Overview of new PhDs in the Nordic countries

Title: Empirical essays at the intersection of economics, health and education
Candidate: Nick Fabrin Nielsen
University: Department of Economics, University of Copenhagen, Denmark

Abstract:
This thesis consists of four self-contained empirical chapters with topics at the intersection of economics, health and education.

In the first chapter, jointly written with N. Skipper, A. Gaulke, S. Sildorf, T. Eriksen and J. Svensson and published in JAMA (2019), we examine the association between type 1 diabetes and standardized test scores among 631,620 children in Danish public schools. We find no difference in standardized reading and mathematics test scores between children with type 1 diabetes and children without diabetes.

In the second chapter, jointly written with N. Skipper, A. Gaulke, T. Eriksen and J. Svensson and published in Diabetes Care (2019), we examine the degree of socioeconomic inequality among Danish children with type 1 diabetes. We document large differences in metabolic control of children across maternal education despite Danish universal access to healthcare. We show that 22.5% of the socioeconomic difference can be explained by more frequent blood glucose monitoring among the children with the highly educated mothers. We consider the number of daily glucose measurements as an indicator of treatment adherence and interpret the associations found between the number of daily glucose measurements and HbA1c as capturing the link between treatment adherence and outcomes.

In the third chapter, published in Journal of Health Economics (2019), I examine the causal effect of retirement on health and healthcare utilization using two identification strategies on Danish full population data. I show that early retirement leads to decreases in GP visits and hospitalizations of 8-10% in the short run and that the reduction in GP visits is driven by women. Additionally, I show that early retirement has no effect on health per se and that statutory retirement has no effect on health or healthcare utilization.

In the fourth chapter, jointly written with J. Laird and T. Nielsen and yet to be published, we investigate the effects of one of the most prevalent childhood shocks: parental divorce. We apply methods previously used by the literature on new compelling data sources. We find small but precisely estimated negative average effects of early family dissolution on children's human capital formation and significant evidence that parental divorce in early childhood leads to higher risk of mental health problems of children in adulthood.
Overview of new PhDs in the Nordic Countries

Title: Essays in health economics - measurement and policy
Candidate: Benjamin Ly Serena
University: Department of Economics, University of Copenhagen, Denmark

Abstract:
The first chapter of the thesis concerns the measurement of inequality in life expectancy across income classes. Period life expectancy of individuals in a given age and income class is normally computed using, as a prediction of future mortality, the current mortality of older cohorts in the same income class. This approach does not account for income mobility.

Using income and mortality records of the Danish population over the period 1980–2013, we show that this leads to a large upward bias in the estimation of the income gradient in life expectancy. By incorporating a classic approach from the social mobility literature, we provide a new method that predicts income mobility and future mortality simultaneously.

With this method, the association between income and life expectancy is lower throughout the income distribution. Without accounting for income mobility, the estimated difference in life expectancy between persons in percentiles 20 and 80 in the income distribution is 4.6 years for men and 4.1 years for women, while it is only half as big when accounting for mobility. We show that life-expectancy inequality is increasing over time, but that this trend is also half as big when accounting for income mobility.

In the second chapter, I study the cognitive consequences of iodine deficiency in adolescence and the benefits of salt iodization policies. While it is well known that iodine deficiency in utero is detrimental to cognitive development, knowledge of the effects of postnatal iodine deficiency is limited. I identify the causal effects of iodine deficiency quasi-experimentally using the introduction of iodized salt in Denmark -- a policy used globally to eradicate iodine deficiency. Denmark went from a ban on iodized salt before 1998 to a mandate after 2001. Combining administrative records on high school grades over a thirty-year period with geographic variation in initial iodine deficiency from iodine in drinking water, I find that salt iodization increases the GPA of high school students by 6-9 percent of a standard deviation. While modest in size these effects come at a low cost, suggesting that improving student nutrition is a low-hanging fruit.

