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Estimating the Socioeconomic Impact from Worksite Health Promoting Activities through a Quantitative Approach

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In recent years, Sweden has faced soaring numbers of sick leave reports and costs associated with sickness absence. This has highlighted the importance of worksite health promoting activities, based on the assumption that such would offset the recent trend shift in public health. Despite the large number of advocates of such programmes, previous literature has failed to draw a consistent conclusion regarding the net economic outcome of worksite health promotion activities. Lack of methodological quality has been pointed out as one of the main reasons to the ambiguous findings. In an attempt to circumvent the caveats associated with longitudinal studies on health promotion programmes, we develop a multi-period dynamic model with the purpose of providing an indication on the socioeconomic implications of worksite health promotion activities in the Swedish economy. We do this by implementing two different programmes, with similar design to existing programmes in Sweden. We find that worksite health promotion programmes implementing mandatory exercise during working hours generate the most efficient outcomes from a socioeconomic perspective.

Keywords: Absenteeism, human capital, health promotion programme, dynamic model

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1. Introduction

Sickness absence and the reduction of it has been on the political agenda in Sweden for years, driven by the rising prevalence of sick leave and the costs associated with it. Since 2010, a trend shift has been observed with soaring numbers of sick leave reports combined with longer absence spells. In 2014, the average number of sick leave days increased to 12.6 per working person, i.e. 5% of the regular annual working days, reaching the highest level since 2007. According to the Swedish Social Insurance Agency, expenditures associated with absenteeism will reach SEK 32 billion in 2015, a 78% increase from 2010, and these are forecasted to continue growing by 10% per annum until 2019 (the Swedish Social Insurance Agency, 2015). Besides rising costs, longer spells of sickness absence are correlated with higher risk of future disability pension, expulsion from the labour market and higher risk of all-cause mortality (Quist et al., 2014).

The importance of exercise as preventive measure has been emphasised in epidemiological studies over the past 60 years. Based on this, the World Health Organisation (WHO) has presented recommendations of exercise in order to offset what they describe as the fourth leading risk factor for global mortality, physical inactivity. The recommendations suggest that healthy adults (18 to 64 years old) should engage in a minimum of 150 minutes of moderate-to-vigorous intensity exercise per week (World Health Organization, 2010). Despite strong support from medical research and national recommendations on physical activity, only a small share of the population in Sweden reach the recommended level of weekly exercise (Eurobarometer, 2014; Hagströmer, Oja & Sjöström, 2007).

The workplace has often been emphasised as a relevant avenue for the promotion of preventive activities, overcoming frequently cited barriers such as the ‘lack of time’ (Malik, Blake & Suggs, 2014). Advocates of worksite health promoting programmes often refer to the compelling evidence on the association between physical activity and health status, arguing that the overall outcome for employers would be positive. Despite these arguments, longitudinal studies evaluating worksite health promotion programmes have failed to provide consistent evidence on the economic implications from these. Recent papers have pointed out methodological caveats as the explanation to the inconsistent evidence and concluded that neither a negative, positive nor a neutral relationship can be established.

In Sweden, various initiatives have been implemented in order to incentivise physical activity. The most popular programme encompasses reimbursement for expenses associated with health promotion, and more recently, a number of organisations have started offering an hour of exercise per week during working hours. Critics have pointed out these programmes lack the necessary ingredients to catalyse intrinsic motivation thereby amplifying inequality in health (Gånedahl et al., 2015; The Swedish Tax Agency, 2005).

Concluding, soaring sick leave numbers and rising costs associated with sickness absence have highlighted the importance of effective preventive measures. WHO has pointed out sedentary living and lack of physical activity as key drivers to this global trend. The worksite is often mentioned as a relevant avenue for the promotion of exercise, overcoming frequently cited barriers such as lack of time. Despite the large number of advocates of worksite health promotion programmes, existing literature has failed to draw a consistent conclusion on the effectiveness of these, mainly due to methodological caveats.

1.1 What are the socioeconomic implications of worksite health promoting activities?

Against the backdrop of existing literature, the purpose of this paper is to provide an indication of the socioeconomic implications from worksite health promoting activities. Our ambition is to complement the current state of knowledge and to provide a conclusion where previous papers have failed to do so.

This is done by evaluating two different programmes, based on existing programme designs in Sweden. By looking at this, we hope to (1) increase the transparency with regards to worksite health promotion, in terms of economic implication, (2) as well as to provide tangible guidance on the design of such programmes for efficient promotion of public health.

We apply a new methodological approach in order to circumvent the main caveats associated with longitudinal studies within this field. Based on the solid evidence drawn from epidemiological studies, we apply a multi-period dynamic model simulating the outcome of worksite health promotion programmes in Sweden, under several simplified assumptions.

Since we do not rely on data collected from organisations implementing health promotion programmes, we avoid endogeneity problems and attrition bias, while quantifying the effects of health promotion programmes on a national level rather than studying just one or two firms - previous literature has mainly focused on organisations within the U.S.

Besides providing a new methodological approach, our intention is to expand the geographical scope of studies on worksite health promotion. In this way, our hope is that the paper will provide new insights to the studies of worksite health programmes applicable to the Swedish economy specifically.

A soaring national budget and increasing sickness absence numbers, in Sweden, highlight the importance of finding tools to tackle lifestyle related diseases. We consider this paper a first step in the direction towards doing so.

1.2 Structure of the paper

In the following, we provide observations regarding the current health state, exercise habits and lifestyle related diseases in the Swedish economy – Section 2. Section 3 provides an overview of the research on physical activity and its outcome from an epidemiologic and economic perspective. This provides the

foundation for the research on worksite health promotion programmes, presented further in the same section. As a final part of Section 3, we lay forward the recent critique on the evaluations of health promoting programmes and their impact from an economic perspective. Section 4, turns towards the choice of methodology for this paper. The model and calibration of it is presented in Sections 5 and 6. Finally, we provide our results and a discussion on potential implications in Sections 7 and 8.

2. Background

Based on existing compilation of scientific evidence on the relationship between physical activity and disease risk, WHO (2010) has presented recommendations of physical activities for three age categories; 5 to 17 years old; 18 to 64 years old; and 65 years old and above. The recommendations suggest that healthy adults (18 to 64 years old) should engage in a minimum of 150 minutes of moderate-to-vigorous intensity exercise per week, or at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week.

Further, it is recommended that the aerobic activity is performed in bouts of at least 10 minutes duration. These guidelines form the foundation of separate WHO member states development of national physical activity action plans and policies.

Despite strong scientific evidence on the positive health effects from exercise and national recommendations, only a small proportion of the population in the European Union engages in sufficient levels of physical activity (World Health Organization, 2010).

2.1 Inconsistencies across data

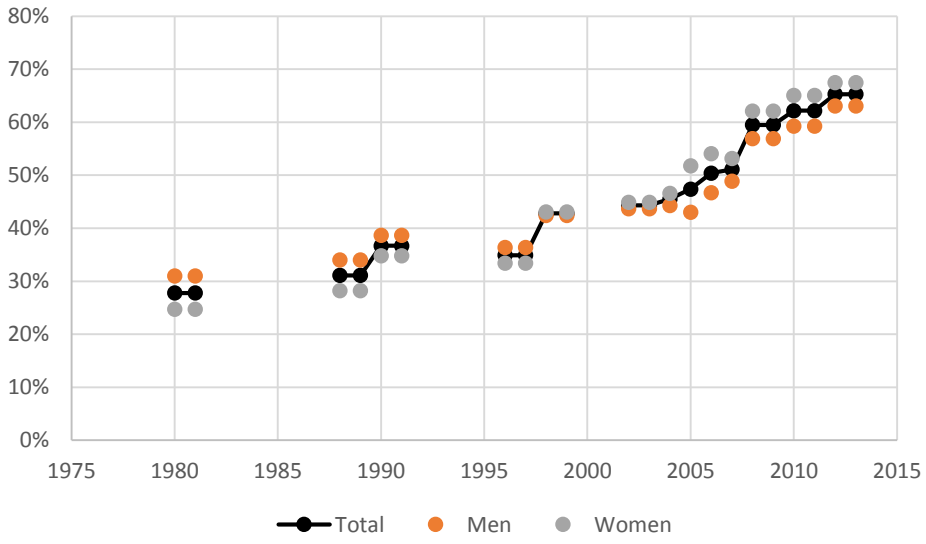
In 2013, according to self-reported data, 70% of Swedish citizens exercised at least once a week, which is significantly above the European average. More, 15% of the Swedes reported to have exercised on a regular basis, at least five times a week, again placing the nation among the top. The results are consistent throughout the report, Sweden is amongst the top five countries. On the other side of the spectrum, the Eurobarometer (2014) reports that Swedes on average spent more than 8.5 hours per day sitting down, placing Sweden amongst the top three nations in Europe.

