilevel modelling provides a convenient framework for studying multilevel data (Guo & Zhao, 2000, p. 444). This framework allowed systematic analysis of how variables at the two different levels affected the outcome variable (DP). At the same time it allowed analysis of how interactions among variables at different levels affected DP.

At the same time, multilevel modelling corrects for the biases in parameter estimates resulting from clustering (Guo & Zhao, 2000, p.444). If observations are highly correlated within clusters, the more likely it is that ignoring clustering would result in biases in parameter estimates. The data had few correlations within clusters and had a low ICC; this could mean that a normal logistic regression would have yielded similar results. This may be regarded as a potential weakness of the study design.

Another advantage of the multilevel model is that it provides correct standard errors and thus correct confidence intervals and significance tests (Guo & Zao, 2000, p. 444). Traditional linear and binary regression tends to underestimate standard errors when clustering is ignored. One of the most basic assumptions underlying linear and binary
regression is independence of observations, this assumption is violated if observations are clustered into higher-level units. Multilevel models adjust for statistical dependence in the data (Eikemo & Clausen, 2007). If all variation on any levels higher than level 1 of the analysis were to be captured by the observed variables, the multilevel data could be analyzed by traditional logistic regression. As there was some unexplained variation on level 2, multilevel modelling seemed appropriate.

Multilevel analysis has some other challenges as well. The groups that are investigated in multilevel analysis should not be convenient groups of individuals, but groups that are hypothesized to be meaningful in explaining the outcome (Diez-Roux, 2000, p. 184). The grouping of individuals within municipalities is considered to be a meaningful grouping when wanting to analyze DP. Although, it could be argued that there are too many municipalities, and large differences in municipality size. In this case economical regions could be more fitting as groups. According to Diez-Roux (p.184) “a key component of the rationale for multilevel analysis is the notion of emergent group properties, the idea that the group-level variables may provide information that is not captured by individual level data”. As mentioned the grouping of individuals within municipalities is considered to be appropriate to provide information that is not captured by the individual-level in my study.

Another critique pointed at multilevel analysis has been that group-level effects may simply reflect unaccounted for (or incorrectly measured) individual-level predictors (Diez-Roux, 2004). The case of omitted variables that affect both DP or one of the controlling variables is such a problem. It would have been desirable to have a variable including an individual’s profession. Industry affiliation acts as a substitute, but can not be expected to capture the vivid lines a variable containing profession would have captured when it comes to DP. As the same industry affiliation may contain many and sometimes quite different professions. That said the industry affiliation variable is of high relevance to the question at hand in the analyses of geographic variation in municipal DP, and widely used by other researchers (Bragstad, 2000, 2007).

It would have been desirable to include two other variables, those of commuting streams and relocation streams. These variables would have made it possible to measure how realistic it would be for an individual to move in order to gain new employment if unemployed. In accordance with stricter demands towards geographic mobility introduced in 1991, the individual was meant to move if this could help the employment situation
As mentioned, one may never be sure that all explanatory variables have been included, and there may also be the presence of confounding. There may be possible confounders of group-level effects in that individuals are selected into groups based on their individual-level attributes; people of low income/education live in certain municipalities because of the employment outlook. It is also possible that because individual-level factors and group level factors are associated for other reasons, persons living in municipalities characterized by fishing, may be more physically active, which is positive with regards to health and DP. Those living in industry municipalities could be less active.

Residual confounding by miss-measured or unmeasured individual-level variables has long been a critique of studies of group effects. Causes of DP may be correlated with unobserved individual level characteristics. See Diez-Roux (1998, 2004) for a closer description of the confounding effects.

5.3.3 Generalisability

Generalisability is sometimes referred to as external validity, and reflects to what extent the sample is representative of the population (Kumar, 2005). In quantitative research one usually has a sample of a population, in order to generalize the findings from the sample to the population, one relies on probabilities and significance tests. As the present study contains data on the entire Norwegian population and therefore the population with some exceptions is the same as the sample, generalisability should be regarded as good. As mentioned the data contains complete records of the relevant groups including age, gender and disability pension for the entire country. The relatively small amount of missing data on some of the other variables is considered a strength, offering a high degree of representability. Please refer to the article in Part 2 of the thesis for a closer description of missing values.
However, when it comes to generalization beyond the selected time period, the external validity is more uncertain. But because of few changes in this area over the past years, it must be considered good enough to draw inference about the situation to date.

