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HOW DOES A REDUCTION IN THE MARGINAL TAX RATE AFFECT LABOR SUPPLY IN THE SHORT-TERM FOR TOP-INCOME EARNERS?

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Abstract. This paper studies the labor market in Sweden after a cut in the top-income marginal tax rate, by conducting a difference-in-difference analysis on data over wages in Sweden two years after the policy change. We find large, positive and significant results on an aggregate level, but insignificant ambiguous results on an income per person level. This study is one of the first to look at this specific policy change and aims to contribute within the field of optimal taxation. It is important since the efficiency-equality tradeoff is a big question in most economies. This study does not only look at the short-term effects, but also studies a policy change in taxation of labor during a time when the labor market was experiencing many other changes caused by the Covid-19 pandemic. While we look at the short-term effects it is important to note that the full effect is estimated to kick in successively during a longer period, and how big the effect will be depends on the elasticity of taxable income.

Keywords: Labor supply, marginal tax rate, progressive taxation, top incomes

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1. INTRODUCTION

Do we work less when the marginal tax is higher? The question of optimal tax progressivity and its effect on labor supply has been studied by many such as (Saez, Slemrod et al. 2012), (Badel, Huggett 2017) (Aaronson, French 2009) to name a few. Increasing marginal tax rates reduces both the returns to working more hours and the returns to acquiring human capital (Guvenen, Kuruscu et al. 2014), (Krueger, Ludwig 2013), and (Heckman, Lochner et al. 1998). (Heathcote, Storesletten et al. 2017) write that progressivity in taxes also reduces incentives to invest in acquiring new skills. Others such as (Rogerson, Wallenius 2009) have created models showing that when increasing the size of a tax it reduces work both on the intensive and extensive margin.

The debate often boils down to a tradeoff between efficiency in the labor market and redistribution of income to decrease wage gaps between different groups in the population, also known as the efficiency-equality tradeoff. (Diamond, Saez 2011) write that one usually wants to maximize social welfare which often occurs when resources are more evenly distributed. However, redistributive taxes and other transfers can reduce incentives to work. Other papers support the conventional view that higher progression decreases labor supply. When setting an optimal degree of taxation, if the progression is not at a point where it does decrease labor supply, then there is no real trade-off between efficiency and equality at that point of progressivity (Sandmo 1983). To balance the tradeoff can be tricky and no economy is like the other, which is why it becomes important to study the relationship empirically.

This paper aims to contribute to the study of the relationship between tax policies and labor supply. This is important because to conduct economic policy to reach certain goals, one must understand how various parts of the economy are connected and affected by certain policy changes. This paper will also be one of the first to study the effects of the removal of "Värnskatten" in Sweden year 2020, which is interesting since it has been a hot topic of political debate. Considering the short time since the change, and the accessible data, we aim to investigate if there is any sign of any short-term impact to be found in the available data.

Policymakers are often debating whether a lower tax rate will incentivize individuals to work more, hence increasing tax revenue despite a lower tax rate. Sweden is one of the countries with the highest marginal income tax in the world, and until 2020 Sweden had the world's highest marginal tax rate, slightly above 60%. This makes Sweden an interesting country to study since its tax policy is at one extreme of the tax spectrum. As of January 1st, 2020, the marginal income tax rate in Sweden was lowered by 5 percentage points by removing the tax known as "Värnskatten". "Värnskatten" was the second and highest of two thresholds where all income above each threshold was subject to additional tax.

This paper answers the following question: "How does a reduction in the marginal tax rate affect labor supply in the short-term for top-income earners?" by conducting a difference-in-difference analysis using aggregate income data in Sweden. We found that there is a large, positive and significant effect on aggregate income for top-income earners, but ambiguous insignificant results on an income per person level.

The Swedish taxation system is based on all labor income being subject to local tax ("kommunal") which is different depending on where in the country you are registered as a resident ranging between 28.98 - 35.15% for 2022 (Högsta och lägsta kommunalskatten 2022). There are numerous ways to lower the effective tax rate by different tax deductions. Deductions can have the largest impact on the effective tax rate at low-income levels.

The first of the two thresholds mentioned earlier is at incomes above SEK 490,700 ~ SEK 40,900 per month (for year 2019), where all income above that threshold is subject to 20% national tax. The national tax goes into the national government's budget while the local tax goes into the local government's budget used for local initiatives. The second of the two thresholds that no longer exists was for incomes above SEK 689,300 ~SEK 57,400 per month (as of 2019), where all income above this level was subject to an additional 5% national income tax.

The removal of the upper threshold was a part of a political agreement known as "Januariavtalet" where four political parties agreed upon certain policy changes to form a government after a record time of not being able to do so due to the distribution of mandates.

1.1 Contribution to Literature

A main difference between this study and other studies of how progressive taxation affects labor supply is what kind of data is studied. Most other studies use micro-level data, and for studies on

Sweden, the Longitudinal Individual Database (LINDA) is most commonly used. This is a more specified dataset containing detailed information of a sample of 3.5% of the Swedish population. For access to the LINDA database, one must be conducting research on a PhD level or above. Our study will thereby contribute to the literature in terms of methodology since we use publicly available, aggregated population data. Also, this study will contribute to the literature since it focuses on a tax cut where the earlier tax was one of the highest in the world. Hence, the results from this study will contribute to evaluating the effects on the labor market for countries with extremely high marginal income taxation.

Another way in which this paper contributes to the literature is the timeframe. This paper examines the economic effects of a change in tax policy in the short run. It seems that none to very few have been able to show compelling evidence of short- or -medium-term large real economic responses by top-income earners as a response to a change in taxation (Piketty, Saez et al. 2014).

Some contribution also comes from the ability to study a change in the marginal tax rate in Sweden's, as mentioned, unique tax-environment. Firstly, the marginal tax rate in Sweden was, and is, one of the highest in the world, significantly higher than in the U.S where most studies on the subject are conducted. This might cause individuals' behavior in response to a change in the marginal tax rate to be different. At the same time, Sweden has individual taxation instead of family taxation. Which means that the marginal tax rate a Swedish citizen faces is entirely based on their own income and decisions. While in other countries, such as the U.S, it is the family that is taxed. This means that a large part of the population faces a marginal tax rate that is not entirely due to their own decisions and actions, which skews incentives. The study of individual behavior in response to a tax-change is therefore more accurate in countries with a taxation system like Sweden’s.

2. PREVIOUS RESEARCH AND HYPOTHESIS

2.1 Theoretical Framework

2.1.1 Canonical Labor Supply Model

Most research on how wages respond to tax changes is based on the canonical labor supply model (Holmlund, Söderström 2011) (Derobert 2001) often referred to as the leisure-income model. It is based on the theory of consumer choices. The individual sees the time spent on labor and leisure as a trade-off and will therefore choose a bundle of consumption and leisure, to maximize utility. In the model below we disregard income from other sources such as dividends and profits arising from owning capital in firms, as well as grants and subsidies from the government. This simplification is done solely to demonstrate the relationship between hours worked and the effective tax rate while removing ambiguity from other sources of income.

The model assumes that there is one representative individual who enjoys utility from two normal goods: consumption (C) and leisure (l). To demonstrate the impact of taxes on the choice of hours devoted to labor, a simple static model will be derived. Starting by assuming the following utility function:

$$(1)\quad U(C,l) = C^{0.5} + l^{0.5}$$

The above utility function is an arbitrary utility function, and in real economies preferences vary between individuals. Another aspect to consider is how the consumption is a result of hours worked(N), the hourly wage(w), and the effective tax rate(t):

$$(2)\quad C = w(1-t)N$$

If one assumes the hourly wage to equal the marginal product of labor, the wage and in extension consumption would depend on what skills the individual possesses. So even if we assume one utility function where consumption and leisure are weighted equally, different skills and varying productivity can explain why people work different hours and have various incomes. Also, the effective tax rate can vary based on income level, sources of tax deduction and tax additions.