Based on data from Statistics Sweden, the share of men and women reporting physical activity during leisure time, has been increasing since the 1980's. During 2012 and 2013, Statistics Sweden estimated that 68% of the population in Sweden engaged in physical activity at least twice a week, compared to 28% in 1980 and 1981 – the data consists of self-reported physical activity[1]. Overall, there has been a

[1] Physical activity is defined as conscious activity with the intention of improving stamina and strength

steady rise in self-reported activity for both men and women since inception of the data collection in 1980 (Statistics Sweden, 2015c).

Figure 1. Self-reported activity, percentage of population exercising at least twice per week

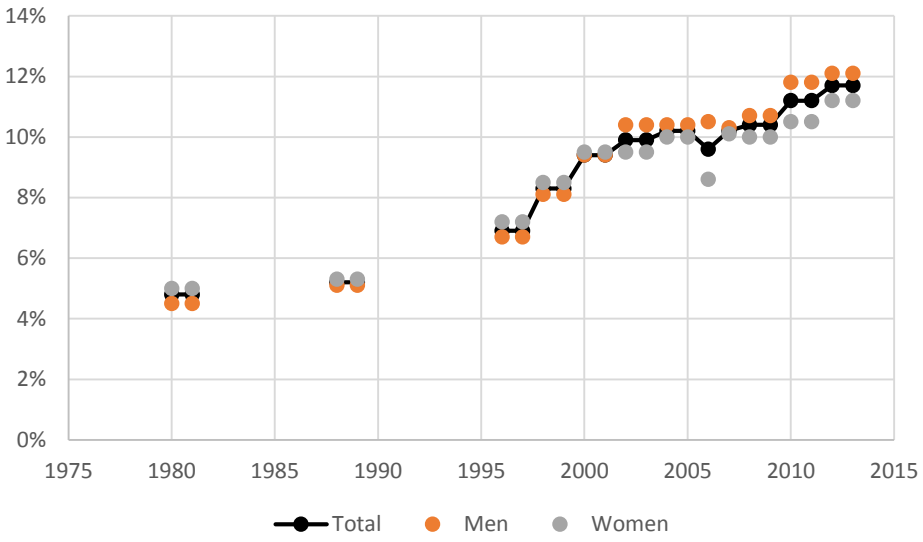


Note: Data represents two-year averages – except 2006 and 2007, which are presented separately – on self-reported physical exercise. The figure shows the share of the population engaging in exercise at least twice a week. Respondents were of the age 16 years or older.
Source: Figure produced by the authors; underlying data from Statistics Sweden (2015c)

Despite a higher rate of self-reported exercise, conditions regularly associated with lower levels of physical activity can be observed in data across the Swedish population. As an example, Sweden has been facing an upswing in obesity rates[2], from 5% (between 1980 and 1981) to 12% (between 2012 and 2013).

[2] This represents the estimated share of individuals in the population with BMI above 30, in accordance with WHO's definition of obesity

Figure 2. Estimated share of Swedish population with BMI >30



Note: Data shows share of the Swedish population – 16 years or older – with BMI above 30. Numbers are presented as two-year averages, except 2006 and 2007, which are presented separately
Source: Figure produced by the authors; underlying data from Statistics Sweden (2015c)

The sharpest rise can be seen within the age group 25 to 44 years, where obesity has increased five-fold with women and three-fold with men. Although not mutually exclusive, the combination of higher self-reported physical activity and soaring obesity rate has raised some questions. One possible explanation provided by Statistics Sweden, is that there has been a general upswing in organised physical activity, gym visits etc., while traditional outdoor activities is becoming less popular, in combination with a more sedentary lifestyle (Statistics Sweden, 2015c). Another explanation is discrepancies between reported and actual levels of physical activity.

In a large experiment conducted by Hagströmer, Oja and Sjöström (2007), physical activity and inactivity was measured with a total number of 1,114 adults in Sweden. Subjects were asked to self-report physical activity combined with objectively measured data through accelerometers. The results showed that only 1% of the subjects actually engaged in the recommended amount of physical activity, of 30 minutes per day, while self-reported numbers suggested that 66% did so. Similar results have been found in other settings, emphasising the importance of objectively measured data (Ronda, Van Assema & Brug, 2001; van Weering, Vollenbroek-Hutten & Hermens, 2011).

2.2 Current health state in Sweden

In general, public health in Sweden has displayed a positive trend over the last decades. Average life expectancy continues to rise for both women and men. In 2013, the average life expectancy for women reached 83.7 years, and for men it rose above 80 years (80.1) for the first time (Statistics Sweden, 2015c). This trend is driven by improved living standards, a decrease in cardiovascular diseases and decreasing

mortality rate for cancer patients. The positive health development has been more prominent with individuals above retirement age, including decreasing incidence of stroke and heart attack within this age category. Senior citizens also report better mental health (Public Health Agency of Sweden, 2014).

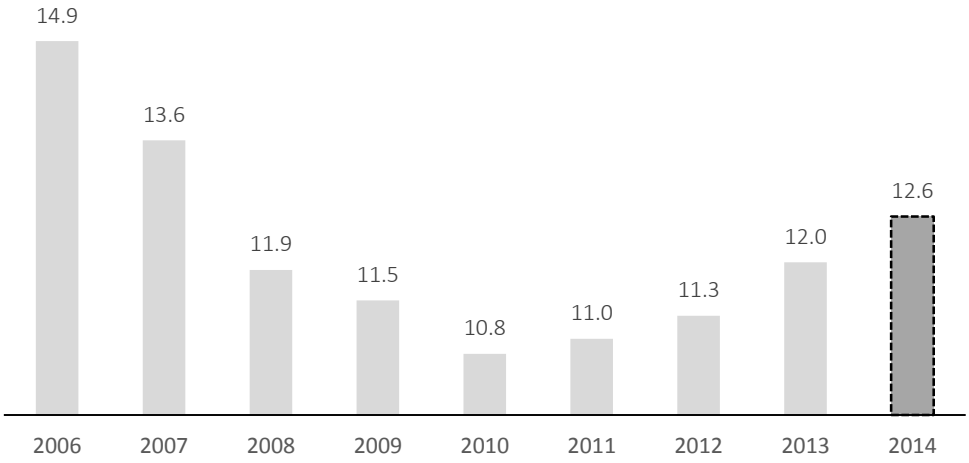
However, among individuals in the age category 35 to 44 years, there is a slight increase in incidence of stroke. Younger persons also report more problems with mental health. Reports of anxiety related issues have increased three-fold among younger men and women, 16 to 24 years old, since the early 1990's and suicide rates are increasing with young men. More, as presented above, obesity has been constantly increasing since the 1980's, and there has been no slowdown in the trend during recent years. Official documents from public institutions have increasingly been reporting on the soaring numbers associated with lifestyle related diseases, highlighting the importance of increasing physical activity and decreasing sedentary habits (Public Health Agency of Sweden, 2014).

2.3 Economic consequences associated with lifestyle related diseases

Lifestyle related diseases and absenteeism have significant economic consequences for the aggregate economy. In Sweden, the estimated direct cost for society associated with diseases that are closely linked to physical activity – e.g. breast- and colon cancer, hypertension, cardiovascular diseases, depression and anxiety, osteoporosis – amounts to SEK 7 billion per annum. More, insufficient physical activity is strongly correlated to obesity, which costs society SEK 18 billion per annum (Public Health Agency of Sweden, 2010).

Further, the number of days on sick leave in Sweden was on average 12.6 days in 2014, approximately 5% of the regular working time, and governmental support is estimated at 4% of GDP (Häggebrink, Lovén, 2010; Statistics Sweden, 2015b).

Figure 3. Average number of sick days per year including sick leave >14 days



Source: Figure produced by the authors; underlying data from Statistics Sweden (2015a)

According to estimates from the Swedish Social Insurance Agency, expenditures relating to sick leave and absenteeism have increased from SEK 18 billion in 2010 to SEK 32 billion in 2015, representing a 78% increase over a five year period (the Swedish Social Insurance Agency, 2015). The expanding budget is driven by increasing cases of reported sick leave (*Figure 4*) as well as longer spells (*Figure 5*).