In the present study it may be assumed that the results can be generalised to the population of the other Nordic countries, as they have similar welfare systems and social benefits. The countries are to some extent similar when comes to geographic layout and division into smaller counties and municipalities. This makes comparability between the Nordic states good and they are often compared in research and inferences are drawn across country lines.

**5.3.4 Limitations**

There are some limitations with the present study. Using municipal typologies may reflect the wrong image of a municipality. The typologies are measurements reflecting characteristics of the municipality itself and not necessarily the individuals living in the municipality; therefore one may see this as a limitation.

One example can be the municipal typology of industry affiliation. If a municipality is characterised as an agriculture municipality, it does not necessarily mean that most of the residents in this municipality are employed within the agriculture sector. Rather, this is a measurement of the local employment market in the municipality, the residents may commute to close-by municipalities and be employed within other sectors.

Another limitation is that the labour market for residents in a municipality is usually not limited to the municipality, but also involves the neighbouring municipalities. A possible limitation is therefore the choice of municipalities as area-level predictor in stead of labour market regions.

Finally, the analyses are based on a rather large data set describing all Norwegian municipalities and their residents in the appropriate age groups over a time period of seven years. For some variables, the data were not complete, presenting a limitation for the analyses. The absence of health measures at the population level is a significant limitation, not only in the present thesis, but for large registry studies on DP in general.
6 Conclusion

The previous chapters attempted to shed light on the thesis’ research question: do municipal unemployment rates and municipal typologies in Norway explain some of the geographical variation in individual disability pensioning?

Already in the 1970s, Kolberg (1974) found that the local situation and developments in municipalities influenced the prevalence of DP, suggesting that social contextual factors are important predictors of DP. Better understanding of these mechanisms might result in more effective prevention strategies.

This study finds geographic variation in the prevalence of DP. The study also suggests that geographic variation and municipal differences in DP are determined not only by individual factors such as age, income and education, but also by municipal-level factors such as municipal unemployment and industry affiliation. The contextual and social factors affecting DP are especially prevalent among people with low socioeconomic status who are often employed in manual labour positions. According to Krokstad (2004, p. 51) “there is an increasing emphasis on context. For reasons not fully understood, poor people living in poor neighbourhoods are likely to have poorer health than equally poor people living in more affluent neighbourhoods”.

The study results provide additional information regarding the municipal differences in DP. When observing the increased prevalence of DP in different municipalities, it is important to consider if this is a result of contextual or individual factors. The finding of municipal unemployment being the single most influential municipal-level factor could be of importance in a public administration perspective. The finding suggests that there could be a potential for economic gains in providing stable labour markets in smaller and at-risk municipalities in Norway. This thesis also suggests that further research is required on the subject as the potential of using multilevel analysis is vast. An interesting development would be to look at the importance of the factors omitted in this thesis, namely relocation streams and commuting streams. It is the author’s hypothesis that further research including these factors has the potential to create important knowledge about municipality structure and characteristics.
Literature


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Part 2 Geografic variation in unemployment and Disability Pension

7 Article: Municipal unemployment and municipal typologies as predictors of disability pension in Norway: A multilevel analysis.

Municipal unemployment and municipal typologies as predictors of disability pensioning in Norway: A multilevel analysis

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Abstract

Background and aims: The rise in the number of disability pensioners in Norway has been given much attention by the government and by researchers due to the resulting financial and societal challenges entailed. Eligibility for a disability pension is decided by The Norwegian Labour and Welfare Administration (NAV), and is closely correlated with several socioeconomic predictors. Geographical differences have also been observed in the allocations to recipients of disability pensions, and the purpose of this study was to investigate whether municipal unemployment rates and municipal typologies in Norway may explain some of the geographical variation in individual disability pensioning.

Methods: 436 municipalities in Norway and all 1,507,192 Norwegian males and females between the ages of 30–55 years in 1997 were included in the analysis. Multilevel logistic random intercept analysis was performed to assess the influence on disability pensioning of the individual factors age, education and income together with the area-level factors municipal unemployment, centrality, industry affiliation and residential density.

Results: Individuals in high unemployment municipalities had a 7-17% higher risk of disability pension. Of the total variability in disability pensioning, 2.5% for males and 1.9% for females was between municipalities. The other municipal factors had only small influences.

Conclusion: In addition to individual socioeconomic factors, area-level factors seem to be important determinants of disability pension rates. Municipal unemployment had the greatest influence.