Each individual has a set number of hours, h to devote to either work or leisure. The relationship between the time and hours devoted to work, N and hours devoted to leisure, l can be written as in equation 3.

$$(3)\ h = l + N$$

In this economy there is a government and there is also only one time period. Given the scope of this study we assume that there is only proportional taxation and that the effective tax rate, t is:

$$(4)\ 0 \le t \le 1$$

The tax is a distortionary tax because it changes the relative price of leisure to consumption.

Further assumptions are that:

I. *C* and *l* are normal goods

II. $MRS(C, l) > 0$

III. $\lim_{C \to 0} MU_{C,l} = \infty \ \ and \ \lim_{l \to 0} MU_{C,l} = \infty$

The overall constraint stating that the implicit real expenditure (left) equals the implicit real income(right) can be written as:

$$(6)\ C + w \times l(1 - t) = w \times h(1 - t)$$

Or it can be drawn as in figure 1 where the utility-maximizing consumption bundle is where the negative of the marginal rate of substitution between consumption and labor equals the slope of the indifference curve.

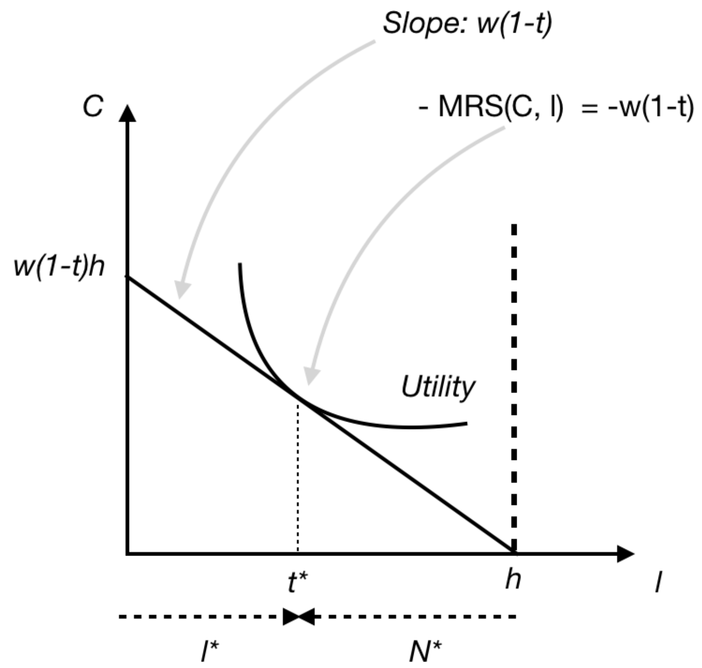


Figure 1. *Showing the overall constraint between consumption (y-axis) and leisure (x-axis), as well as the utility maximizing point, all of which depend on the hourly wage and the effective tax rate.*
Source: Authors' own drawing.

To derive the relationship between hours worked and the tax rate one must assume that the individual is maximizing their utility with regards to leisure and consumption:

(8) $\text{Max } U(C, l)$

(9) $\text{subject to: } C = w(1 - t) \times N$

(10) $\text{or subject to: } C + w(1 - t)l = w(1 - t)h$

The individual will choose a bundle of consumption and leisure so that the marginal rate of substitution between leisure and consumption equals the net wage, or the gross wage multiplied by the fraction of the income kept for consumption.

$$(11)\ MRS(C, l) = \frac{MU_l(C,l)}{MU_C(C,l)} = \frac{\frac{\partial \ln(l)}{\partial l}}{\frac{\partial \ln(C)}{\partial C}} = \frac{0.5l^{-0.5}}{0.5C^{-0.5}} = \left(\frac{C}{l}\right)^{0.5} = w(1 - t)$$

By using the above equation where the marginal rate of substitution equals the net wage, the consumption can be written as:

$$(12)\ C = l \times w^2(1-t)^2$$

Substituting C in the overall constraint (equation 7):

$$(13)\ l \times w^2(1-t)^2 + l \times w(1-t) = w(1-t)h$$

Which gives the following leisure demand and labor supply functions:

$$l^D = \frac{h}{w(1-t)+1} \qquad N^S = h - \frac{h}{w(1-t)+1}$$

Visible from the equations above, the tax rate has an inverse relationship with hours worked, and a positive relationship with leisure demand, meaning that a decrease in the effective tax rate will increase hours worked and decrease leisure. According to this theory, the people with top incomes who were affected by the lowering of the tax would, *ceteris paribus*, work more, which would be reflected in their incomes.

This example assumes that the income effect dominates the substitution effect. The income effect means that if the net hourly wage increases (which is the case when the tax rate is lowered, and the gross wage is constant) the individual will work more since he or she now earns more for every hour worked. The substitution effect on the other hand says that if the hourly net wage increases the individual will choose to work fewer hours since he or she now earns more for the same number of hours and therefore will smooth the benefit to enjoy increased utility from more leisure. Whichever one dominates depends on preferences. If there were to be different preferences the impact of the change in the tax rate would also be different. For example, if no change in labor supply is detected it could be because the income and substitution effect are of the same magnitude. It is possible that the substitution effect becomes more important for people with higher incomes.

In the static model above, the tax is represented by the effective tax rate, t. Even if this study intends to look at a cut in the marginal tax rate, for the treatment group it would also imply a cut in the effective tax rate which is why it is used as a simple model to demonstrate the relationship between hours worked and the effective tax rate.

2.1.2 Bargaining and Traditional Models

There are two different views on how wages are determined in the economy. In the canonical model, the traditional view is assumed. The traditional model assumes the individual in the economy to be a price taker with regards to wages. In contrast, the bargaining model says that if labor supply were to decrease (increase), that due to supply-demand equilibrium the hourly wage would have to increase (decrease). However, the labor market is somewhat lagging since employment is a result of a contract between employer and employee. These contracts are valid for different amounts of time, and usually aren't changed just because the labor market changes. For example, not very many people would accept a lowering of their wage if labor supply were to increase for a given year. Due to the lagging characteristics, equilibrium does not occur instantly, and oftentimes real wages only decrease if nominal wages do not increase more than inflation. The traditional view above represented by the canonical model assumes that the hourly wage does not change due to bargaining when supply and demand changes.

2.1.3 Bargaining Models

Some papers argue that if the labor market is imperfect, a decrease in tax progressivity might have a negative impact on employment. This was according to (Sørensen 1999) surveyed in (Bovenberg, van der Ploeg 1994), (Sørensen 1997), and (Pissarides 1998). Given the unique setting of the Swedish labor market where unions from the employer- and employee-side, to a considerable extent, are responsible for bargaining the terms of the labor market, the union bargaining model will contribute to the theoretical background by highlighting other aspects (Sørensen 1999). The model implies that an increase in the marginal tax rate would benefit the employment rate, ceteris paribus, since the trade-off-cost between high wages and the employment rate would decrease. If the union would like to increase employment for its members, it would be at the cost of lower wages by using the logic of demand equal supply. If this were to happen at a higher marginal tax rate, the net wage decrease would be smaller for the same cut in gross wage at a lower marginal tax. Since this paper intends to study top income earners, it is ambiguous if the union bargaining model is applicable since unionizing is more common where workers are substitutable, which is often the case for lower income levels.