Figure 4. Average incidence of sick leave <14 days, times per year

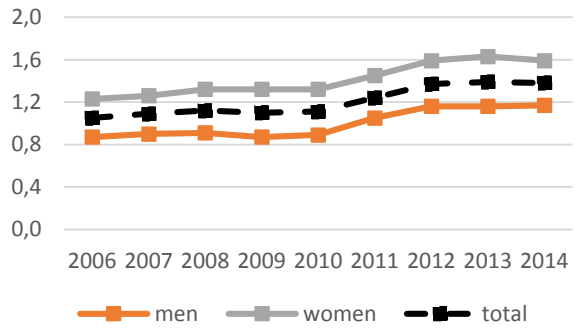
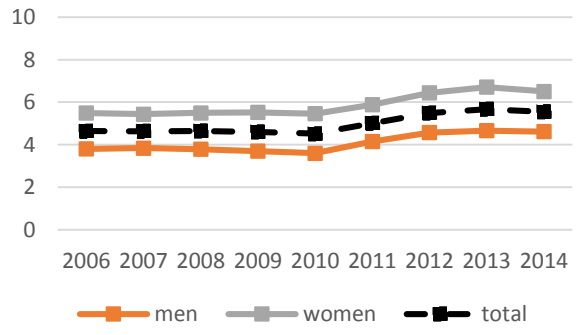


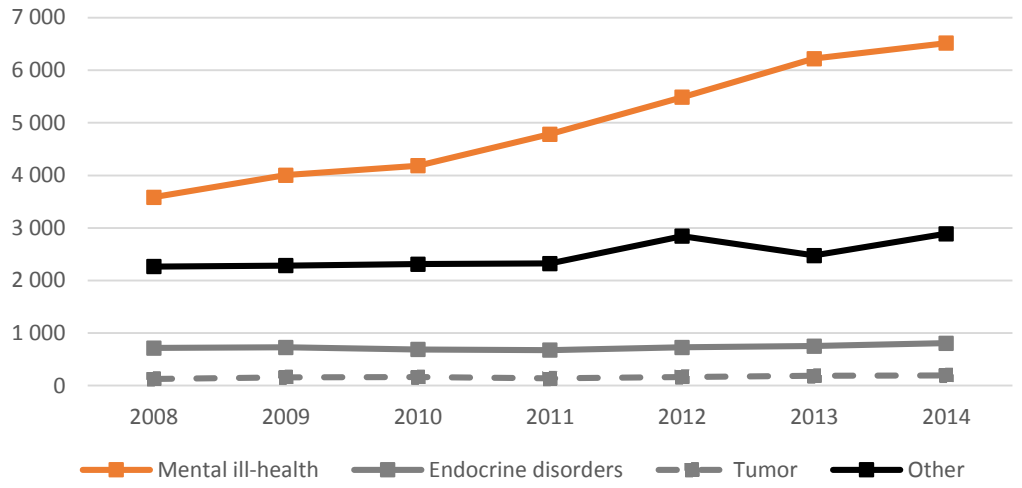
Figure 5. Average length of sick spell <14 days, days per sick period



Source: Figure produced by the authors; underlying data from Statistics Sweden (2015b)

This can be broken down into a growing category of mental ill-health with younger women, in the age 30 to 39 years (the Swedish Social Insurance Agency, 2015). As displayed by *Figure 6*, the number of sick leaves due to mental ill-health has accelerated strongly during the illustrated period. In 2014, sick leave due to reasons of mental illness represented 63% of the total number of newly reported cases in Sweden (Public Health Agency of Sweden, 2014).

Figure 6. Number of reported sick leaves in 2014 by diagnose category

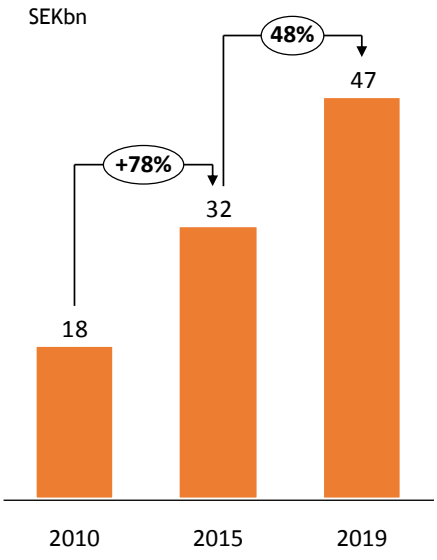


Source: Figure produced by the authors; underlying data from the Swedish Social Insurance Agency (2015)

This corresponds to 38% of total absenteeism expenditures covered by the Swedish Social Insurance Agency, while muscle disorders represent 22%, other injuries 6% and cancer 6%, and other causes stand for 28%.

Based on the Swedish Social Insurance Agency budget, a 48% increase is expected in sick leave reimbursement between 2015 and 2019. This represents a total increase of 48% or 10% per annum for the coming five-year period (the Swedish Social Insurance Agency, 2015).

Figure 7. The Swedish Social Insurance Agency's expenditures referring to sick leave reimbursement



Source: Figure produced by the authors; underlying data from the Swedish Social Insurance Agency (2015)

2.4 Health promotion in Sweden

Various forms of worksite wellness programmes are available for employees in Sweden, including exercise during work hours and reimbursement for expenses associated with health promotion. The latter is considered the most common form, enabling tax relief on employer subsidies used for employee health promotion (Gånedahl et al., 2015; The Swedish Tax Agency, 2005).

The subsidised health promotion structure was introduced in 1999 as part of a wider governmental programme with the ambition to offset increasing costs related to sickness absence. Combined, the Swedish government introduced a law on mandatory

follow up on sickness absence as well as changes in reimbursement for sickness absence. The objective was to provide incentives for employers to take an active role in the prevention of lifestyle related diseases (Backlund, 2014).

The worksite wellness subsidy encompasses various activities such as regular physical activities, enrolment fees for sports events, expenses for sports clothing, smoking cessation advisory, diet advisory and rehabilitating measures. Ultimately, the Swedish Tax Agency defines the outer boundary of activities valid for wellness allowances. The employer decides the amount available for each employee, while local authorities decide the upper limit valid for tax deductibility. In other words, the amount per employee varies depending on region and employer. The average amount of allowances has ranged between SEK 1,200 to SEK 2,000, with a variation between SEK 500 to 6,000 (The Swedish Tax Agency, 2005).

In 2010, approximately 58% of all blue-collar workers and 77% white-collar workers were entitled to wellness subsidies, out of these 63% used the resources available. Translated into number of individuals, only 2.0 million used this subsidy, corresponding to approximately 40% out of the total workforce. The total amount of allowances is estimated at approximately SEK 4.2 billion per annum (The Swedish Tax Agency, 2005).

In a paper by Gånedahl et al. (2015), 1,022 subjects answered a questionnaire relating to health status and worksite wellness programme. Out of the 656 individuals participating in the worksite wellness programme, the most common use was gym membership (45%), massage (35%) and water activities (8%). Of the respondents not participating, the main reasons were "activities not covered by the programme" (29%), "forgetting to apply" (16%) and "lack of time" (12%).

Critics have pointed out that only a small share of the individuals entitled to the allowances actually use them (The Swedish Parliament, 2013). Also, it has been emphasised that the wellness subsidies are being used by those who need it the least and that it thereby increases the inequality of health – individuals which already exercise during leisure time are more likely to make use of available resources. Regarding the latter, it has often been argued that a cognitive step in health related behaviour is missing in such intervention and that little is done to catalyse intrinsic motivation.

3. Previous literature

3.1 Physical activity and health outcome

The benefits of an active lifestyle are widely documented, over the past 60 years epidemiological studies have unanimously showed that physical fitness and physical activity is associated with better health conditions (Morris & Heady, 1953; Morris et al., 1953). In a recent publication by WHO (2010), physical

inactivity is identified as the fourth leading risk factor for global mortality, associated with 6% of deaths globally on an annual basis.

In general, physical inactivity has been associated with 25 chronic conditions, some of which have major implications for modern societies: coronary heart disease, stroke, hypertension, breast cancer, colon cancer, type 2 diabetes and osteoporosis (Malik, Blake & Suggs, 2014; Bouchard, Shephard & Stephens, 1994; Erikssen et al., 1998; Erikssen, 2001). Studies looking at long-term health outcomes have consistently concluded that physically active individuals have a 20% to 35% lower all-cause and cardiovascular related mortality than individuals with a sedentary lifestyle (Kesaniemi et al., 2001; Macera & Powell, 2001; Macera, Hootman & Sniezek, 2003; Warburton, Nicol & Bredin, 2006b; Warburton, Nicol & Bredin, 2006a; Warburton et al., 2007).