Keywords: Disability pension, unemployment, municipal typologies, municipal, two-level logistic regression, multilevel analysis.
Introduction

Social security benefits such as the disability pension (DP) are important cornerstones in the Nordic welfare states [1]. Due to the societal and financial costs of these benefits, DPs have been the object of much attention by the Norwegian government and among public and private researchers [2]. The Norwegian Labour and Welfare Administration (NAV) grants all DP’s in Norway, and has reported an increase in the number of disability pensioners. In Norway, as in other countries that are members of the Organisation for Economic Co-operation and Development (OECD), this growth has also been the subject of substantial research. The increasing disability rolls has occurred with no obvious change in the prevalence of self-reported disabilities [3]. Several studies have found individual factors such as age, income and education as well as certain structural factors to be important predictors of DP [4,5]. Studies have also found geographical variance in the allocation of DPs [6,7,8]. From previous research, the municipal age composition has proven to be a strong explanatory factor of DP, but also the local employment market has had a great influence [7]. McVicar found that local labour markets play a role, both directly and indirectly, in explaining why DP benefits vary between regions in the USA and UK [9].

There is also a known correlation between the probability of getting a DP and other aspects of the labour market, like restructuring, downsizing and foreclosure of workplaces [10,11]. These local effects caused by factors from without may also be amplified by what Rege et al. [12] calls a contagion effect. This contagion effect is that there tends to be a higher occurrence of DP among people who live in the proximity of those affected by restructuring, and who have social characteristics making interaction possible with those affected.

Geographical variation of DP in the population may be explained by different individual propensities for DP. Advanced age, low education and low income are examples of such individual characteristics. In addition to these individual propensities we had the suspicion that gender specific municipal unemployment in particular would have an impact on number of new recipients of DP. Tests were conducted to determine whether other municipality typologies like centrality, industry affiliation and density of occupation had an effect or would change the potential effect municipal unemployment had on DP.

Aims

We wanted to investigate whether municipal unemployment rates in Norway, as well as municipal typologies, may explain some of the geographical variation in individual disability pensioning, adjusted for individual predictors.

Methods

Our data was a linkage of independent municipal variables collected from the Norwegian Social Science Data Services (NSD) Municipal Database, and data on individual social security variables in the data file “FD-trygd” from NAV. The data on individual factors
and data from NSD were linked through the unique municipality code, permitting us to link characteristics of the municipality to the individuals, since the municipality and place of residence was stated in “FD-trygd”. The sample population comprised Norwegian inhabitants aged 30–55 years in 1997 who were all eligible for a disability pension in the period under study (1998–2004). Persons already receiving a disability pension by the end of 1997 and those who were not registered as living in Norway by the end of 2004 were excluded. This gave us a study population of 1,507,192 persons. The independent municipal characteristics were based on data from the Census of 1990 and were considered to be applicable even though they had been collected some years prior to the study period.

Dependent variable: Disability pension (DP)

Recipients of a DP from 1 January 1998 to 31 December 2004 were the dependent variable. Information on DP was obtained from FD-trygd, which is a reliable source because NAV grants all DPs in Norway. The Norwegian social security system was not changed in the period 1997–2004, the Government’s trial of restrictions was not successful [13].

Independent individual variables

Education. All courses and examinations from all schools and universities are reported to Statistics Norway. The highest obtained level of education was ordered in four groups (Table I). There is a known, strong association between socioeconomic status and disability pension [3,4], and education is often used as a proxy for socioeconomic status when we do not have occupation.

Income. Income reflects the personal, taxable earnings in the calendar year 1997. Income data was obtained from Statistics Norway. Taxable earning comprises wages, pensions and financial income.

Independent municipal variables

Municipal unemployment in 1997. Rates were linked to the individual data by the unique municipality number. The rates were constructed by dividing the gender and age group-specific unemployment numbers in each municipality with the equivalent population numbers taken from NSD to get the gender and age group-specific unemployment rates in each municipality. The variable was divided into three groups (low-, average- and high unemployment) which were based on annual unemployment rates in Norway taken from NAV for the years 1980–2010. These were ordered by ascending sequence, and the ten lowest where put in the low group, the next ten in the average group and the last ten in the high group.