Holmlund & Söderström (2011) states that in the bargaining model, a rise in the marginal tax rate will lead to wage moderation and a decline in overall income which could be welfare improving by the increased employment. By using his logic, a lowering in the marginal tax rate would lead to excessive wages and increased overall income while reducing welfare.

2.2 Previous Research

2.2.1 Progressive Taxation and Distortion

The incentives on an individual level are primarily dictated by the marginal tax the person faces, and since this marginal tax disconnects the pre-tax and after-tax income a distortion is created. These distortions affect other parts of the economy creating deadweight losses. Hence, when removing the Värnskatt the deadweight losses decrease. In the Sørensen (2010) article, which is referred to in the bill to abolish the Värnskatt, they argue that these dead-weight losses could very well finance a tax cut by themselves, as well as the opposite. The size of these deadweight losses is hugely dependent on the change in labor supply caused by the change in tax policy. With an ETI (Elasticity of Taxable Income) of 0.2 the abolishment of the Värnskatt would finance itself almost twice, while with an ETI of 0.1 the self-financing degree would be between 50-90%. Hence, the ETI is of immense importance to the potential economic benefit of removing the Värnskatt.

2.2.2 Redistribution

When deciding on a taxation system, the major trade-off to consider is the trade-off between redistribution and the above-mentioned distortions. To weigh these two against each other could be hard. The distortions are relatively easy to measure, the question here is merely how much aggregate income is affected by the relevant law. The effects of redistribution can not only be measured in a monetary way but is also a question of more ethical nature. If individuals benefit from this depends for example on their opinion of right and wrong, ownership and altruism etc. This is apparent in the literature discussing optimal levels of redistribution. One factor that correlates with higher rates of redistribution is a population's opinion of whether income levels are based on luck or effort (Alesina, Angeletos 2005). In Alesina & Angeletos (2005), they show that even if the opinion differs between countries of how important a factor luck is, all countries might use redistribution in a rational way. Depending on how a country views luck, their level of taxation and redistribution will vary. For countries who believe that luck plays a major part in determining income, the redistribution will be higher, which in theory decreases effort. Lower effort contributes to luck becoming a bigger determinant of income, which makes high distribution socially desirable.

Hence, it is a self-fulfilling prophecy. The utility maximizing rate of redistribution in Sweden might therefore be higher than in the US, even if the fundamental economics in both countries are similar, i.e., how much income that is due to effort in the first place does not matter.

In Piketty (1995), they create a model where income for a certain generation depends on their current effort but also if your parents had a high or low income. They also assume that society thinks all income due to factors that are beyond our control should be redistributed to those with worse conditions. Under these assumptions the utility maximizing tax rate decreases if income mainly depends on effort and decreases if it mainly depends on your parents' income, a factor similar to luck, referred to in the earlier paper (Piketty 1995).

From the world values survey we can see that almost 45% of Swedes thinks that luck determines income (Alesina, Angeletos 2005), and that more than every tenth Swede answers 1 on a scale from 1 to 7, where 1 is "incomes should be made more equal" and 7 is "We need larger income differences as incentives for individual effort" (worldvaluessurvey.org). This suggests that those values are present in Sweden that make utility maximizing tax rates and redistribution high. Or put more practically, Swedish norm makes Swedish politicians benefit from embracing policies of relatively high redistribution.

2.2.3 ETI: s in Sweden

A few studies trying to estimate the ETI in Sweden have been conducted, some of which are mentioned in the bill. The studies often use data from the late 2000: s, where the major tax reforms done during the 1990: s are the main focus, but some studies use even earlier data. The findings range from almost no effect at all (Bastani, Selin 2014), to more moderate levels like an ETI of around 0.1 (Holmlund, Söderström 2011). But some studies find even higher levels than this, reaching an ETI of 1.44 (Blomquist, Selin 2010).

The explanations for the discrepancy among results are many. The papers study different time periods and use different sampling and statistical techniques. Another important part is how the endogeneity in explanatory variables are handled, since there is reverse causality between the marginal tax rate an individual faces and their taxable income (Holmlund, Söderström 2011). At the same time, the difference between the short run and long run effects can be large as well. Some papers account for this and the bill argues that the full impact of the abolishment would be apparent first after a 10-year period.

Some previous research also finds a major difference between the ETI for females and males. In Holmlund Söderström (2011) they find an ETI of over 0.1 for men but no significant result for women. They argue that this could be because they do not take into consideration the decisions made by households. Succeeding papers have therefore tried to control for the corresponding spouse's change in marginal tax rate as well, with significant results for both men and women as a result (Gelber 2014).

Most literature on public finance studies ETI:s instead of elasticity of hours or participation. This is mainly because ETI:s capture total behavior such as tax avoidance and occupational choices, and also because data over tax returns measures the ETI very well.

2.2.4 ETI:s in the world

A study on the elasticity of taxable income in the U.S looking at reforms during the 1980s, Gruber & Saez (2011) finds an overall elasticity of taxable income of 0.4. What is interesting about this finding is that they believe that this elasticity of 0.4 is mainly because high-income earners with annual incomes above $100,000 have very elastic responses of taxable income. They write that the high-income group has an estimated elasticity of 0.57 while those with incomes below $100,00 have an elasticity of less than one-third of the high-income group.

Just like in Sweden different studies have found different behavioral elasticities. For example (Hausman 1981) and (Boskin 1978) claim that both labor supply and savings are very elastic, and a lowering of the tax rate could increase economic activity significantly. Meanwhile, (Slemrod 1990) argues for more moderate elasticity.

2.3 Theoretical Issues

One large normative problem for prior research is how the result of the paper can be applied practically. The normative approach heavily depends on which model of the labor market you assume to be more, or less, accurate. For example, a high ETI means that in a canonical model, the deadweight losses from a tax hike will have a large negative effect, while in a bargaining model there will still be deadweight losses, but the increase in employment might cause the tax hike net effect on welfare is positive (Holmlund, Söderström 2011).

Another issue comes from the demographic distribution of income. It is common for older individuals to have a higher income than younger ones, but at the same time their income growth is generally smaller (Holmlund, Söderström 2011). This could underestimate the effect of a change in the marginal tax rate for higher income brackets. Rogerson & Wallenius (2009) creates a model that implies that the characteristics of older and younger people is the dominating explanation behind differences in the employment to population ratio.

There is also an issue of endogeneity in almost any model testing the ETI. This is the reverse causality between marginal tax rate and taxable income, which was mentioned earlier. What is tested is the marginal tax rates effect on taxable income, but at the same time taxable income also affects marginal tax rate.

2.3.1 The Source of Elasticity

One important aspect of the previous research is what the source of the elasticity really is. In previous research and in our models presented above the major cause of elasticities is pure changes in labor supply. I.e., that hours worked, effort, or the employment rate increases or decreases. Other channels apart from the supply side elasticity could be a reason as to why taxable income might respond to a change in marginal tax rate (Piketty, Saez et al. 2014).

One of them is the tax avoidance response. This means that some of the increase or decrease in labor income is due to individuals reporting their labor income as something else, like capital income, or fails to report it entirely. A relevant example of this in Sweden is how for small businesses with few employees it can under some circumstances be more profitable for the owner to receive monetary compensation through dividends rather than salary. That is also why there are multiple laws to prevent tax avoidance. There is some cost to tax avoidance though, monetary or non-monetary, which can be assumed to increase with the size of the sum misreported. When the marginal tax rate decreases the comparative cost of avoidance increases and more income will be reported as labor income as a result of the tax cut. In other words, there is no real effect on actual output in the country (Piketty, Saez et al. 2014). This is also discussed extensively in a study made on Danish ETI:s. Here it is found that the major effect on taxable labor income is due to an intertemporal shifting of said income, from the earlier year of higher marginal taxes to the latter year of lower marginal taxes. With this shifting the estimated ETI was 0.1, and without it, it was not significantly different from zero (Kreiner, Leth-Petersen et al. 2016).