Exercising on a regular basis also improves mental health. Regular exercise reduces symptoms of depression, anxiety and stress (Blake et al., 2009; Fox, 1999). The evidence is even stronger for parts of the population suffering from depression (Blake et al., 2009; Babyak et al., 2000; Bartholomew, Morrison & Ciccolo, 2005; Martinsen & Stephens, 1994). In support of the use of exercise therapy, meta-analyses have concluded that physical activity may be as effective as psychotherapy and more effective than other behavioural interventions (Craft & Landers, 1998; North, McCullagh & Tran, 1990).

3.2 Dose-response relationship between exercise and health benefits

Much of the previous research has been dedicated to evaluating the effect of variation in physical activity on health outcomes, with regards to frequency, duration, intensity, type and total amount of physical activity. Summarising the outcome, research has found that 30 minutes of moderate intensity exercise, corresponding to ~40% to 59% of heart rate reserve, five days per week reaches a threshold associated with significant reductions in health risks (Myers et al., 2004). This concludes that aerobic fitness exercise, defined by heart rate, is the key driver to the promotion of health. Further, it has been shown that exercise in bouts of 10 to 15 minutes throughout the day, as a substitute for one prolonged exercise session generate similar health outcomes (Murphy, Blair & Murtagh, 2009).

The abovementioned studies suggest that there is a progressive relationship on all-cause mortality, cardiovascular diseases and cancer with physical fitness, with the greatest difference in risk occurring between the lowest and next-lowest fitness category (Erikssen, 2001; Warburton et al., 2007; Blair et al., 1989; Katzmarzyk, Janssen & Ardern, 2003; Paffenbarger Jr et al., 1986; Slentz, Houmard & Kraus, 2007). Erikssen et al. (1998) conclude “probably the most important suggestion is that moderate improvements in physical fitness, particularly among those who are the least fit, bring substantial benefits to health”. This suggests that individuals could substantially improve their health status with only a minor change in physical activity (Erikssen et al., 1998; Erikssen, 2001; Warburton et al., 2007).

3.3 Too much sitting is distinct from too little exercise

Independent on the time spent on moderate-to-vigorous-intensity activity, recent research has showed that there are significant implications from sedentary living on all-cause mortality (Healy et al., 2008; Katzmarzyk et al., 2009; Owen et al., 2010). Longer periods with low metabolic rates are associated with chronic diseases including cardiovascular diseases, type 2 diabetes, as well as breast and colon cancer. Katzmarzyk et al. (2009) showed that even within physically active individuals, there was a strong correlation between sitting and risk of mortality. The results remained significant after adjustments for potential confounders, including age, sex, smoking, blood pressure, cholesterol, alcohol consumption and diet (Katzmarzyk et al., 2009; Owen et al., 2010). Concluding, this research suggests that high amount of sitting cannot be compensated for with occasional leisure time physical activity even if the amount exceeds the recommendations on physical activity.

Summarising, there is compelling evidence from a large body of longitudinal studies supporting the positive health outcome of physical activity and physical fitness on physical and mental health. Further, the relationship of a sedentary lifestyle with chronic diseases and all-cause mortality is strong and independent of physical activity. All together, these findings highlight the importance of decreasing sedentary time as well as increasing time spent on physical activity.

3.4 Costs associated with lifestyle related diseases

Lifestyle related diseases increase the economic cost for societies through national health care systems. As described, the prevalence of obesity, type 2 diabetes, depression, cancer, coronary heart diseases and other chronic diseases is strongly associated with sedentary living (Breuer, 2014). In the past, it has been calculated that inactive people on average spend 38% more days in hospital care, use 6% more medical nurse visits, access 13% more specialist services and 12% more nurse visits compared to physically active individuals (Sari, 2009).

In terms of indirect costs, authors make a distinction between three types: absenteeism, productivity loss and premature mortality (Malik, Blake & Suggs, 2014; Breuer 2014). The first, absenteeism, is acknowledged as a measure of global health with significant economic implications on western societies (Kivimäki et al., 2003). Besides immediate consequences for the economy, it has been shown that longer periods of sickness absence is correlated with higher risk of future disability pension, expulsion from the labour market and higher risk of all-cause mortality (Quist et al., 2014).

3.5 Absenteeism

Although sickness absence could be considered a measure of absence rather than sickness, influenced by several factors such as attitudes, work satisfaction and generous sick pay schemes, there is strong support for absenteeism as a predictor of both disability pension and mortality. Moreover, longer periods

of sickness absence is strongly associated with future illness (Holtermann et al., 2012). For these reasons, absenteeism is recognised as a measure of health and frequently used as parameter when evaluating the efficiency of various forms of exercise programmes (Kivimaki et al., 2003, Holtermann et al., 2012).

3.6 Cardiovascular fitness and absenteeism

The relationship between aerobic fitness and absenteeism is as uncontested as positive effects enjoyed from physical activity. High levels of cardiovascular fitness is significantly associated with low levels of absenteeism, even after adjustments for differences in age, gender, income, cigarette smoking and percentage body fat (Tucker, Aldana & Friedman, 1990; Jacobson & Aldana, 2001). Lahti et al. (2010) examined the relationship between volume and intensity of physical activity with shorter (<14 days) and longer (>14 days) sickness absence spells and found that those who were vigorously active systematically had reduced risk for sickness absence. Further, higher levels of exercise was associated with lower risk of subsequent sickness absence. The results were similar for both women and men and for shorter as well as longer sickness absence spells (Lahti et al., 2010; van den Heuvel et al., 2005; van den Heuvel et al., 2005; Proper et al., 2006; van Amelsvoort et al., 2006).

3.7 The workplace provides an important avenue for the promotion of exercise

Promoting regular physical activity is crucial for societal health and economic activity within the public and private sectors. The employers' role as promoters of health and well-being within the working age population has been emphasised, overcoming frequently cited barriers such as the 'lack of time' (Malik, Blake & Suggs, 2014). Further, it has been argued that health-promoting programmes will yield multiple benefits for employers, though, for example, reduced sickness absence, increased staff retention and enhanced individual productivity (Proper et al., 2003).

However, existing literature has failed to provide consistent evidence on the socioeconomic outcomes from health promoting programmes in a workplace environment. There is a large plethora of research looking at health promotion programmes at the workplace, from an economic perspective. A lion's share of these look into organisations in the US, driven by national labour market practices where employers traditionally offer health insurance coverage. It has been estimated that approximately 90% of all workplaces in the United States with 50 or more employees have implemented some form of health promotion programme. This serves as an indication of the economic resources funnelled towards this area of research (Aldana et al., 2005). Despite this, current literature presents ambiguous results with regards to net economic outcome.

3.8 Critique towards previous literature

As a reaction, recent papers have been questioning the efficiency of health promoting programmes in this setting. The authors have applied a meta-analysis approach, in order to evaluate the efficiency of various health promotion programmes through an economic perspective. Also, these have generated ambiguous findings (Malik, Blake & Suggs, 2014; Amlani & Munir, 2014; Baxter et al., 2014, O'Donnell, 2014; Proper et al., 2002). Malik, Blake and Suggs (2014), looked into 58 studies produced on the benefits of an active lifestyle with varying results. A majority of these utilised health promotion initiatives, including physical/exercise interventions (6), counselling/support interventions (13), and health promotion message/information interventions (39). The results pointed towards some evidence that workplace physical activity interventions could be efficient, although the authors of the paper concluded that the evidence base was not overwhelmingly strong.

More recently, Baxter et al. (2014) performed a rigorous systematic review of the literature on return on investment (ROI) from health promoting activities. The data set constituted 51 different studies, with 261,901 participants, in 12 countries, published between 1984 and 2012, in order to evaluate methodological quality and the association with ROI. For each study, the authors extracted study design (retrospective, prospective), sample size, control group design, programme length, intervention focus, organisation size, industry type, discount rate, cost reported (direct, indirect) and benefits as well as form of analysis (cost-benefit, cost-effectiveness, cost utility). Overall, the review generated 68 different mean ROIs. The authors conclude that the ambiguous findings with regards to the net economic outcome, to a large extent could be explained by lacking quality in methodology combined with low consistency with regards to study design, data collection and analysis and interpretation.

In conclusion, recent reviews, including Baxter et al. (2014), Lerner et al. (2013) and Malik, Blake and Suggs (2014), point out that higher methodological quality studies have been a critically missing element. In the light of this, it is problematic to draw any conclusion on positive, negative or neutral economic outcome from health promoting programmes in the existing body of literature.