Centrality. The municipal classification of centrality refers to a municipality’s geographical location in relation to a centre where there are features of high-order (core functions). These centres are divided into three levels. The three levels of city centres and the municipalities with no city centre form the four groups in our study (Table I).
We chose to use the main NSD classification including nine codes which are partly based on industry affiliation and partly on centrality. The first four groups in our analysis did not have any special demands in terms of centrality and were kept as they were, while our two last groups were based on the criterion of centrality and were a merger of four codes from NSD in order to remove possible correlation with centrality (Table I).

Residential density. Residential density shows the percentage of the municipality’s population living in urban areas by the 1990 census date. The variable was grouped in three of the original ten groups (Table I). Urban areas were considered areas with at least 200 residents and where the distance between residences usually did not exceed 50 metres.

Statistical analysis was performed using Predictive Analytics SoftWare (PASW) statistics 18 for the bivariate associations and Stata v11 for multilevel analysis. All analyses were done gender specific because differences in DP across gender are substantial [14]. Bivariate associations were tested with chi-square statistics and t-tests with 95% confidence intervals. We used two-level logistic random intercept models with individuals (first level) nested within municipalities (second level). A total of five two-level logistic random intercept models were tested for each gender. In Table III Model II age was included together with the individual level variables, Model III had age and all the municipal level variables, and Model IV had all the variables included. In Table IV only the age variable was entered in Model 0. Model I was made of several small models where age was included together with the other individual and municipal level variables one by one. This gave a total of six steps within Model I. Model II had age and all the individual variables entered simultaneously, and Model III integrated age and all the municipal variables. Finally Model IV had all the variables included.

Intra-municipality correlation was calculated following the formula: [Municipality variance/(municipality variance+(π^2/3))]x100 [15]. When the intra-municipality correlation is high, it should be interpreted as a high level of disability pension clustering in the municipalities and a strong municipal influence on the individual disability pensioning. While a low intra-municipality correlation indicates small geographic differences and a weak municipal influence on individual disability pensioning. In Table IV the contribution to the variance by the stepwise introduction of the different variables in the models was determined using the formula [(V_0-V_1)/V_0]x100, where V_0=municipal variance of the initial null model and V_1=municipal variance of the adjusted model.
Missing data

A total of 8\% of the population (n=121,183) had missing data on one or more of the independent variables, mostly on income (Table I). Of these missing cases, 66.4\% were females and 33.6\% were males. Missing female data were spread equally across the age and income groups and were overrepresented in the lowest education group. Males with missing data were represented to a slightly greater extent in the age group 30–39 years and in the lowest education group and were also overrepresented in the highest income group.

Results

Of all 1,507,192 inhabitants aged 30–55 who were eligible for a disability pension in the period 1998–2004, 9.1\% females and 6.7\% males received a DP (Table I). The municipalities with a high unemployment rate had about 1\% higher DP rate when compared to municipalities with a low unemployment rate, for both females and males. Metropolitan areas had the lowest DP rate for both genders. In the variable industry affiliation, service municipalities had the lowest DP rate for both genders. Fishing municipalities had the highest DP rate for females, and agriculture and mixed service and industrial municipalities the highest rate for males. The municipalities in which 30–59.9\% lived in urban areas had the highest DP rate for both genders.

For both genders, most of the municipalities in Norway were in the low unemployment rate group, and only 11.5\% had high female unemployment and 16.8\% had high male unemployment (Table II). Most municipalities in Norway were characterized by being small centre regions, that is municipalities with no city centres holding more than 5000-10000 residents. Residential density was equally distributed among the three groups.

The fixed part of our models showed that education and income had a great influence on the odds of getting a DP (Model I Table III). This goes for all models and remained unchanged when more variables are added in Model IV. Living in a municipality with average or high unemployment rates gave a 12–34\% higher risk of getting a DP (Model III) compared to low unemployment rates, which seemed to be reduced slightly to 7–17\% when adjusted for municipal variables (Model IV). Males living in municipalities characterized as small town regions and with a low residential density had higher odds of getting DPs than the more central, densely populated municipalities. Females had higher odds in the densely populated municipalities, but were equal to males under the variable of centrality. Males had the highest odds of getting a DP in the mixed service and industry municipalities. Males in fishery municipalities had the lowest odds of getting DPs. Females had the highest odds in the service municipalities and the lowest odds in mixed agriculture and industry municipalities.