The third chapter asks whether insurance coverage for psychotherapy affects psychiatric hospital use and mental health. I study a 2008 reform of the Danish public health insurance that introduced a 60 percent subsidy on psychotherapy for depression and anxiety patients below age 38. I exploit this policy change and the age threshold in Difference-in-Differences and Regression Discontinuity designs. I find that the subsidy on psychotherapy reduces outpatient psychiatric hospital use by 8 percent, with savings equal to 30 percent of the cost of psychotherapy coverage. The policy also reduces the incidence of suicide attempts by 20 percent, suggesting that psychotherapy coverage improves mental health.

Title: Evaluating organisational changes using quasi-experimental study designs – evidence from a case study including low back pain patients
Candidate: Morten Sall Jensen
University: Faculty of Health Sciences, University of Southern Denmark, Denmark

Abstract:
Introduction: In this thesis, we focus on quasi-experimental designs used for evaluation of the impact of organisational change on low back pain (LBP) patients in one region of Denmark. The organisational changes comprise of centralisation of spine departments in
the region to one specialist hospital and giving general practitioners (GPs) the opportunity to refer LBP patients for a lumbar MRI.

Methods and Data: All analyses in this thesis are based on an unbalanced panel dataset provided by Statistics Denmark. It comprises all Danish citizens aged 18+ from 2008–2013. We have yearly information on citizens’ socio-demographic characteristics, use of primary care providers, and use of pain medication prescribed by a doctor, and detailed information on secondary care usage (procedure codes and ICD-10 diagnosis). We rely on a natural experiment, using the organisational changes to allocate GP’s to intervention region or control regions. We use difference in difference and instrument variable analyses to assess the effects of the organisational changes from 2010–2013 (intervention years) and using 2008 and 2009 as pre-intervention years.

Results: Study I, show that organisational changes, increase the use of lumbar MRI compared with other regions without the specialist hospital or GP referral opportunity.

Study II find an overall increase in lumbar surgery rates compared with other regions without the specialist hospital or GP referral opportunity. When examining lumbar stenosis surgery and lumbar herniated disc surgery, we find the opposite effect—an insignificant decrease in lumbar stenosis surgery rates and a significant increase in lumbar herniated disc surgery rates.

In Study III found a significant reduction in the length of long-term sickness absence following the increases in lumbar MRI for some groups of patients. However, this finding should be interpreted with caution, as there might have been confounding not controlled for in the study. Our outcome is too crude to detect less than 21 consecutive days of sickness absence, and our identification strategy for finding LBP patients in the registries may also be too crude, allowing for contamination from other patient groups, blurring the effects. As a consequence, further investigations are needed in other settings to confirm the effects found in the study.

Conclusions: The thesis concludes that quasi-experimental studies can be used to assess large organisational changes aimed at LBP patients using claims based registries. The thesis advocates that we should continue developing these registries, both at the hospital and primary care levels, as these have the potential to become valuable sources for analyses of the effects of future organisational changes and other health-related matters.

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Title: Costs, effectiveness and cost-effectiveness of biological drugs in the treatment of rheumatoid arthritis and inflammatory bowel diseases

Candidate: Saara Huoponen

University: Faculty of Pharmacy, University of Helsinki, Finland

Abstract:

Objectives: The aim of this study was to evaluate the costs, effectiveness, and cost-effectiveness of biological drugs in the treatment of rheumatoid arthritis (RA) and inflammatory bowel diseases (IBD) (including Crohn’s disease (CD), ulcerative colitis (UC) and IBD unclassified).

Methods: Systematic literature reviews (SLRs) were performed to identify published data on the cost-effectiveness of biological drugs for RA and IBD (study I and II). A patient-level simulation model (study III) was developed to predict costs and outcomes associated with four biological drugs (abatacept, tocilizumab, rituximab and Tumour Necrosis Factor Alpha (TNF) inhibitors) in the treatment of RA patients who have previously been treated with TNF-inhibitors. The patients’ baseline characteristics and regression models used in
the simulation were based on observational data from the National Register for Biological Treatments for RA patients in Finland. In the single-centre prospective observational study (IV), all IBD patients receiving maintenance infliximab therapy at Helsinki University Hospital were switched to biosimilar-infliximab. HRQoL was measured using the generic 15D utility measurement and the disease-specific Inflammatory Bowel Disease Questionnaire (IBDQ). Crohn’s Disease Activity Index (CDAI) or Partial Mayo Score (pMayo), and faecal calprotectin (FC) served for evaluation of disease activity. Data were collected at time of switching and at 3 and 12 months after switching.