The other channel is a result of imperfect labor markets, more precisely, individuals can through bargaining, raise their wage above their marginal product. Like the case of tax avoidance, this bargaining comes at a cost. As with the avoidance effect, when the marginal tax is decreased the relative cost of bargaining decreases and wages increase, with no effect on productivity (Piketty, Saez et al. 2014).

Piketty, Saez et al. (2014) also finds when studying 18 OECD countries that cuts in marginal tax rates strongly correlate with increased income for the top 1% earners, suggesting the overall elasticity to be large.

2.3.2 Local and National Tax

Changes in the marginal tax rate for an individual is most commonly caused by a change in the local tax-rate. The local tax rate changes roughly once every 4 years and affects everyone in the municipality. Changes to the national tax rates are, at the same time, rare. Instead, national taxes are adapted over time through constant increases of the income limit where the additional tax rates kick in. For an individual to be affected by this repeatedly is however unlikely. The reason behind national tax changes being the focus of most studies is because individual local tax rates are treated as endogenous in most literature (Holmlund, Söderström 2011). The local tax rate is determined by the individual's choice of area to live in, which might correlate with other factors that in extension correlate with income as well. For example, the level of education probably correlates both with where you live and your income. National tax-rate changes, on the other hand, affect all those with the relevant income equally, regardless of other factors.

2.4 Hypothesis and Theoretical Motivation

The models described above view the relationship between tax progressivity and labor supply in different ways. The canonical model for labor supply predicts that labor supply should increase for the group affected by the tax. Assuming the hourly wage stays constant, that would mean that we would see an increase in both income per person and the aggregate income for the top income group caused by increased labor supply. The bargaining model also predicts higher wages and higher overall income, but whether it is because labor supply changes or the bargaining situation changes is unclear.

For literature focusing on ETI:s the value varies between studies. For studies on the ETI in Sweden, all papers we have come across have found at positive ETI, which means that labor supply would increase for those affected when the marginal tax rate was lowered. Something else that supports a positive ETI is that papers studying the U.S have found a higher elasticity for top-income earners. If the same applies to Sweden, there is even more evidence supporting the view that labor supply should increase.

While the impact of taxation can be modelled in different ways, and there are many surroundings to take into consideration, our hypothesis is that the people affected by the removal of the tax should work more after it was removed.

2.5 More Information About the Tax Studied

The Värnskatt has its roots in World War one. Like in many other times of war, an additional tax was enforced to finance the rearmament of the military in order to defend the country in times of worry. This war tax differed from previous war-taxes in Sweden since it was a progressive tax only affecting people with incomes of more than SEK 5,000 per year (at a time when the average industrial worker earned SEK 1,300 per year) (skatteverket.se). However, this tax did not disappear after the war and took different forms up until 2019.

For 2020 approximately 345 000 people are expected to have taxable incomes at a level where they would be affected by the new policy. They are expected to see an average decrease in paid taxes with SEK 17,700 per year, and the median effect is expected to be SEK 8,375 SEK per year (Regeringskansliet 2019).

2.6 Difference in Difference

Our study will use a difference in difference (we use DiD for short) approach to try to prove some causality. The DiD-approach is widely used in economic research and is especially effective when trying find an effect of a policy change or similar on some interesting variable. The fundamental idea is to compare two similar groups before and after the implementation of the policy, where one of the groups is affected by the policy and the other is not. The effect of the policy is then assumed to be the difference between the changes in both groups after the repeal (see appendix for a graphical example).

To carry out a DiD-strategy without getting biased results it is important that it is safe to assume that the trend in the relevant outcome variable would be similar for both groups in the absence of any treatment (e.g., a policy change). Otherwise, the potentially observed effect could be caused by some underlying trend, and not the treatment (Schwerdt, Woessmann 2020).

3. DATA AND SAMPLE

3.1 Collection of Data

The data used to answer the question consists of aggregate monthly incomes. This is grouped into the following levels: SEK 0 k, SEK 0-100 k, SEK 100-200 k, SEK 200-300 k, SEK 300-400 k, SEK 400-500 k, SEK 500 k- 1 M, above SEK 1 M. The data is collected from Skatteverket and it is based on information about wages and other compensations to employees. This is based on reports from employers. Something that might come across as strange is how the average income for the SEK 0 k group is quite high. That is because the SEK 0 k group is a group of people who work in Sweden but are taxed in another county, hence their taxable income in Sweden is zero even though their actual income is higher. Noteworthy is that the data is not a sample of the Swedish population, but rather it contains the *actual* population data. It is also noteworthy that the data is based on gross wages.

As a complement to the monthly data we also use yearly data to study the repeal, which is also collected from Skatteverket. It contains the same information but on an annual basis from 2013 to 2021, more precisely it contains annual gross incomes grouped by the same levels as the monthly data described in the paragraph above.

To answer the question, we use gross labor income as a proxy for labor supply, since *ceteris paribus* an increased income should be due to more hours devoted to labor, assuming the traditional view where the individual is a price taker with regards to wages.

When defining a treatment and control group, there are different ways to split the two considering the income levels in the dataset are not equal to the threshold we intend to study. The treatment group, i.e., the people who paid the tax before it was removed is defined as the people who earn SEK 1 M or above annually. This is way above the Värnskatt threshold (SEK 689,300), but the group below (SEK 500,000 – 1,000,000) also contains people who were not subject to the tax. Another reason is to ensure that people in the treatment group are not actually a part of the control group due to tax deductions on the gross income. If a person were to have a gross income of SEK 700,000 annually, making them a part of the treatment group, and then be able to do deductions of SEK 50,000 they would no longer be a part of the treatment group because their wage would be below the threshold. By using the 1 million or above group as the treatment group we can be surer that the people in the treatment group receive treatment since it is very unlikely for people in this group to make deductions of a magnitude so large that they would no longer be affected by the tax. The classification of the control and treatment group is based on maximum likelihood classification to be sure only treated people will be in the treatment group.

4. METHODOLOGY AND METHODS

As mentioned previously, our aim with this paper is to determine if the repeal of the värnskatt has any short-term effects on labor supply. To determine this, we use the publicly available data from Skatteverket which is not as precise as data used by others researching optimal taxation. Nevertheless, it gives a great overview of the aggregated movements in labor income. For the grounds of our analysis, we will use difference in difference models for different variables to try to prove some causality.

We will not be able to find any precise measures of the ETI, since we do not have access to any individual data. Individual data would not be needed if taxation were equal all over the country, but since the size of your local tax varies with where you live, individuals in the same income bracket face different marginal taxes. Instead, with our difference in difference method, we will only try to identify an increase or decrease in labor supply, which is equivalent to determining the sign of the ETI. It is also important to note that we only look at the short-term effects of the tax repeal.

4.2 Issues Mentioned Previously

The issue of reverse causality needs to be addressed as well. In our DiD model we want to see how an individual in the treated group's income is affected after the repeal. But the individual's income also affects whether the individual is treated or not. We also have the problem of differences in income levels and income growth associated with each level caused by age to address. These problems would be hard to deal with due to our very "blunt" dataset if we only had a sample of the population. But our study is not focused on individual ETI like earlier research, and our goal is not to make any claims regarding how individual people react to a tax reduction. Instead, our study focuses only on the aggregated, total and population level effects of the repeal. Since we use population data, we do not have to take any biases on an individual level into account, since we look at a population level.