The random part of our models showed that introducing more variables from Model 0 to Model IV in Table IV reduced municipal variance in DP for both genders. Model 0 suggested that there was a rather low clustering of disability pensioning within the municipalities (age-adjusted intra-municipality correlation of 2.5\% for males and 1.9\% for females). Though small, the intra-municipality correlations were statistically significant.
Municipal unemployment explained 17.4% of the crude between-municipality variation in DP for males, being the single variable which most influenced the variation. For females, the industry affiliation and residential density variables influenced variation the most, at 6.2%. In Model III, age and the municipal variables accounted for 13.9% of the crude variation for females as compared with age and the individual variables in Model II, which accounted for only 1.5% of the crude variation. The full model significantly reduced the between-municipality variation in DP for males by 34.9% and by 15.5% for females, leaving an intra-municipality correlation of 1.7% for both males and females (Model IV).

Discussion

Municipal unemployment is the area-level predictor with the greatest influence on DP in both the fixed and the random part of our model, with a seemingly greater influence for males than females (Tables III and IV). Surprisingly municipalities with average unemployment have the highest DP rates.

Fishing municipalities have the lowest odds of getting a DP for males, whereas females in fishing municipalities are among the highest odds of DP (Table III). Mixed service and industry municipalities have the highest odds for both genders. Interestingly, living in a small centre region is associated with the lowest odds for DP, that is, living in rural living conditions with many manual labourers and few jobs. The greatest effect of adding the municipal predictors was for females were these predictors substantially reduced the municipal variance (Table IV).

Strengths and weaknesses

The advantage of this study is the large number of persons assessed, the data referring to the relevant age groups for the whole country and the data on age, gender, and disability pensions being complete. Data quality is good and comes from reliable registers in Norway. The method used is another strength, since it utilises both individual and municipal data. The used predictors, to our knowledge, have not been studied to a great degree in a multilevel analysis in Norway. The relatively small amount of missing data (8%) is a strength, offering a high degree of representability.

Correlations between unemployment and disability pension may be regarded as a weakness in our design. We agree that almost all disability pensioners may be regarded as unemployed because they are able to do a job if they get a proper one. On the other hand, relatively few unemployed people apply for a DP. In our study, municipal unemployment explained only 7.1% of age-adjusted male DP rates and 6.2% of female rates (Table IV Model I). Other predictors influencing DP, both individual and municipal, may have been omitted, but those most commonly used are included. Over-adjusting for inter-level confounding is a risk, in that some of the individual variables mentioned could in fact be determined by area-level factors [16]. It is possible to limit the risk of over adjustment by including only a limited number of individual predictors in the study, and this is done by only adding the most commonly used.
Odds ratios of DP

We find that there are geographical differences in disability pensioning across municipalities in Norway. Others have also found similar results [5,6,7,8,9]. Of the area-level characteristics, municipal unemployment explains a part of the individual odds of disability pensioning and is seemingly greater for males than for females (Table III). In a study of geographical variation in DP, Bragstad et al. [8] finds small or no relationships between access to DP for males and municipal unemployment, and some relationship for females, but these are mostly explained by cyclical upturns in the national economy. They propose that the differences may be caused by females being less mobile than males because of family obligations. The differences in results may come from differences in study design. They have used a panel data model with repeated observations on aggregated data for each counting unit, opposed to our multilevel analysis which includes individual data. There are also some differences in terms of industry affiliation showing females in fishery and service municipalities with higher DP rates when compared to the other affiliations. For males, the highest rates are found in agriculture and in the mixed service and industry municipalities. This coincides with previous research showing that disability pensions are more frequently granted to manual labourers than to other segments of the population in Western countries [3,4]. Our results may be transferable to a study which Krokstad and Westin did in Nord-Trøndelag county in Norway [15]. They found a high prevalence of DP in the western and coastal municipalities, where many people are occupied in fishing and industry. They also found a low prevalence of DP in forest and agriculture municipalities in the northeast inland regions of Nord-Trøndelag. The small differences may come from the fact that their study does not differentiate between genders.

Municipal variation

The present study suggests that individual factors as well as municipal factors are important determinants of disability pension rates in Norway. The intra-municipality correlation of 2.5% was small, but was still associated in this particular study with a statistically significant between-municipality variance (Table IV). The study also suggests that there are some gender differences in disability pensioning. It seems that municipal unemployment has a greater impact on males than females. This gender divide may be due to males employed in manual labour work who have experienced some downsizing during recent years. The individual variables explain more of the variance in male disability pensioning than in female. The intra-municipality correlation is rather small in size, but still important enough to be considered as an indicator of between-municipality differences in disability pensioning. After adjustment for individual and municipal factors, an unexplained significant 1.7% intra-municipal correlation remained, showing that there might be other influential factors than those included in our analysis. Although some research on the subject of why disability benefits vary between regions in other countries has been done, such as a literature review of the US and UK research on the subject by McVicar [9], it is acknowledged that this is a complex area in need of more quantitative research. McVicar draws some indications from the literature that the local labour markets
both directly and indirectly, together with other demographic and health characteristics, play a role in explaining why disability benefits vary between regions.