Several methodological issues have been highlighted in recent meta-analysis reviews:

- ***Endogeneity and attrition bias*** − The nature of the intervention within health-promoting programmes limits randomisation possibilities. In previous studies, participation in the interventions has primarily been voluntary, leading to self-selection bias (Kerr & Vos, 1993). More, at firm level, it is more likely that "good" organisations introduce health-promoting programmes, which causes endogeneity problems (Malik, Blake & Suggs, 2014). Also, many of the previous studies have been conducted by the employers who have implemented health-promoting interventions. Given the conflict of interests, authors such as Breuer (2014) argue that negative results are likely to have been withheld.

- ***Inconsistent treatment methods*** − Worksite health promotion have been used at three different levels. Level 1 programmes primarily aim at providing educational and promotional materials in an attempt to create awareness of health behaviour. Second-level programmes are aimed at altering employees' lifestyle directly through for example self-administered fitness programmes or free access to training facilities. Level 3 programmes are designed to assist employees to maintain a healthy lifestyle by providing necessary equipment and facilities (Kerr & Vos, 1993). Throughout previous reviews, authors have treated these methods non-discriminating when evaluating the economic implications.

- ***Time-horizon*** − In a study by (Holtermann et al., 2012), data from three large Dutch databases was used to evaluate the dose-response relationship between physical activity and sick leave. Amongst all, the authors concluded that the effect of sick leave was greater with the passage of time. Existing research on the efficacy of health promoting programmes on sick leave have evaluated the outcome on shorter time horizons, 9 to 15 months, which suggest that the full effect of these programmes cannot be captured (Holtermann et al., 2012).

- ***Geographical limitations*** − a majority of existing reviews perform a meta-analysis approach excluding studies conducted outside of the United States, which results in lacking applicability for stakeholders in other geographies, where employee health is not incumbent on employers due to a national health care system (Baxter et al., 2014).

- ***Evaluation criteria*** − von Thiele Schwarz, Hasson (2012) illustrates that when only direct costs such as salary, medical costs and pharmaceutical costs are included in evaluations of financial impact of interventions, the total cost reduction may be underestimated and therefore not generating a positive return on investment. Meta-analyses make inter paper comparisons failing to take methodological differences, with regards to cost-benefit estimates, into consideration.

Concluding, the uncontested evidence on exercise and its positive health outcome, including reduced sickness absence, suggests that active measures should be taken in order to increase the level of exercise within the Swedish population. This is supported further by objectively measured data on physical activity, indicating levels of physical activity below WHO recommendations. Increasing prevalence of lifestyle related diseases, rising levels of absenteeism and soaring socioeconomic costs further emphasise the importance of active measures. The workplace is considered an important avenue in the promotion of such activities. However, despite the strong evidence on the association between physical fitness and health outcomes, as well as sedentary life style and chronic diseases, longitudinal studies

have failed to provide consistent evidence on the correlation between health promotion programmes and net socioeconomic outcome. Recent meta-studies have pointed out that the lack of methodological quality in these studies makes it problematic to draw any conclusions. As a reaction, this paper aims at applying a different methodological approach as a first attempt to provide new insights to the studies of worksite health promotion programmes.

4. Our approach

This paper applies a dynamic macroeconomic model, using some of the established facts from previous literature. Hence, we find support from existing evidence on the positive effects of physical activity and implement these in a workplace environment, with the ambition of quantifying aggregate welfare and economic outcomes. To the authors' knowledge, this represents a new approach in the field of health promotion research.

By doing this, we aim at circumventing some of the methodological issues highlighted in the previous section. Since we do not rely on data collected from organisations that have implemented health promotion programmes, we avoid endogeneity problems and issues related to attrition bias while quantifying the effects of health promotion programmes on a national level rather than studying just one or two firms. Further, in comparison to previous papers, model parameters have been adjusted to suit a Swedish setting.

We use a multi-period dynamic model where agents have the possibility to invest in their health by spending time on cardio enhancing exercise. The agents allocate their resources between consumption, saving and exercise in each period. Through exercise, the agents can improve their health status. In effect, the agent will be able to work more productive hours which will increase her income. We consider this as equivalent to a reduction in absenteeism. However, the agent will also incur a cost/pain of exercise. This cost will be heterogeneous across the population to capture the notion that some individuals experience more pain from exercising than others.

A difference is made between "leisure" time exercise, i.e. exercise conducted during non-working hours and exercise conducted during work time. Agents only experience disutility from leisure time exercise, since job time exercise is captured in the exogenous labour supply. Since labour supply is fixed and we make no distinction between traditional work assignments and exercise as a work assignment, agents will not experience any additional disutility from exercising during work time. With this approach, we try to capture the notion that it is not the physical activity per se that is the obstacle keeping individuals from exercising, but rather that they are constrained with regards to leisure time.

The baseline agent is assigned with moderate health, from which two additional health types have been calibrated in order to have the economy comprising of three health types, with different health levels and heterogeneous experience with regards to pain from exercise.

The parameters for the baseline case are kept constant whilst implementing two different types of health promotion programmes inspired by existing designs in Sweden. In one programme, agents receive a fitness allowance conditional on engaging in leisure time exercise according to a specified minimum. In the other programme, agents are forced to exercise during work hours. In this case, they do not receive a monetary transfer.

The outcome is evaluated with regards to lifetime utilities in the two programmes as well as economic benefits, defined as the compensating variation in consumption. In other words, in the case were agents experience higher utility post-promotion, we will calculate the consumption increase needed in the base case to equate the lifetime utilities pre- and post-promotion. A higher utility for the agent, and thus a positive compensating variation in consumption, would indicate an economic benefit for the society. We assume that the amount goods demanded by agents is identical to the goods supplied in the economy.

5. The model

5.1 Multi-period dynamic model

In our multi-period dynamic model each agent has perfect foresight and is fully rational, so that utility maximising decisions are made when the agent is "born" into the economy. For simplicity, the economy will be small and open, hence interest rates and wages are determined exogenously. The model comprises of four periods, where agents enter the economy at age 20, retire at 65 and die at 80 years of age. Thus, each period comprises of 15 years. Further, no borrowing is allowed in the model. Finally, we keep labour supply fixed and abstract from capital formation. For simplicity, we choose to solve the model as a partial equilibrium and assume perfect markets.

The agent will decide how much to consume, save and exercise in each period and her retirement decision will be made exogenously, forcing her to retire after 3 periods. The agent will make a decision in every period in order to maximise her lifetime utility. This utility is dependent on consumption and leisure in every period. Future utility is discounted by a time preference factor, β.

$$\mathrm{U_i}\left(c_{1,t}, l_1, s_{1,t} \dots, c_{4,t}, l_4, s_{4,t}\right) = \sum_{\mathrm{i}=1}^{4} \beta^{\mathrm{i}-1}\left(\mathrm{u}\left(c_{i,t}, l_i, s_{i,t}\right)\right)$$

Where $c_{i,t}$ is the consumption of a representative agent of generation *t*, in period *i* of her life. Likewise, l_i is the exogenous labour supply and $s_{i,t}$ is the time spent on leisure time exercise in each period.

The utility function is characterised by constant relative risk aversion (CRRA) and more specifically we use the log-utility case, represented below:

$$u(c_{i,t}, l_i, s_{i,t}) = \ln(c_{i,t}) + \alpha_{i,t} \ln(1 - l_i - \varphi_{i,t} s_{i,t})$$

$\varphi_{i,t}$ captures the agent's personal time cost of exercise (or "pain" of exercise). The parameter is larger for agents with low health status and is assumed to increase during the lifetime to take into account that older individuals might find it more difficult to spend time on exercise than younger individuals. As mentioned, we make a distinction between exercise performed outside working hours (leisure time exercise) and exercise conducted during work hours. Since the agents only experience disutility from leisure time exercise, we can express leisure time exercise $s_{i,t}$ as the total time spent on exercise in excess of work time exercise:

$$s_{i,t} = s_{i,t}^{q} - s_{i,t}^{j}$$

where $s_{i,t}^{q}$ is the total amount spent on exercise and $s_{i,t}^{j}$ is the amount of time spent on exercise at the worksite. The $\alpha_{i,t}$ parameter indicates the utility an agent experience from leisure i.e. disposable time net of working and exercising outside working hours. $\alpha_{i,t}$ is dependent on the agent's health status and the return to health is diminishing, therefore:

$$\alpha_{i,t} = \sqrt{h_{i,t}}$$

Thus, an agent with high health will experience greater utility from each unit of leisure than an agent with low health but an extra unit of health will yield greater returns for the agent with lower health.