As to whether any effects are caused by real changes to labor supply, or just changes to other behaviors such as tax avoidance or bargaining is hard for us to tell. We assume though, that labor income is a relatively good measure of labor supply. The elasticity due to tax avoidance is often assumed to be quite low (Piketty, Saez et al. 2014), so the effect of this is probably negligible. The bargaining effect could be larger (Piketty, Saez et al. 2014), but it is something that we, at the time, do not have the tools to handle. It would demand that we had some way to evaluate the aggregated over, or under payment for every income group, which is quite difficult.

This bargaining effect, and how it is described by (Piketty, Saez et al. 2014), is therefore probably something that could bias the result, because of our choice to measure labor supply as labor income. Higher income levels will probably have more factors that cause wage and actual marginal output to differ (one cause for this might be that it is harder for the employers to measure high skilled labors actual output), and it is the higher income levels that have a higher chance of being treated.

4.3 Potential Issues in Our Data

Another potential issue with our data is that people move between income brackets over time. This would mean that some individuals will belong to both the treatment group and the control group over the studied period. We deem this unlikely though, since we have removed the group of people with earnings between SEK 500 k – SEK 1 M, and movements in labor income of this magnitude are rare. However, it might be more likely that there are top-income earners who are close to retirement that quit their high-paying jobs but still stay in the labor force by only working a small part of their time at a lower income level. This could cause problems with people moving from the treatment group to the control group over the studied time.

4.4 The Method

In our difference in difference method, our treatment group will be, as mentioned, those individuals who have a gross income of more than SEK one million per year. The control group consists of those earning less than SEK 500 k per year, which excludes the SEK 500 k - SEK 1 m group from the study.

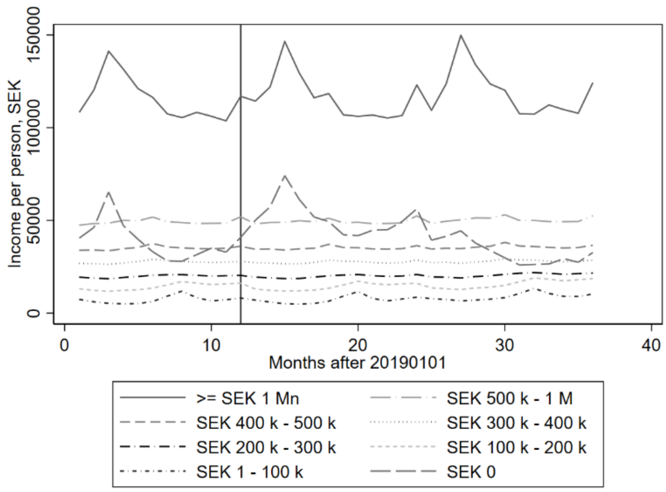


Figure 2. *Description: The event occurs in month 12 on the x-axis. The graph displays the average monthly gross income for different groups, grouped by annual gross income.*

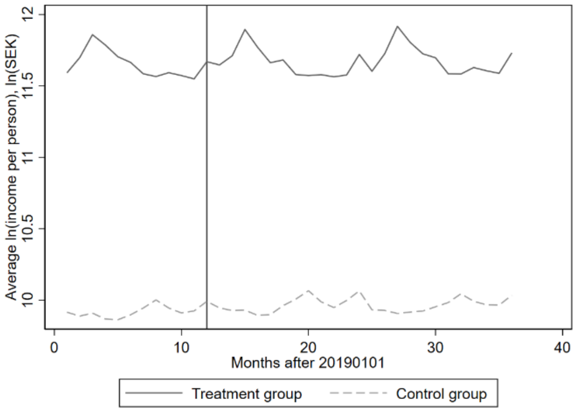
Source: Skatteverket, 2019-2021

4.3.1 Dependent variable no:1

Our first model will be a DiD approach to the logarithmic form of income per person. While studying income it is always beneficial to use the log-form of the variable. This is done partly to make the errors more normally distributed. But mainly, this also means that in combination with our DiD-model the effect will be shown through percentage-points instead of SEK, which better ties into earlier ETI-focused research, and is also easier to apply to countries with other currencies. Other functional forms can be used as a complement.

4.3.2 The Control Group

The most important thing when choosing a control group for a DiD-approach is to make sure that the control group and treatment group share a common trend in the dependent variable before the repeal. Otherwise, the result could get heavily biased. The straightforward way for us would be to look at the logarithm of income per person for each group. The problem is that this does not fulfill the common trends assumption. Instead, if we choose to look at the logarithm of average income per person, we find that the trends are more alike.



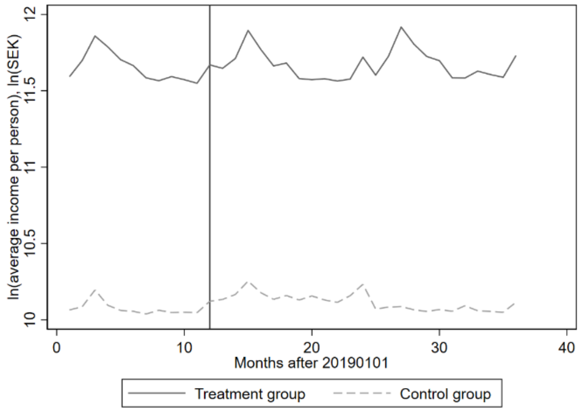


Figure 3. *The average logarithm of income per person* ***Figure 4.*** *The logarithm of average income per person*

Source: Skatteverket, 2019-2021

This means that we choose to calculate our control group for every unit of time like:

$$(14)\quad C_t = \ln\left(\frac{\sum_{i=0}^{5}\left(\frac{X_{i,t}}{N_{i,t}}\right)}{5}\right)$$

Instead of:

$$(15)\quad C_t = \frac{\sum_{i=0}^{5}\ln\left(\frac{X_{i,t}}{N_{i,t}}\right)}{5}$$

Were $X_{i,t}$ is total income for income bracket *i* in month or year *t,* and $N_{i,t}$ is the number of people in income bracket *i* in month or year *t.* Because the average is calculated before the logarithm, we get 1 observation for every month in the control group instead of 5. This will increase standard errors and decrease our ability to use the Central Limit Theorem to assume approximately normally distributed errors. But the common trend allows us to use the DiD approach in the first place.

How we calculate the average income per person should also be discussed. The straightforward way would be to calculate it like:

$$(16)\quad A_t = \left(\frac{\sum_{i=0}^{5} X_{i,t}}{\sum_{i=0}^{5} N_{i,t}}\right)$$

Instead, we calculate it like, as can be seen in equation 14:

$$(17)\quad A_t = \frac{\sum_{i=0}^{5}\left(\frac{X_{i,t}}{N_{i,t}}\right)}{5}$$

This means that we weigh every group's income per person equally, without weighing the number of people in each group. We argue that this is more representative of the *average behavior* of the groups. The groups are not homogenous enough to group everyone together like is done in equation 16, which rather communicates the average behavior of a random individual. This would cause the behavior of the group with the most people to get more weight, which does not make sense in our case, since behavior might differ vastly between income brackets.

4.3.3 Common Trend

By comparing the control and treatment group in figure 4 we can identify some common trends in the movement before the repeal. This also becomes apparent when plotting the percentage changes from month to month for the two groups.