Results: The SRL (I) showed that rituximab was the only biological drug that seemed to be cost-effective among RA patients with a previous exposure to TNF-inhibitors with the cost-effectiveness threshold of 35000 €/QALY (Quality-Adjusted Life Year). According to the patient-level simulation model (III), drug costs were the lowest for rituximab in RA patients who had been previously been treated with TNF-inhibitors, but when administration costs and costs of switching were included, drug costs were the lowest for TNF-inhibitors. Rituximab was associated with the highest outpatient and inpatient care costs. The amount of QALY gained ranged from 9.41 for rituximab to 9.66 for TNF-inhibitors.

According to the SLR (II), biological drugs seemed to be cost-effective for the treatment of active severe IBD with the cost-effectiveness threshold of 35000 €/QALY, but the cost-effectiveness remained unclear in the maintenance treatment. Based on the prospective observational study (IV), HRQoL and disease activity, in light of 15D, IBDQ, CDAI, pMayo and FC, were similar over one year following switching in IBD patients. The costs of biosimilar-infliximab were around one third of the costs of originator one, whereas costs related to secondary healthcare (excluding the costs of infliximab) were similar before and after switching to biosimilar.

Conclusions: The patient-level simulation model showed that TNF-inhibitors, abatacept, and tocilizumab were dominant in comparison to rituximab in RA patients, who had been previously been treated with TNF-inhibitors. TNF-inhibitors were the most cost-effective treatment option. In contrast to the results of patient-level simulation model, rituximab was the most cost-effective biological drug among RA patients with an adequate response to TNF-inhibitors based on SLR. The systematic search of the literature revealed that biological drugs seemed to be cost-effective for the treatment of active and severe IBD. Based on the Finnish observational data, HRQoL and disease activity of the infliximab-biosimilar were comparable to the originator one in the maintenance treatment of IBD.

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**Title:** Industrial organization study on spillovers between pharmaceutical markets  
**Candidate:** Markku Siikanen  
**University:** Department of Economics, Aalto University, Finland

**Abstract:**
This thesis is a study in the field of applied industrial organization. The unifying theme of the study are the spillovers between hospital and retail pharmaceutical markets in Finland. This dissertation consists of five chapters where the first chapter serves as the thesis introduction.

The second thesis chapter introduces the Finnish pharmaceutical market. The chapter highlights the institutional arrangements which foster connections between the two pharmaceutical markets and explains the regulation relevant to the analysis presented in this thesis.
The third chapter develops a simple theoretical model which describes the equilibrium relationships between the two pharmaceutical markets. The theoretical model provides testable implications for Chapters 4 and 5.

The fourth thesis chapter investigates the existence of demand spillovers between the two pharmaceutical markets. I examine how pharmaceutical use in the public sector hospitals influences pharmaceutical sales in the retail market. Hospitals use public procurement to obtain pharmaceuticals to the hospital pharmaceutical selection. My research design exploits procurement-induced changes in the hospital selection. I find that retail market sales increase by 2%-47% due to winning the hospital procurement. I also find that reimbursement status and procurement discounts are positively associated with the demand spillover size. For the procurement losers, the effect is mostly negative and ranges from -16% to 2%. A conservative interpretation is that these results represent the upper bound of the actual treatment effect.

The fifth thesis chapter investigates the existence of pricing spillovers between the two markets. I investigate how changes in the price paid by the retail market pharmacies are transmitted to the prices offered in the hospital procurements. The retail market price regulation tries to keep the wholesale prices as low as possible but at the same time the regulator does not take into account the fact that the wholesale prices are used as the reservation price in the hospital procurements. I examine the effect of reference price regulation on pricing in both markets. I find that exogenous changes in the wholesale prices paid by the retail market pharmacies are fully transmitted to the bids hospitals receive. The resulting cross-market price elasticity between the hospital bids and the retail market wholesale price varies between 1.15-1.3, implying that the impact of price regulation reaches more widely than just to the retail market. These results demonstrate the need for incorporating the hospital market into the analysis of the pharmaceutical reforms.