Health evolves as follows:

$$h_{i+1,t} = (1 - \delta_{i,t}) h_{i,t} + \rho_{i,t} s_{i,t}^{q} \sqrt{h_{i,t}}$$

Future health is dependent on current health, less age dependent depreciation, plus the effect of exercise today. The depreciation rate is age dependent, in order to represent a more rapidly declining health status in later stages of life. $\rho_{i,t}$ is also age dependent and indicates the return to exercise. This parameter is also modelled to be declining to capture the notion that it might be harder to improve health status through exercise in later stages of life.

The multiplicative term between total exercise and health today indicates that a healthy agent is able to transform more of her time spent on exercise into health in the next period. We use the square root of health also in this case to capture the notion of decreasing marginal returns to health capital.

The agents in the economy face a series of constraints. The first constraint is the individual agent's budget constraint:

$$c_{i,t} = (1 + r)a_{i,t} + w_i l_i \sqrt{h_{i,t}} - a_{i+1,t} + \nu_{i,t} * T_i$$

It states that an agent spends, i.e. consumes and saves, an amount equal to the assets saved from previous period plus interest, the wage earned in the period and transfers received in the period. w_i is the exogenously given wage earned in the economy, r is the interest rate, $a_{i,t}$ is the assets brought from the previous period and $a_{i+1,t}$ is the assets brought to the next period. The multiplicative term between health and labour indicates that a healthy agent will be more efficient than an unhealthy agent and be able to produce more for every given working hour. This captures the same effects as a reduction in absence rates, however since we do not want to restrict health to values between 0 and 1 for computational reasons we use this form instead. T_i is the amount received through fitness allowances which is dependent on $\nu_{i,t}$. The amount received in each period can be expressed as:

$$\nu_{i,t} * T_i,$$

$$\text{where } \nu_{i,t} = max\frac{\{s_{i,t} - \Omega, 0\}}{s_{i,t} - \Omega},$$

and Ω equals the minimum amount of exercise needed to be performed to receive the fitness allowance

As mentioned above,

$$h_{i+1,t} = \left(1 - \delta_{i,t}\right)h_{i,t} + \rho_{i,t} s_{i,t}^{q} \sqrt{h_{i,t}}$$

moreover,

$$0 \leq s_{i,t}, \qquad l_i + s_{i,t} \leq 1, \quad a_{1,t} = 0, \quad a_{5,t} = 0, \qquad h_{5,t} = 0$$

The first constraint states that the time spent on leisure time exercise, must be equal to or larger than 0 in every period. This is evident since an individual cannot spend negative time on any task. The second constraint simply states that an agent cannot spend more time at work and on leisure time exercise than her endowed amount of time. The third and fourth constraints show that each agent brings zero assets into the economy when "born" and that they end their life with zero assets. The fifth constraint states that agents will have zero health when dead.

From the utility function and the constraints above we can set up the Lagrangian to solve the individual's maximisation problem:

$$\mathcal{L} = \sum_{i=1}^{4}\Big[\beta^{i-1}\big(\ln(c_{i,t}) + \sqrt{h_{i,t}} * \ln\big(1 - l_i - \varphi_{i,t}(s_{i,t}^{q} - s_{i,t}^{j})\big)\big)$$

$$-\lambda_1^{i,t}\Big(c_{i,t} - \Big((1+r)a_{i,t} + w_i l_i\sqrt{h_{i,t}} - a_{i+1,t} + \nu_{i,t} * T_i\Big)\Big)$$

$$-\lambda_2^{i,t}\big(h_{i+1,t} - \big(1-\delta_{i,t}\big)h_{i,t} - \rho_{i,t}s_{i,t}^{q}\sqrt{h_{i,t}}\big)$$

$$-\lambda_3^{i,t}(s_{i,t}^{q} - s_{i,t}^{j})$$

$$-\lambda_4^{i,t}\big(1 - l - (s_{i,t}^{q} - s_{i,t}^{j})\big)\Big]$$

The agents maximise utility with respect to consumption, asset holdings, total exercise and health. The Lagrangian yields the following Karush-Kuhn-Tucker conditions:

$$I.\ \frac{\partial\mathcal{L}}{\partial c_{i,t}} = \frac{\beta^{i-1}}{c_{i,t}} - \lambda_1^{i,t} = 0$$

$$II.\ \frac{\partial\mathcal{L}}{\partial a_{i+1,t}} = \lambda_1^{i+1,t}(1+r) - \lambda_1^{i,t} = 0$$

$$III.\ \frac{\partial\mathcal{L}}{\partial s_{i,t}^{q}} = -\frac{\beta^{i-1}\sqrt{h_{i,t}}\varphi_{i,t}}{1 - l_i + \varphi_{i,t}(s_{i,t}^{j} - s_{i,t}^{q})} + \lambda_2^{i,t}\rho_{i,t}\sqrt{h_{i,t}} - \lambda_3^{i,t} + \lambda_4^{i,t} = 0$$

$$IV.\ \frac{\partial\mathcal{L}}{\partial h_{i+1,t}} = \frac{\beta^{i}\ln\Big(1 - l_{i+1,t} - \varphi_{i+1,t}\big(s_{i+1,t}^{q} - s_{i+1,t}^{j}\big)\Big)}{2\sqrt{h_{i+1,t}}} + \frac{\lambda_1^{i+1,t}w_{i+1}l_{i+1}}{2\sqrt{h_{i+1,t}}}$$

$$-\lambda_2^{i,t} + \lambda_2^{i+1,t}\left(\big(1-\delta_{i+1,}\big) + \frac{\rho_{i+1,t}(s_{i+1,t}^{q} - s_{i+1,t}^{j})}{2\sqrt{h_{i+1}}}\right) = 0$$

$$V.\ \frac{\partial\mathcal{L}}{\partial\lambda_1^{i,t}} = c_{i,t} - \Big((1+r)a_{i,t} + w_i l_i\sqrt{h_{i,t}} - a_{i+1,t} + \nu_{i,t} * T_i\Big) = 0$$

$$VI.\ \lambda_1^{i,t}\Big(c_{i,t} - \Big((1+r)a_{i,t} + w_i l_i\sqrt{h_{i,t}} - a_{i+1,t} + \nu_{i,t} * T_i\Big)\Big) = 0$$

$$VII.\ \frac{\partial\mathcal{L}}{\partial\lambda_2^{i,t}} = h_{i+1,t} - \big(1-\delta_{i,t}\big)h_{i,t} - \rho_{i,t}s_{i,t}^{q}\sqrt{h_{i,t}} = 0$$

$$VIII.\ \lambda_2^{i,t}\big(h_{i+1,t} - \big(1-\delta_{i,t}\big)h_{i,t} - \rho_{i,t}s_{i,t}^{q}\sqrt{h_{i,t}}\big) = 0$$

$$IX.\ \lambda_3^{i,t}(s_{i,t}^{q} - s_{i,t}^{j}) = 0$$

$$X.\ \lambda_4^{i,t}\big(1 - l - (s_{i,t}^{q} - s_{i,t}^{j})\big) = 0$$

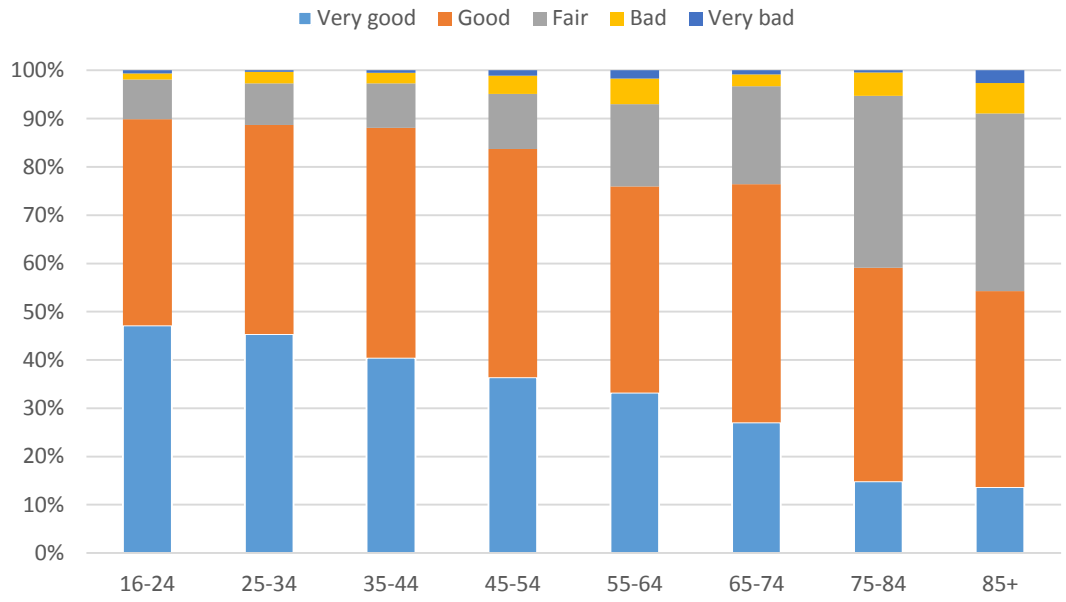
These ten equations provide the framework we need to solve the individual's maximisation problem in MATLAB. Likewise, we can solve for optimal asset holdings, consumption, health and exercise in each period.