**Conclusion**

Municipal differences in disability pensioning are determined not only by individual factors such as income and education but also by area-level factors such as municipal unemployment rate, centrality, industry affiliation and residential density. These results add information on the municipal differences in disability pensioning. In a public administration perspective, groups of individuals ranked according to certain socioeconomic characteristics should be targeted not only based on these criteria in order to affect the problem of high disability pensioning in Norway, but also on certain municipal characteristics, such as the ability to provide stable labour markets in the smaller and at-risk municipalities in Norway.

**Conflicts of interest**

None of the authors have any conflicts of interest.

**Acknowledgements**

Some of the data used in this publication are based on the Norwegian Social Science Data Services (NSD) local database. NSD is responsible neither for the data analysis nor for the interpretation expounded in this study.

We thank Agata Wrzos-Kaminska for linking data in Statistics Norway and Magne Thoresen for statistical supervision. The study is financed by our appointments at the University of Oslo.
Table I. Frequency of independent variables (vertical percent) and incidence (horizontal percent) of new disability pensions in the period 1998–2004 among inhabitants in Norway aged 30–55 years in 1997.

<table>
<thead>
<tr>
<th>Individual and municipality predictors 1997</th>
<th>Females (n=726,343)</th>
<th>Males (n=780,849)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Incidence of DP</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30–39</td>
<td>42.9</td>
<td>4.1</td>
</tr>
<tr>
<td>40–49</td>
<td>38.0</td>
<td>9.4</td>
</tr>
<tr>
<td>50–55</td>
<td>19.1</td>
<td>19.3</td>
</tr>
<tr>
<td>Missing</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic education</td>
<td>13.7</td>
<td>18.0</td>
</tr>
<tr>
<td>Middle education</td>
<td>56.3</td>
<td>9.3</td>
</tr>
<tr>
<td>College</td>
<td>25.6</td>
<td>4.7</td>
</tr>
<tr>
<td>University</td>
<td>4.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Missing</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Income (NOK)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–42,050</td>
<td>33.8</td>
<td>9.7</td>
</tr>
<tr>
<td>42,051–184,651</td>
<td>29.5</td>
<td>8.7</td>
</tr>
<tr>
<td>184,652–377,499</td>
<td>18.2</td>
<td>8.9</td>
</tr>
<tr>
<td>377,500+</td>
<td>10.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Missing</td>
<td>8.5</td>
<td>8.7</td>
</tr>
<tr>
<td><strong>Municipal unemployment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low unemployment 0–2.5 %</td>
<td>58.7</td>
<td>8.6</td>
</tr>
<tr>
<td>Average unemployment 2.5–3.5 %</td>
<td>36.8</td>
<td>9.5</td>
</tr>
<tr>
<td>High unemployment 3.5+ %</td>
<td>4.5</td>
<td>9.9</td>
</tr>
<tr>
<td>Missing</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Centrality</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small centre regions</td>
<td>13.0</td>
<td>9.5</td>
</tr>
<tr>
<td>Small town regions</td>
<td>7.2</td>
<td>9.3</td>
</tr>
<tr>
<td>Urban regions</td>
<td>24.8</td>
<td>10.0</td>
</tr>
<tr>
<td>Metropolitan areas</td>
<td>55.0</td>
<td>8.4</td>
</tr>
<tr>
<td>Missing</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Industry affiliation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture municipalities</td>
<td>3.0</td>
<td>8.7</td>
</tr>
<tr>
<td>Fishery municipalities</td>
<td>1.4</td>
<td>9.8</td>
</tr>
<tr>
<td>Mixed agriculture and industrial</td>
<td>4.4</td>
<td>8.5</td>
</tr>
<tr>
<td>Industrial municipalities</td>
<td>8.9</td>
<td>9.4</td>
</tr>
<tr>
<td>Mixed service and industrial</td>
<td>36.1</td>
<td>9.6</td>
</tr>
<tr>
<td>Service municipalities</td>
<td>45.3</td>
<td>8.5</td>
</tr>
<tr>
<td>Missing</td>
<td>0.8</td>
<td>8.2</td>
</tr>
<tr>
<td><strong>Residential density</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–29.9 % in urban areas</td>
<td>7.6</td>
<td>8.9</td>
</tr>
<tr>
<td>30–59.9 % in urban areas</td>
<td>17.7</td>
<td>9.6</td>
</tr>
<tr>
<td>60–100 % in urban areas</td>
<td>72.7</td>
<td>9.0</td>
</tr>
<tr>
<td>Missing</td>
<td>2.0</td>
<td>6.1</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td>100</td>
<td>9.1</td>
</tr>
</tbody>
</table>