Title: Health and the macro economy: Health responses to the 2008 economic collapse in Iceland
Candidate: Kristín Helga Bærings Birgisdóttir
University: Department of Economics, University of Iceland, Iceland

Abstract:
Health and mortality can be affected in a number of ways by general business cycles and specific macroeconomic events. The varying pace of production over the business cycle can affect the health of a population through changes in factors such as workplace accidents, traffic accidents, and air pollution. For individuals, changes at the macroeconomic level can affect health behaviors because of their effect on incentives due to individuals’ altered leisure time and income. In the case of an economic collapse such as the one in Iceland in 2008, and a subsequent recession, unemployment and/or fewer work-hours can for example change both time usage and consumption patterns, where increased available time is used for leisure, sleep, and exercise.

This dissertation is comprised of three papers where the health response of the 2008 Icelandic economic collapse and subsequent economic crisis is examined. Moreover, the general relationship between business cycles and health in Iceland is explored.

The first paper examines the long-term relationship between economic conditions and population health in Iceland, where health is proxied by mortality rates, life expectancy at birth, and infant mortality. The results of this analysis suggest that such a relationship does not exist in general, but different responses between causes of death are found, and in
some instances between genders. We do however find that for 45-64 years old women a relationship exists, where economic downturns are associated with lower all-cause mortality.

The second paper examines the relationship between the economic collapse of 2008 and hypertension and heart disease in Iceland. When compared to the boom year 2007, the results point to an increased probability of Icelandic women having hypertension in the year 2012, when the Icelandic economy had recovered substantially from the economic collapse in 2008. This represents a deviation from pre-crisis trends, thus suggesting a true economic-recovery impact on hypertension.

The third paper examines whether the economic collapse in 2008 and subsequent economic crisis had an effect on the probability of ischemic heart disease (IHD) events, independent of general business-cycle effects. The results show that the sharp change in economic conditions in 2008 had a positive effect on the probability of IHD events in both males and females. In absolute term these effects were small in magnitude albeit statistically significant. A negative business-cycle effect on the probability of IHD events is furthermore found for both genders. Thus the general business cycle and the economic collapse in 2008 and subsequent crisis can be thought of as separate phenomena with differing effects on IHD.

Title: Health economic aspects of low back pain
Candidate: Gylfi Ólafsson
University: Department of Learning, Informatics, Management and Ethics (LIME), Karolinska Institutet, Sweden

Abstract:
Four out of five people experience low back pain sometime during their lifetime. Problems of the back—and to a less extent of the neck—are consistently in the top seats among the most burdensome diseases in the developed world. In addition to its often-debilitating pain, low back pain is a major contributor to health care costs and lost productivity. The objective of this thesis is to enhance the understanding of the economic aspects of low back pain. The overarching research themes are two. First, are surgical interventions for low back pain cost-effective? Second, what is its burden in Sweden?

The first two papers present results from analyses of a vast database assembled from a range of Swedish institutions covering health care consumption of all patients with low back pain in the Västra Götaland region during 2000–2012. The former paper shows that the national cost of all patients that experienced an episode of low back pain in 2011 was €739 million or €78 per capita. Of this, 65% were due to indirect costs such as absence from work.

The second paper draws on the dataset to create an economic model. It shows that although the majority of patients improve within a few months at a relatively low cost, the sheer number of patients experiencing back pain make the disease costly.

Narrowing down, using results from a randomised controlled trial, the third paper shows that under certain assumptions, surgical treatment of degenerative disc disease is cost-effective when compared to multidisciplinary treatment involving physical therapy and cognitive behavioural therapy. The results are not robust to different assumptions and the interpretation of the results should take that into account.