6. Calibration

As mentioned, a period corresponds to 15 years and the agents enter the model at age 20. The annual interest rate, r, is set to the average interest rate on a Swedish 10-year government bond (4.1 %) (The National Institute of Economic Research 2015). We assume that $\beta = 1/(1+r)$ and that the labour supply of each agent in working age is 1/3, corresponding to a 40-hour work week $\left(\frac{40}{5*24} = 1/3\right)$, in accordance with previous literature (McCandless, 2008). Labour supply is set to zero at retirement. The wage rate is exogenously set to 3 so that an agent with health status 1.00 earns 1 unit of income.

In the *baseline model*, we set workplace exercise to zero and calibrate the model to comprise of three different types of agents, with varying levels of health at "birth" and different experience of pain from each unit of leisure time exercise. Thus $\varphi_{i,t}$, is heterogeneous. The agents' health status will be declining over time, which is in line with the OECD-data on self-reported health status (Owen et al. 2010, The National Institute of Economic Research 2015).

Figure 8. Self-reported health status by age category



Source: Figure produced by the authors; underlying data from Eurostat (2015)

This feature has the implication that φ and δ has to increase with age and ρ has to decrease with age. This will make agents experience more pain from exercise and have lower returns to health from

exercise when age increase. In effect, the agents will exercise less when older, which seem like a reasonable outcome.

The agents of moderate health is the starting point for our calibration. The goal is to have agents of the moderate health status allocating time to physical activity in accordance with the average time spent on exercise in Sweden. While reports on time spent on exercise are ambiguous, empirical findings suggest that the average Swede does not meet the recommendation set forth by WHO, on 150 minutes of physical activity per week. Thus, agents of moderate health have been calibrated to exercise on average 90 minutes per week – corresponding to physical exercise two or three times per week. Based on the assumption that agents of moderate health enter the economy with a health status of 1.00 and a pain of leisure time exercise parameter,$\varphi_{i,t}$, also equal to 1 we can calibrate $\rho_{i,t}$ and $\delta_{i,t}$ to return the desired paths of health and exercise described as above. Also, we calculate asset holdings, consumption and lifetime utility for the agent of moderate health.

Next, we keep the obtained parameter values of $\rho_{i,t}$ and $\delta_{i,t}$ fixed and are able to calibrate the value of φ that equates lifetime utility (compared to the agent of moderate health) for any initial health status. In this way we can create two additional types of agents, one agent with low initial health and one agent with high initial health. Through the values of initial health and an φ, values of leisure time exercise, $s_{i,t}$ is returned. We assume that the agent of low health exercise significantly less than the agent of moderate health and calibrate the time spent on exercise to be 30 minutes per week. Likewise, we calibrate the time spent on exercise by the agent with high health status to be 240 minutes per week on average. Model parameters and graphs depicting the development of health and time spent on exercise in the baseline model is found in the *Appendix.*

7. Results

When evaluating the effects of a programme, we are strictly referring to physical activity as the moderate-intensity exercise.[3]

7.1 Health promotion through fitness allowance

As described under *2.4 Health promotion in Sweden*, fitness allowances represent the most common form of worksite health promotion in Sweden. This encompasses an amount, specified by local authorities and the employer, of reimbursement for physical activity before or after the expense has been

[3] According to WHO's definition this equates to physical activity that is performed at a level 5 or 6 on a scale of 0–10, relative to an individual's personal capacity – or 3 METs (metabolic equivalent)

incurred. Each employee is entitled to the allowance provided that the activity falls under the definition set forth by the Swedish Tax Agency's framework.

In the following, we have designed a programme similar to the Swedish design for fitness allowances, with the difference that it is conditional on the agent reaching a minimum amount of leisure time exercise per week. In this programme, we restrict the physical activities to taking place during leisure time, since most physical activities that are reimbursed by fitness allowances take place outside the work site.

The average fitness allowance in Sweden is SEK 2,000 and the median annual wage is SEK 325,000. This means that the average fitness allowance is 0.6 % of the annual income. The income in our model is calculated as:

$$y_{i,t} = w_i l_i \sqrt{h_{i,t}}$$

Since the wage rate is set to 3 and the labour supply is equal to 1/3, when in working age, the income of the individual is entirely dependent on the health level. We can calculate the average health level over the economy in our baseline model in order to get the average income. The average health level for the working periods is 0.872, thus $\sqrt{h_{i,t}} = 0.934$. We then multiply the average income with 0.6 % to get the corresponding per-period fitness allowance in the economy(0.0056).

Under this programme, agents have the possibility to receive the fitness allowance in each period while in working age. If the agents decide to exercise a specified minimum amount Ω, they will receive the fitness allowance. The amount received in each period can be expressed as:

$$v_{i,t} * T_i,$$

$$\text{where } v_{i,t} = max \frac{\{s_{i,t} - \Omega, 0\}}{s_{i,t} - \Omega},$$

$$\text{and } T_i = 0.0056$$

Table 1. **Output from different health promotion programmes** illustrates the utility from the baseline model, as well as the output from the cases where the agent exercise the demanded minimum amount and receive the fitness allowance. An agent will only exercise the minimum amount if it increases her lifetime utility. We test this programme for different levels of demanded leisure time exercise.

Table 1. Output from different health promotion programmes

	Health group		
Base case: unconditional of exercise	**Low**	**Moderate**	**High**
Utility	-1.4296	-1.4269	-1.4296
Avg. consumption	0.8570	0.8784	0.9036
Avg. exercise (% of time)	*0.36 %*	*1.25 %*	*3.34 %*
Avg. health	0.7570	0.7990	0.8550
Total capital	0.8601	0.8757	0.8865

	Health group		
Conditional on exercise, 150 minutes / week	**Low**	**Moderate**	**High**
Utility	-1.4296	-1.4269	-1.4110
Avg. consumption	0.8570	0.8784	0.9079
Avg. exercise (% of time)	*0.36 %*	*1.25 %*	*3.32 %*
Avg. health	0.7570	0.7990	0.8550
Total capital	0.8601	0.8757	0.8939

	Health group		
Conditional on exercise, 60 minutes / week	**Low**	**Moderate**	**High**
Utility	-1.4296	-1.4115	-1.4077
Avg. consumption	0.8570	0.8826	0.9086
Avg. exercise (% of time)	*0.36 %*	*1.24 %*	*3.32 %*
Avg. health	0.7570	0.7990	0.8548
Total capital	0.8601	0.8829	0.8912

Table 1. **Output from different health promotion programmes** shows that the agents with high health are those that benefit the most from the fitness allowance while those in with low health status are unaffected. This is in line with often cited critique of fitness allowance as health promotion programme. Those with high health and low cost of exercise benefit from this type of programme since they exercise above the demanded exercise level without incentives for exercise. They utilise the allowance and are able to increase their consumption, resulting in higher utility.

For those agents with low health status the story is reversed. Their pain of leisure time exercise is too high for them to get incentivised to exercise, i.e. the pain is not offset by the potential increase in income the fitness allowance constitute. This example is reinforced by how those with moderate health behave. While the minimum exercise level is too high, their pain of reaching that exercise level is not offset by the potential reimbursement. However, when the minimum exercise level is lowered to 60 minutes per week, they can benefit from the promotion programme.

7.2 Exercise as a work task: mandatory exercise on work time

Because of the often cited critique against fitness allowance as a form of health promotion it has become more common to allow employees to exercise during work hours. Recently, several municipalities and companies in Sweden have introduced mandatory exercise on work time.

We introduce a similar programme testing for the changes in utility when agents are forced to exercise during work hours. The difference from the above discussed programme is that no monetary compensation is paid, the benefit comes from reduced hours of traditional work but with maintained income levels.