All differences are statistically significant with p<0.000
Table II. Number of municipalities in Norway (435 in total) within each of the explanatory municipal variables (percent).

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Frequency (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Female municipal unemployment</strong></td>
<td></td>
</tr>
<tr>
<td>Low unemployment</td>
<td>274 (63.0)</td>
</tr>
<tr>
<td>Average unemployment</td>
<td>111 (25.5)</td>
</tr>
<tr>
<td>High unemployment</td>
<td>50 (11.5)</td>
</tr>
<tr>
<td><strong>Male municipal unemployment</strong></td>
<td></td>
</tr>
<tr>
<td>Low unemployment</td>
<td>252 (57.9)</td>
</tr>
<tr>
<td>Average unemployment</td>
<td>110 (25.3)</td>
</tr>
<tr>
<td>High unemployment</td>
<td>73 (16.8)</td>
</tr>
<tr>
<td><strong>Centrality</strong></td>
<td></td>
</tr>
<tr>
<td>Small centre regions</td>
<td>203 (46.7)</td>
</tr>
<tr>
<td>Small town regions</td>
<td>46 (10.6)</td>
</tr>
<tr>
<td>Urban regions</td>
<td>82 (18.9)</td>
</tr>
<tr>
<td>Metropolitan regions</td>
<td>104 (23.9)</td>
</tr>
<tr>
<td><strong>Industry affiliation</strong></td>
<td></td>
</tr>
<tr>
<td>Agriculture municipalities</td>
<td>63 (14.5)</td>
</tr>
<tr>
<td>Fishery municipalities</td>
<td>29 (6.7)</td>
</tr>
<tr>
<td>Mixed agriculture and industrial municipalities</td>
<td>59 (13.6)</td>
</tr>
<tr>
<td>Industrial municipalities</td>
<td>65 (14.9)</td>
</tr>
<tr>
<td>Mixed service and industrial municipalities</td>
<td>150 (34.5)</td>
</tr>
<tr>
<td>Service municipalities</td>
<td>63 (14.5)</td>
</tr>
<tr>
<td>Missing</td>
<td>6 (1.4)</td>
</tr>
<tr>
<td><strong>Residential density</strong></td>
<td></td>
</tr>
<tr>
<td>0–29.9% in urban areas</td>
<td>141 (32.4)</td>
</tr>
<tr>
<td>30–59.9% in urban areas</td>
<td>146 (33.6)</td>
</tr>
<tr>
<td>60–100% in urban areas</td>
<td>142 (32.6)</td>
</tr>
<tr>
<td>Missing</td>
<td>6 (1.4)</td>
</tr>
</tbody>
</table>
Table III. Fixed part model. Age-adjusted gender specific odds ratios for disability pension in 2004 (95% confidence intervals) in the population of Norway between 30–55 years of age not having a disability pension in 1997, across individual (model II), municipal predictors (model III) and both individual and municipal predictors (model IV) in two-level logistic regressions.