The fourth and last paper also uses results from a randomised controlled trial of decompression surgery for spinal stenosis. This type of surgery, the most common of all
spinal surgeries, involves treating the spinal stenosis—painful narrowing of the spinal canal—with decompression, where parts of bone and soft tissue are removed to make room for the nerves. The study shows with robust results that fusing vertebra together as part of decompression surgery increases costs with neither short-term nor long-term benefits.

This dissertation shows that the burden of low back pain, including lumbar spinal stenosis and lumbar disc herniation, is not only heavy but distributed widely within and outside of the health care system. Although most treatments are effective, this thesis shows an example of treatments that are being used extensively but are in fact quite wasteful. This could not have been shown without careful research and robust methodology. In order to improve the use of money within the health care, research needs to be conducted to assess where to spend it.

Title: Public policy, health and welfare. three essays in applied microeconomics
Candidate: Signe Aase Abrahamsen
University: Department of Economics, University of Bergen, Norway

Abstract:
The thesis consists of an introductory chapter followed by three academic papers.

The first paper looks at how parental leave use by fathers affects the labor market decisions of the parents, their time allocation, and gender equality. I exploit reforms that extended the father exclusive leave period using regressions discontinuity designs. I find that extending the length of the father quota leads to increased parental leave taken by fathers. However, I find no evidence of neither a shift from market work to home production by fathers, nor a shift in the opposite direction for mothers. Home involvement as measured by parents’ work absence due to the child being ill, is also unaffected. Additionally, the gender pay gap within a couple is not affected. Taken together, this points to the conclusion that continuing expansions of the father quota needs to be justified by arguments other than the commonly used claim, that the father quota works as a policy instrument for gender equality.

The second paper, co-authored with Rita Ginja and Julie Riise, is concerned with how increased availability of health care professionals at schools affects educational achievement, teenage childbearing, welfare dependency, and health in early adulthood. Our empirical strategy uses two dimensions of variation: we combine a 1999-reform that led to a differential expansion in the ratio of school nurses to pupils across Norwegian municipalities, with differences in exposure to the reform across cohorts within each municipality. The reform increased the likelihood of high school graduation and college attendance, and it lead to stronger labor market attachment, and reduced teenage pregnancies. There is also an increase in the use of primary and outpatient hospital services at ages 25-35, which may reflect raised awareness of own health and lowered barriers to consult health professionals. These findings suggest that preventive health care services at schools, provided at a relatively low cost, have positive and lasting impacts.

The third paper, co-authored with Maja W. Grøtting, looks at how increased access to publicly provided eldercare affects later life health of the elderly’s middle-aged daughters, which are often the informal caregivers. We exploit a reform introduced in 1998, that led to an arguably exogenous regional variation in the expansion of formal care services and compare outcomes across municipalities with different levels of care expansion. We find that expanding formal care for the elderly reduced sickness absence for single-child daughters of lone parents in the short run, and that the decrease seems to be driven by
absences due to musculoskeletal disorders and psychological disorders. When assessing long-term health outcomes for the same group of daughters, we find that, overall, long-term health is not affected.

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**Title:** Essays on socioeconomic health inequalities within a setting of specialist health care  
**Candidate:** Søren Toksvig Klitkou  
**University:** Department of Health Management and Health Economics, University of Oslo, Norway

**Abstract:**
The thesis consists of four articles on socioeconomic differences in health and health care in Norway. Socioeconomic differences are investigated for three separate disease groups; for patients with acute myocardial infarction, for patients with breast cancer, and among children who were born before the 32nd week of gestation or weighing below 1500 grams (very premature birth). The first two articles investigate potential mechanisms of differences in survival for acute myocardial infarction and breast cancer patients. In the first article, differences in use of cardiac services for infarction patients are assessed with regard to the relation this has to post-infarction survival. The results for Norway are compared with results for Finland. In both countries, cardiac services contribute toward higher survival by income, but not by education. The magnitude of the contribution is, however, minor when compared to overall survival differences by income and education. The second article evaluates the introduction of a public mammography program targeted at breast cancer in Norway, regarding the effect this program has for survival differences between education groups. It is shown that the decrease in patient mortality is by lower cancer stage-specific mortality at the introduction of the program. The education group differences are similarly reduced, primarily due to fewer differences by cancer stage. In the third article, a cohort of children born very prematurely is followed by the use of hospital care, through the ages one to nine. Compared to children whose maternal grandparents have lower education, the children of higher educated maternal grandparents use equal amounts of hospital care between 1-4 years of age, but a lesser degree of hospital care between 5-9 years. In the fourth article, the differences by educational level in post-infarction survival are compared to the survival differences in the general population. Similar socioeconomic differences exist in the general population, although these are less pronounced. The analysis demonstrates that, of the differences accruing among patients, only some are amenable to change by health services from a disease-specific perspective.