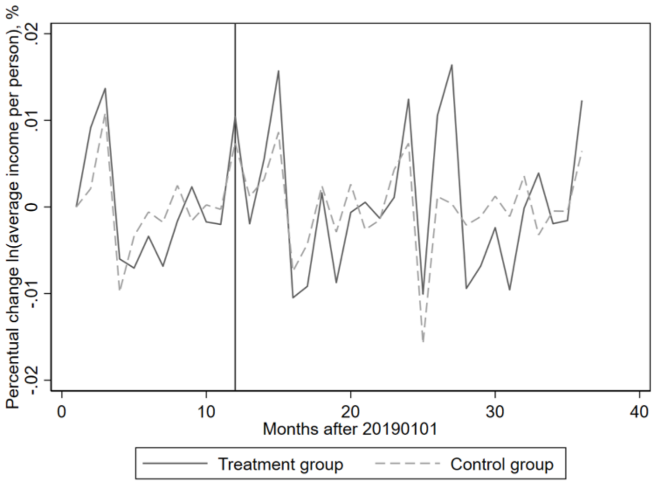


Figure 5. *The monthly percentage change in average income per person for the control group and treatment group. Source: Skatteverket, 2019-2021*

In figure 5 we can see how the direction of the movements are remarkably similar for both groups over the months, i.e., both groups react similarly (positively or negatively) to different events in the economy the year before the repeal. We argue that this common trend is enough to fulfill the DiD-approach's identifying assumption.

While figure 5 suggests that we could look at the percentual change in income per person as well, we imagine that a DiD-approach is not that fitting for that variable. DiD identifies a constant change to the mean value of the dependent variable for the treatment group. For a significant change to be found in the percentual change it would mean that the growth rate of income would have to have changed, which would, in extension, have a massive effect on income distribution in the future. An effect of this magnitude is unlikely and therefore we focus on the log-form of income.

4.4.1 Dependent Variable no:2

As discussed above, monthly percentage changes in income per person is not that fitting of a variable. Still, comparison of the groups gets easier when we look at proportional changes in both groups, instead of comparing them both directly. We imagine that if there is an effect, this would manifest itself in just one, or some, percentual monthly changes. To find this effect, we will have to accumulate all percentual changes over the relevant period of time. This can be done by comparing every month with one specific base month. We have chosen this month to be the month before the repeal took practical effect, December 2019 to be exact. The value for each month for the control group is created in the following way:

$$(18)\ F_t = \frac{A_t}{A_{2019-12}}$$

Where A_t is the average income per person in the control group for month *t,* calculated in the way described in equation 17. Therefore, we lose the same number of observations as in dependent variable no:1. This is the only way the control group can be created that fulfills the common trend assumption though.

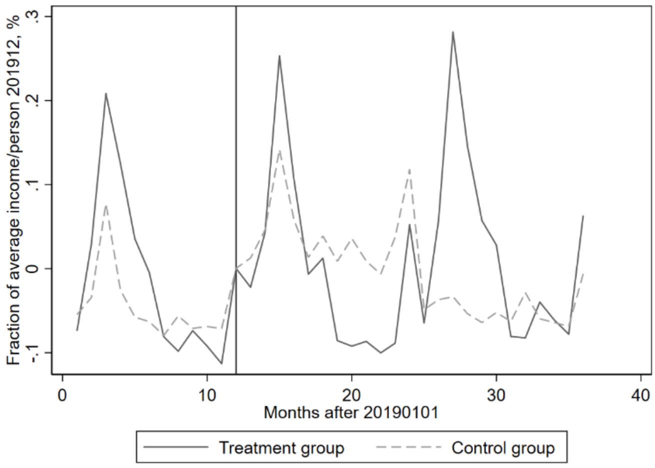


Figure 6. *Income for each month for the treatment and control group in relation to the income of the specific group December 2019. Source: Skatteverket, 2019-2021*

4.4.2 Common Trend

Here we argue that figure 6 shows that the common trend holds the year before the repeal, on the same grounds as for dependent variable number one.

4.5.1 Dependent Variable no:3

As the last dependent variable, we will look at logarithm of the aggregated income. This is to get rid of all potential biases caused through the way we create our control group. The two groups we will be comparing are the above 1 million group and the group with the second highest income, the SEK 400-500 k group. Here it is harder to motivate the fulfilment of the identifying assumption for a DiD approach though.

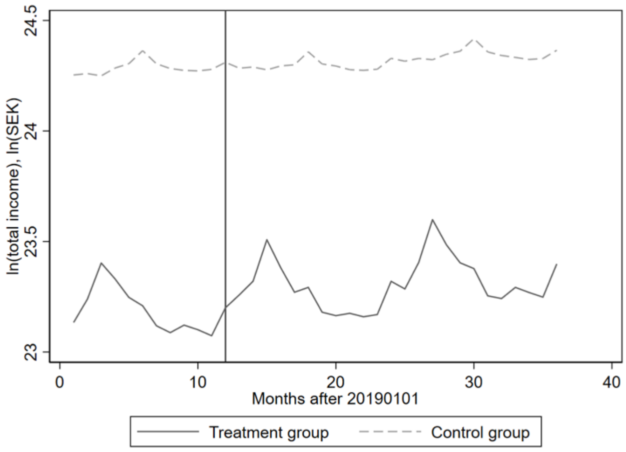


Figure 7. *Logarithm of aggregated income for the ≥ SEK 1 M and SEK 400-500k groups during the months from January 2019 to December 2021. Source: Skatteverket, 2019-2021*

4.5.2 Common Trend

To motivate a common trend using figure 7 alone is not possible. The two lines move in completely opposite directions as opposed to earlier studied trends. Still, the average growth rate for the first year for the two groups seems similar even though the movement around this growth rate is vastly different. A DiD approach builds on comparing averages for two groups before and after the treatment. If we can assume that these averages move similarly we might be able to extract some causality.

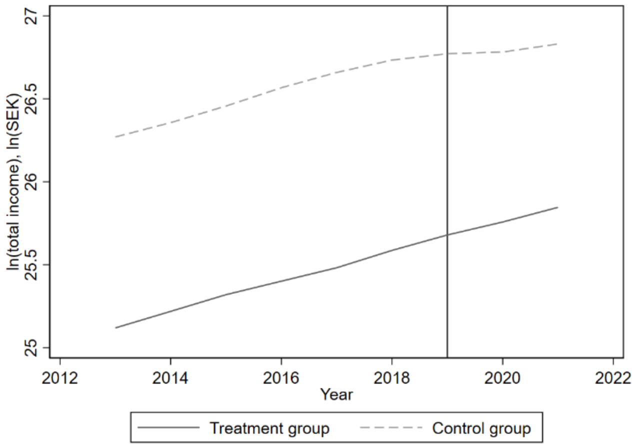


Figure 8. *Logarithm of the aggregated income for the ≥ SEK 1 M and SEK 400-500 k groups during the years leading up to the repeal. The labelled years on the x-axis refers to the end of the respective year. Hence, the red line splits the graph, one part being before the end of 2019, and the other the time after the beginning of 2020. Source: Skatteverket, 2013-2021*

4.5.3 The Years Leading up to the Repeal

In figure 8 we can see that during the years leading up to the repeal the two groups' trends seem very similar over time. This makes the idea of comparing the averages before and after the repeal in figure 7 not too unreasonable. The ground for this approach is still unstable, and it will only serve as a complement to the other models.

4.5.4 Control Variables, Dependent Variable no:3

It is apparent that the number of people in both the treatment and control group will have a large effect on total income. To single out if the effect comes from increased labor participation in these groups or not, we will control for the number of people in the group. This is similar to just looking at income per person as earlier but as mentioned, we avoid potential biases caused by the way we create the control group in these cases by looking at aggregated income.