<table>
<thead>
<tr>
<th>Individual predictors</th>
<th>Males (n=740,082)</th>
<th>Females (n=645,927)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model II</td>
<td>Model III</td>
</tr>
<tr>
<td>Education (Low=1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle education</td>
<td>0.62 (0.61–0.63)</td>
<td>0.62 (0.61–0.64)</td>
</tr>
<tr>
<td>College</td>
<td>0.30 (0.29–0.31)</td>
<td>0.30 (0.29–0.31)</td>
</tr>
<tr>
<td>University</td>
<td>0.14 (0.13–0.15)</td>
<td>0.14 (0.13–0.15)</td>
</tr>
<tr>
<td>Income (0–42,050=1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42,051–184,651</td>
<td>0.53 (0.52–0.55)</td>
<td>0.53 (0.51–0.55)</td>
</tr>
<tr>
<td>184,652–377,499</td>
<td>0.35 (0.34–0.36)</td>
<td>0.35 (0.34–0.36)</td>
</tr>
<tr>
<td>377,500+</td>
<td>0.26 (0.25–0.26)</td>
<td>0.26 (0.25–0.27)</td>
</tr>
<tr>
<td>Municipal predictors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Municipal unemployment (Low =1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>1.22 (1.13–1.30)</td>
<td>1.17 (1.09–1.25)</td>
</tr>
<tr>
<td>High</td>
<td>1.34 (1.22–1.46)</td>
<td>1.13 (1.03–1.23)</td>
</tr>
<tr>
<td>Centrality (Small centre regions=1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small town regions</td>
<td>1.09 (0.98–1.21)</td>
<td>1.14 (1.04–1.26)</td>
</tr>
<tr>
<td>Urban regions</td>
<td>1.01 (0.93–1.11)</td>
<td>1.04 (0.96–1.13)</td>
</tr>
<tr>
<td>Metropolitan regions</td>
<td>1.01 (0.92–1.10)</td>
<td>1.02 (0.94–1.11)</td>
</tr>
<tr>
<td>Industry affiliation (Mixed service/industry=1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.91 (0.82–1.02)</td>
<td>0.95 (0.85–1.05)</td>
</tr>
<tr>
<td>Fishery</td>
<td>0.90 (0.78–1.04)</td>
<td>0.84 (0.73–0.97)</td>
</tr>
<tr>
<td>Mixed agriculture/industry</td>
<td>0.90 (0.81–1.00)</td>
<td>0.91 (0.83–1.01)</td>
</tr>
<tr>
<td>Industrial</td>
<td>0.88 (0.80–0.96)</td>
<td>0.87 (0.80–0.95)</td>
</tr>
<tr>
<td>Service</td>
<td>0.86 (0.79–0.94)</td>
<td>0.89 (0.82–0.96)</td>
</tr>
<tr>
<td>Residential density (0–29.9%=1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30–50.0%</td>
<td>0.98 (0.91–1.07)</td>
<td>0.98 (0.90–1.05)</td>
</tr>
<tr>
<td>60–100 %</td>
<td>0.94 (0.86–1.03)</td>
<td>0.93 (0.86–1.02)</td>
</tr>
</tbody>
</table>
Table IV. Random part model. Municipal-level variance, intra-municipal correlation and explained variance for different models.

<table>
<thead>
<tr>
<th>Model</th>
<th>Municipal-level variance (percent)</th>
<th>Intra-municipal correlation (percent)</th>
<th>Explained municipal-level variance1 (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td>Males</td>
</tr>
<tr>
<td>Model 0: Age-adjusted</td>
<td>0.086</td>
<td>0.065</td>
<td>2.54</td>
</tr>
<tr>
<td>Model I: Age adjusted individual variables and municipal-level variables separately</td>
<td>0.079</td>
<td>0.063</td>
<td>2.35</td>
</tr>
<tr>
<td>Education</td>
<td>0.074</td>
<td>0.064</td>
<td>2.20</td>
</tr>
<tr>
<td>Income</td>
<td>0.071</td>
<td>0.062</td>
<td>2.10</td>
</tr>
<tr>
<td>Municipal unemployment</td>
<td>0.083</td>
<td>0.063</td>
<td>2.46</td>
</tr>
<tr>
<td>Centrality</td>
<td>0.081</td>
<td>0.061</td>
<td>2.41</td>
</tr>
<tr>
<td>Industry affiliation</td>
<td>0.084</td>
<td>0.061</td>
<td>2.49</td>
</tr>
<tr>
<td>Residential density</td>
<td>0.067</td>
<td>0.064</td>
<td>2.00</td>
</tr>
<tr>
<td>Model II: Age and all individual variables</td>
<td>0.065</td>
<td>0.056</td>
<td>1.93</td>
</tr>
<tr>
<td>Model III: Age and all municipal variables</td>
<td>0.056</td>
<td>0.055</td>
<td>1.67</td>
</tr>
</tbody>
</table>

1Calculated as \([V_0-V_1]/V_0\)\*100, where \(V_0\)=municipal variance of the initial null model and \(V_1\)=municipal variance of the adjusted model

Model 0 had only age as explanatory variable.
References