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**Title:** Health care utilization, costs and benefits of treatments in metastatic colorectal cancer  
**Candidate:** Gudrun Maria Waaler Bjørnelv  
**University:** Institute of Health and Society, University of Oslo, Norway

**Abstract:**
Economic evaluations consider both costs and benefits of new interventions and are performed to inform decision makers regarding priorities in the health care sector.

Colorectal cancer is the third-most common cancer, and the third-most common cause of cancer-related deaths. It is also the most resource demanding cancer in Norway.
Colorectal cancers frequently metastasize to the liver, but the economic evidence for curative treatments for colorectal liver metastases, and colorectal cancer patients’ end-of-life, remains limited. As a response, Gudrun Waaler Bjørnelv and her co-authors performed three economic evaluations targeting these patients in her dissertation titled “Health Care Utilization, Costs, and Benefits of Treatments in Metastatic Colorectal Cancer”.

In the first analysis (paper I)—which was performed within a randomized controlled trial—they found that laparoscopic liver surgery, compared to open surgery, led to higher benefits to equal costs for patients with resectable liver metastases. Paper II—which was performed within a mathematic simulation model—showed that liver transplantation compared to chemotherapy-alone for patients with non-resectable liver-only metastases led to substantial increased costs, but also to high health benefits (3-4 life years gained). Lastly, paper III—which was performed by linking six national registers—showed that colorectal cancer decedents on average spent two of their last six months of life in institutions. Married patients (i.e., with access to informal care) stayed 30 more days at home than the never-married, but used more primary and secondary health care services.

The findings support the implementation of laparoscopic surgery and defends the implementation of liver transplantation (in selected patients). The results also show the importance of simultaneously considering care in all levels of the health care sector, in addition to informal care, when researching and planning care delivery for patients at their end-of-life.

Title: Essays in empirical labor economics
Candidate: Thomas Hofmarcher
University: Department of Economics, Lund University, Sweden

Abstract:
This thesis contributes to empirical research in labor economics. It consists of three self-contained papers.

The first paper, The Effect of Paid Vacation on Health: Evidence from Sweden, analyzes the causal effect of paid vacation on health. Using register data on the universe of central government employees in Sweden, I exploit an age-based rule stipulated in the collective agreement covering these employees. The results indicate that no statistically significant changes in health are induced by an increase of three paid vacation days at age 30 and four days at age 40. These findings challenge the anecdotal view of additional paid vacation days as an adequate means to improve workers’ health.

The second paper, The Effect of Education on Poverty: A European Perspective, studies the causal relationship between education and poverty. I construct a novel database comprising compulsory schooling reforms in 32 European countries and use them as instruments for education. I find economically large poverty-reducing effects of education among people aged 30 to 80. This holds true for both objective and subjective measures of poverty. An additional year of education thus reduces not only the likelihood of being classified as poor but also the likelihood of feeling poor.

The third paper, Is There Less Household Specialization in Gay and Lesbian Couples?, examines intra-couple differences in earnings potential as a source of specialization in same-sex and different-sex couples. We find that spouses with a higher earnings potential spend significantly more time on market work and less time on household work than spouses with a lower earnings potential. We observe this pattern in gay, lesbian, and different-sex couples. The effect of intra-couple differences in earnings potential on
household specialization does mostly not differ statistically in gay and lesbian couples relative to different-sex couples.