4.6.1 Dependent Variable no: 4 and 5

As a complement to the monthly data, we will also look at yearly data to single out an effect. Over longer periods of time the movement in income is not as cyclical when looking at an annual total income. This makes it easier to motivate a common trend. In both cases we will use the second highest, the SEK 400-500 k bracket, group as the control group, since it is easier to motivate a common trend this way. When looking at aggregated income we will control for the number of people in each group, for the same reason as earlier.

4.7.2 Common Trend

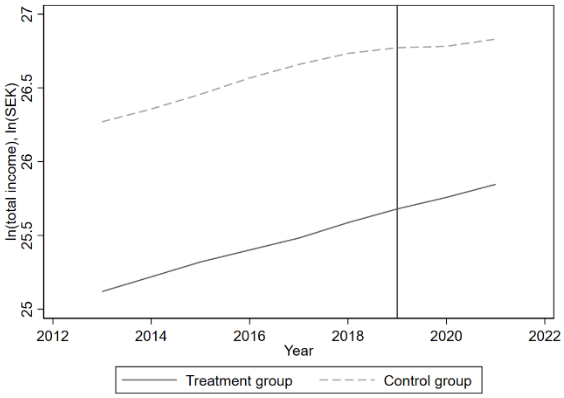


Figure 9. *Logarithm of total income for each group*

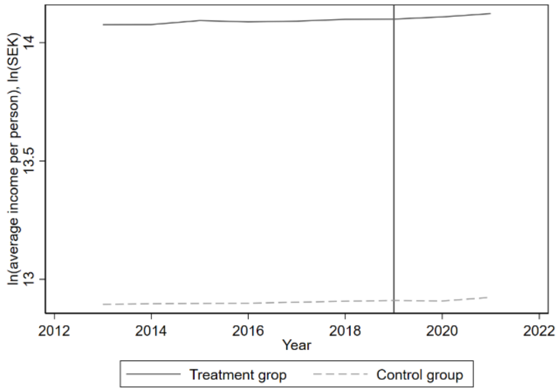


Figure 10. *Logarithm of average income per person*

Source: Skatteverket, 2013-2021

We can see here how both groups seem to share a common trend over the years. It is most apparent in figure 9 but by comparing both lines in figure 10 closer together we can see that it is safe to assume here as well.

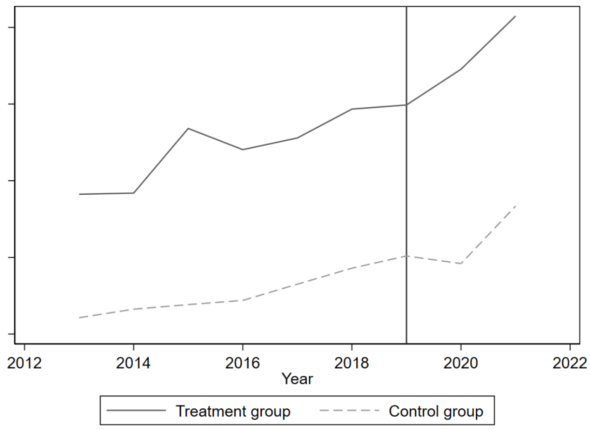


Figure 11. *Income per person per year for both relevant groups compared closer together. Apart from the treatment group's significant increase in 2015 they seem to share a common trend.*
Source: Skatteverket, 2013-2021

4.8 Model

The model used to identify the effect can be written as:

$$y_{g,t} = \beta_0 + \beta_1 \cdot Treat_g + \beta_2 \cdot After_t + \beta_3 \cdot After_t \cdot Treat_g + u_{g,t}$$

Where $y_{g,t}$ is either the income in ln(gross income/person) or the income of the group in relation to the income of 12/2019, for the group *g* (either control or treatment group) at time *t*. The *Treat* variable is a dummy variable that takes on the value 1 for the treatment group and 0 for the control group. The *After* variable is also a dummy variable, which takes on the value 1 after the tax repeal and 0 before the tax repeal. β_3 is the DiD-estimator. When looking at aggregated income we also control for the number of people in the group:

$$y_{g,t} = \beta_0 + \beta_1 \cdot Treat_g + \beta_2 \cdot After_t + \beta_3 \cdot After_t \cdot Treat_g + \ \beta_4 \cdot Thousands_{g,t} + u_{g,t}$$

Where $Thousands$ is thousands of people in group *g* at time *t*.

5. RESULTS

5.1 Regressions Over Monthly Variables

Table 1.

VARIABLES	(1) ln(average income/person)	(2) Fraction of income/person 201912	(3) ln(total income)	(4) ln(total income)
Treat	1.576***	0.0305	-1.098***	0.989
	(0.0325)	(0.0338)	(0.0337)	(0.837)
After	0.0396	0.0393	0.0344	-0.0237
	(0.0281)	(0.0293)	(0.0292)	(0.0365)
After*Treat	-0.0199	-0.0190	0.0876**	0.120***
	(0.0398)	(0.0414)	(0.0412)	(0.0418)
Thousands				0.00231**
				(0.000925)
Constant	10.08***	-0.0420*	24.29***	21.96***
	(0.0230)	(0.0239)	(0.0238)	(0.931)
Observations	72	72	72	72
R-squared	0.990	0.044	0.977	0.979

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Skatteverket, 2019-2021

5.1.1 General Comments on the Monthly Result

We can see here how the effect seems different depending on if income per person or total income is studied. When regressing on income per person or income per person as a fraction of the income per person in December 2019, the effect is far from significant and around negative 2%. When regressing on total income instead, it seems like the change in total income was on average 8% higher in the treatment group than in the control group after the repeal and is significant on a 5% level. When controlling for number of people in the groups the effect increases to 12% and gets significant on a 1% level. Number of people in the groups has a large effect and turns the Treat variable positive, which is reasonable because the income per person is much higher in the treatment group. For income per person, calculating the mean as in equation 15 and regressing over the 252 observations, which this calculation of the mean makes us able to do, does not make a large difference. Both in coefficient and significance.

5.2 Regression over yearly variables

Table 2.

VARIABLES	(5) ln(average income/person)	(6) ln(total income)	(7) ln(total income)
Treat	1.188***	-1.144***	-0.100
	(0.00443)	(0.0971)	(0.256)
After	0.0148**	0.261*	-0.0408
	(0.00665)	(0.146)	(0.122)
After*Treat	0.0120	0.139	0.393**
	(0.00940)	(0.206)	(0.151)
Thousands			0.00135***
			(0.000321)
Constant	12.90***	26.54***	25.39***
	(0.00313)	(0.0687)	(0.278)
Observations	18	18	18
R-squared	1.000	0.928	0.969

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
Source: Skatteverket, 2013-2021

5.2.1 Comments on the Yearly Results

When looking at the regressions over the yearly variables the situation is similar to the monthly variables. When looking at income per person the effect is small and not significant. When instead looking at total income the effect turns positive. Controlling for number of people increases the coefficient of the DiD-estimator and makes it significant on a 5% level.

5.2.2 Problems in the Yearly Variables

The yearly variables suffer from some problems. The observations are few which first of all creates large standard errors, but also with such a small number of observations we cannot rely on the errors being approximately normally distributed according to the Central Limit Theorem. This is something we must assume to carry out hypothesis testing. The fact that we use logarithmic income makes this assumption stronger though.

5.3.1 Potential Biases Caused by Our Models

The regressions over total income, both yearly and monthly, could suffer from bias, even after controlling for number of people in the group. This is because an increase in total income in the treatment group causes no difference in the demographic of the group, while an increase in total income in the SEK 400 –500 k group might cause those with the highest income in this group to move to the SEK 500 k – 1 M bracket, therefore reducing the increase in total income. This means that the effect might be overestimated. For example, that the repeal causes an increase in labor income as large as almost 40%, which is found in regression 7, seems unlikely.