We test for a mandatory exercise amount of one hour per week during work hours. This is in line with most mandatory exercise programmes that have been reported from Sweden. The output from this case is presented below.

Table 2. Output from mandatory worksite exercise programme

	Health group		
1 hour per week	**Low**	**Moderate**	**High**
utility	-1.3887	-1.3820	-1.4020
avg. consumption	0.8579	0.8785	0.9038
avg. total exercise (% of time	*0.89 %*	*1.38 %*	*3.47 %*
avg. health	0.7604	0.7997	0.8558
Total capital	0.8588	0.8785	0.8862

All health groups have increased their utility compared to the baseline case. We note that consumption is fairly constant so the change in utility levels can instead be explained by increased exercise in each case with increased health (and increased utility from leisure) as a result.

To set the changes in utility into another perspective we calculate the compensating variation in consumption. This means that we calculate the consumption increase needed in the baseline case to equate the lifetime utilities pre- and post-promotion.

Table 3. Output from mandatory worksite exercise programme, compensating variation in consumption

	Health group		
Compensating variation in consumption	**Low**	**Moderate**	**High**
utility pre-promotion	-1.4296	-1.4296	-1.4296
utility post-promotion	-1.3887	-1.3820	-1.4020
consumption pre-promotion	0.8570	0.8784	0.9036
compensating variation consumption	0.8670	0.8900	0.9100
change in consumption %	*1.17 %*	*1.32 %*	*0.71 %*

We note from the compensating variation analysis in *Table 3* that each health group would have to increase their consumption in the baseline model in order to equate the utility in the baseline model with the utility post-promotion. This indicates economic benefit for the society. It is interesting to note that the group with high health benefit the least from this type of programme as opposed to the previous programme where they received a fitness allowance. Since the agents with high health already have high health status, the mandatory exercise programme have little impact on their health. The other two groups

can impact their health to a higher extent since they have lower health status to begin with. Moreover, since they are required to exercise during work hours, they can reduce the amount of exercise conducted on leisure time (which is more painful for them relative to the ones with high health status).

8. Discussion and concluding remarks

Summarising, fitness programmes conditional on exercise mainly incentivise individuals with good health to exercise while discouraging individuals within the lower health category. The disutility for individuals within the lower health status is not offset by fitness allowances, as leisure time is valued higher than better health status. Individuals in the *Moderate* category only exercise when the conditional recommendations are set at 60 minutes per week rather than 150 minutes per week. In the second programme, all individuals experienced utility gains from mandatory exercise during working hours. However, consumption only increases marginally within the economy, driven by decreasing absenteeism from better health. The group that gains the most is the mid health category. Low health individuals do not reach significant levels on health from the low levels of exercise, whilst high health individuals find work time exercise only marginally better than leisure time exercise, due to the low costs associated with leisure time exercise.

The results generated from fitness allowances conditional on exercise are in line with the criticism directed towards existing programmes on the Swedish market. Individuals that are physically active during leisure time perceive the allowances as a bonus income – they would exercise in any case. As explained previously, these types of programmes are more likely to increase inequality in health than to generate the right incentives for an individual lacking the proper motivation to improve their health. More interesting, the results from mandatory training during working hours suggest that all individuals experience improvements in utility. This is explained by the fact that the disutility from sacrificing leisure time is now substituted by an hour of work, which is subsidised by the employer and therefore has no economic impact on individual level. The mid-health category experience the greatest utility improvement.

Summarising, the results suggest that the implementation of a mandatory health promotion programme would be preferable from a socioeconomic perspective. This is explained by that fact that (1) all agents experience improved utility and (2) the “masses” experience the largest gain.

This paper aims at paving the way for a new perspective with regards to the economic review of health promotion programmes. Existing literature has solely applied a longitudinal approach, failing to draw consistent conclusions due to methodological limitations. Instead we have proposed a different approach, based on the solid evidence drawn from epidemiological studies, in order to the evaluate health promotion programmes through a quantitative approach. By applying a multi-period dynamic model, we have simulated the outcome of worksite health promotion programmes on Sweden, under

several simplified assumptions. Besides providing a new methodological approach, we have hoped to expand the geographical scope of studies on worksite health promotion - current body of literature has primarily focused on the US economy, due to the incentives created from local labour market structures. In this way, our hope is that the paper will provide new insights to the studies of worksite health programmes applicable to the Swedish economy specifically.

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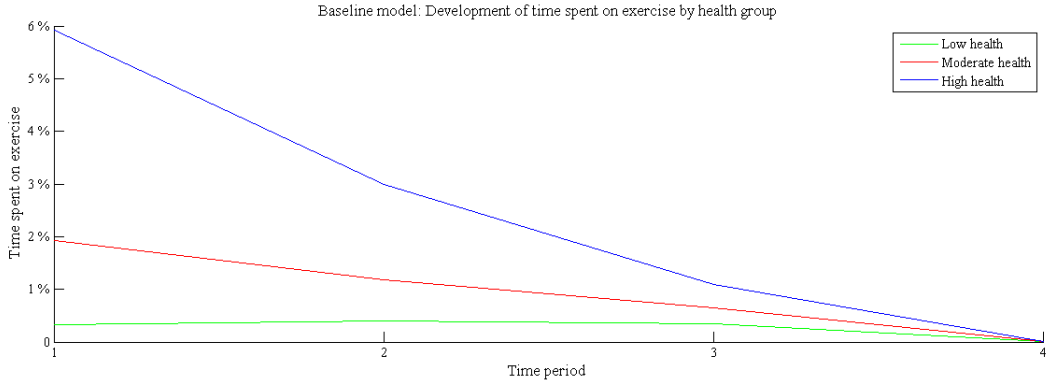
10. Appendix

Table 4. Model parameters

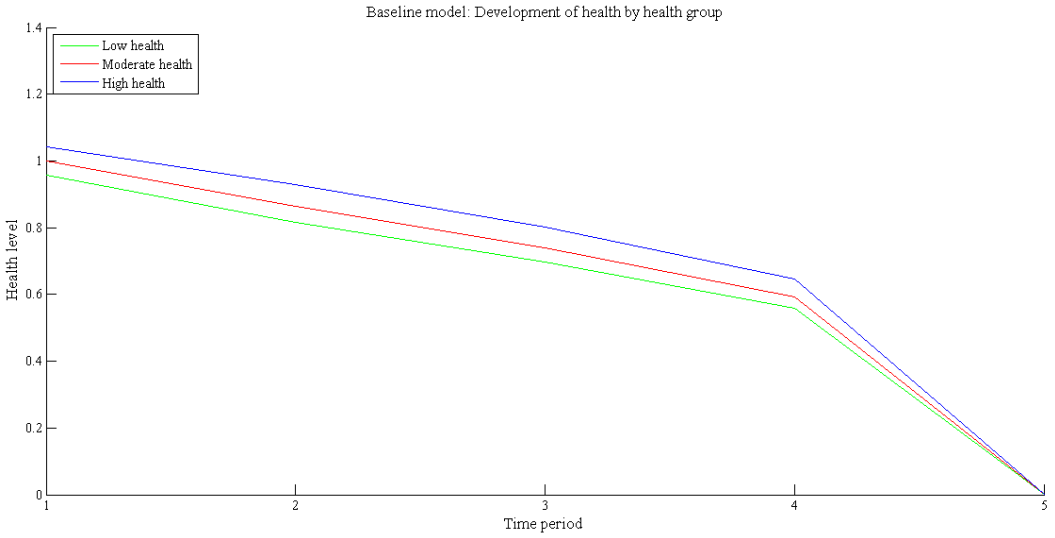
	Health group		
Parameter	**Low**	**Moderate**	**High**
$\delta_{1,t}$	0.150	0.150	0.150
$\delta_{2,t}$	0.150	0.150	0.150
$\delta_{3,t}$	0.200	0.200	0.200
$\delta_{4,t}$	1.000	1.000	1.000
$\varphi_{i,t}$	1.957	1.000	0.557
$\rho_{1,t}$	0.728	0.728	0.728
$\rho_{2,t}$	0.442	0.442	0.442
$\rho_{3,t}$	0.265	0.265	0.265
$\rho_{4,t}$	0.100	0.100	0.100
$h_{1,t}$	0.958	1.000	1.042
Avg. leisure time exercise	*0.40 %*	*1.25 %*	*3.33 %*

Figure 9. Baseline model – development of time spent on exercise by health group



Source: Figure produced by the authors

Figure 10. Baseline model – development of health by health group



Source: Figure produced by the authors