Also, the split into the treatment and control group is not ideal since not all treated people are captured. It is therefore possible to miss some behavioral change, and if the change of the treated people differs within the group at different income levels it is not possible to detect using the current grouping. The common trend in our models can also be questioned, especially in regression 3 and 4, this is another way our models might not capture the result in a representative way.

6. DISCUSSION AND CONCLUSION

6.1 Discussion

The value and significance of the DiD estimator (after*treat) varies depending on what data is tested and how it is tested. In table 1, where only the monthly data is used, one can see that the estimator is negative and insignificant for the first two regressions, but positive and significant on an aggregate level. In table 2, where annual data is considered, all estimations of the after*treat variable are positive, but only significant when looking at total income.

Comparing the results with the predictions made by the canonical model, the predicted and actual outcome does not appear to totally align. The canonical model predicts that one should decide to work more when the tax rate is lowered. That should then be reflected on an income per person level, and not only on an aggregate level. There are many ways to explain the gap between predicted and actual outcomes. One issue is us only being able to access aggregated data, which comes with difficulties capturing the entire group affected. More related to the canonical level there is one aspect that might need to be revisited. The preferences outlined in the example when deriving the model showed that the income effect was larger than the substitution effect. Perhaps that assumption is invalid, and it is possible that the income and substitution effect are the same size, especially for top-income earners, which explains the lack of a distinguishable effect.

Assuming that our results are not biased the only explanation for a rise in income on an aggregate level without an effect on income per person is that either more people, with a relatively high income (otherwise there would be a larger negative effect on income per person), would have to have entered the higher income bracket. Or, that people with more modest salaries enters the higher income group, but this effect on income per person is balanced out by higher incomes for the top earners. Both of these scenarios might be because those people affected by the repeal in the SEK 500 k – 1 M group have increased their labor supply greatly and moved to the SEK 1 M group.

One obvious explanation for the insignificant results in income per person is that it takes time for policy changes to influence the labor market. In higher income brackets, the most widespread form of employment is probably permanent employment, an increase in income in this case only comes from wage negotiation or a change of job, both of which could take time. As mentioned in the bill to remove the tax, the effects on the labor market are expected to occur successively over a long period of time. Considering that we only analyze the first two years after the realization of the policy change, the effects might not yet be large enough for us to detect with the difference-in-difference method, over income per person, with the available data.

6.2 The Covid-19 Pandemic

What probably distorts our results the most, and makes it hard to distinguish causality from correlation, is the Covid-19 virus, which started to spread in Sweden only one month after the Värnskatt was effectively repealed and has been present ever since. The DiD-approach controls for any effects that affect both the control and treatment group in the same way, but if the risk of being laid off or terminated because of the pandemic correlates with which income bracket you belong to then our results might be heavily biased. Evidence suggests that the industries who were hit the hardest by the pandemic were the hotel, restaurant, and retail business, but also different kinds of manufacturing industries have been hit hard. These are all industries where most employees do not qualify into our treatment group, which might cause the effect of the repeal to look larger than it actually is. Uncertainty has probably spread through the whole labor market though. The volatile economy and some jobs being threatened more than others might have contributed to people becoming more risk averse. Instead of changing jobs or demanding more from a current employer to reach a higher salary, people might have felt it being a better option to stay in their current positions, which might cause increases in income in some brackets to be smaller than they otherwise would be.

6.3 Conclusions

To conclude, there seems to be a positive effect on the labor supply of high-income earners on an aggregate level from the removal of Värnskatten. People with top incomes earn more after the removal on an aggregate level, but not on an income per person level. One of the main weaknesses of this study is the dataset, and that could explain why there does not seem to be an effect on an income per person level. Another explanation could be that the substitution effect plays a bigger role than expected at high income levels. Our way of creating the different groups might also cause some upward bias, especially in the total income variables, but maybe also in the income per person variable. The Covid-19 pandemic might also heavily distort our results since we do not have any tools to control for it.

For further studies on the subject, it would be interesting to look at other aspects of the removal of Värnskatten, such as investment in skills. If more precise data is available, it would also be interesting to look at the results without excluding groups like we did with the SEK 500 k – 1 M. Another side of it that one could look at in further studies is to see if there are any differences in how the removal affected different groups, for example by looking at gender or age. Something else that could be studied is to try to better tease out the effects of bargaining, and tax avoidance.

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APPENDIX

Figure 11.

Graphic illustration of a DiD-strategey

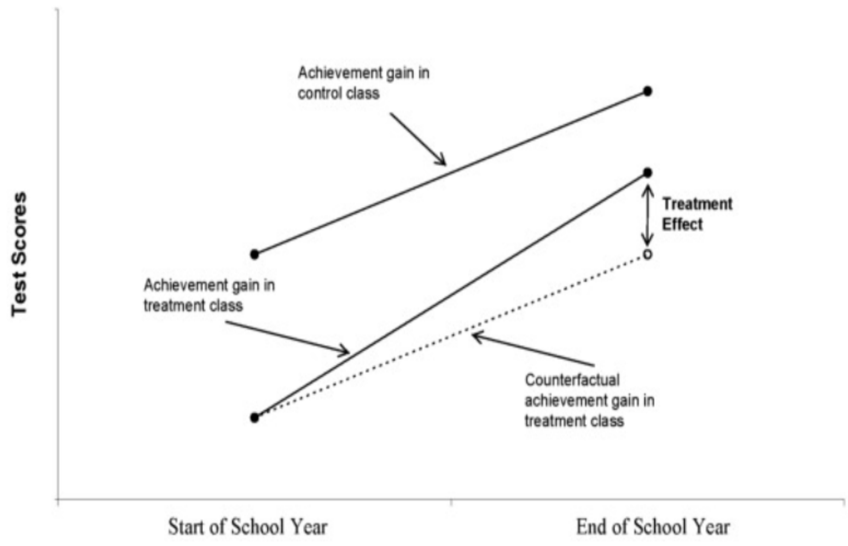

Table 3. **Average income per person and average number of people per group, per month**

VARIABLES	(1) Income per person	(2) Number of people
SEK 0	41,283	11,875
	(1,964)	(1,427)
SEK 0-100 k	7,762	259,800
	(348.6)	(11,621)
SEK 100-200 k	14,770	317,374
	(358.3)	(4,533)
SEK 200-300 k	20,083	707,475
	(149.6)	(7,412)
SEK 300-400 k	27,645	1.289e+06
	(123.1)	(5,941)
SEK 400-500 k	35,270	1.024e+06
	(166.0)	(3,096)
SEK 500 k-1 M	49,641	1.083e+06
	(235.7)	(10,364)
≥ SEK 1 M	117,163	109,667
	(2,010)	(1,046)
Observations	288	288

Table 4. **Average income per person and average number of people per group, yearly**

VARIABLES	(1) Income per person	(2) Number of people
SEK 0	153,159	26,679
	(13,661)	(4,466)
SEK 0–100 k	33,557	739,072
	(862.0)	(7,104)
SEK 100–200 k	111,953	550,038
	(2,048)	(17,928)
SEK 200–300 k	199,536	1.038e+06
	(1,850)	(48,913)
SEK 300–400 k	311,030	1.413e+06
	(580.4)	(11,960)
SEK 400–500 k	402,091	904,093
	(1,226)	(55,517)
SEK 500 k-1 M	570,383	860,816
	(1,236)	(77,510)
	(6,553)	(7,009)
Observations	72	72