

# The Norwegian Tax Holiday: Salience, Labor Supply Responses, and Frictions\*

Jósef Sigurdsson<sup>†</sup>

May 17, 2023

## Abstract

An emerging consensus is that the Frisch elasticity of labor supply is small. This may reflect a lack of salience, inelastic preferences, or prevalence of frictions. Studying survey data collected during a tax holiday in Norway, when earnings were untaxed during a transition between tax systems, I report three findings. First, 80 percent of adults were aware of the tax holiday. Second, one-fifth of adults responded by working more. Third, frictions in adjusting working hours or non-working time appear to be the reason for a majority of non-responses. The findings support the long-held notion that labor supply choices are constrained.

**JEL Codes:** E65, H24, J20, J22.

**Keywords:** Labor supply, Frisch elasticity, Salience, Adjustment frictions.

---

\*I thank Eirik Berger for invaluable help in gathering data and background information. I thank Ola Grytten, Arash Nekoei, Emmanuel Saez, Kjell Salvanes, David Seim, Michael Siegenthaler, and Mikael Stenkula for their helpful comments and suggestions.

<sup>†</sup>Stockholm University, CEPR, CESifo, and IZA. Address: Stockholm University, Department of Economics, 106 91 Stockholm, Sweden. Email: [josef.sigurdsson@su.se](mailto:josef.sigurdsson@su.se).

# 1 Introduction

How responsive is labor supply to transitory wage changes? The quest for quantifying this response, measured by the Frisch elasticity of intertemporal labor supply, dates back to the seminal work of [Lucas and Rapping \(1969\)](#) and [MaCurdy \(1981\)](#) and has since constituted an important research program in economics. This is for a good reason. Understanding how people respond to temporary changes in wages is key to understanding business cycles and labor markets.

Empirically identifying the Frisch elasticity is, however, no easy task. It requires exogenous and transitory changes in wages. The most prominent estimates rely on short-run (experimental) variation in pay in specific occupations or exploit natural experiments such as ‘tax holidays’ which temporarily exempt earnings from taxes during a transition between tax systems.

The evidence from these studies is mixed. Occupation-specific studies—such among bicycle messengers ([Fehr and Goette, 2007](#)) and taxi drivers ([Farber, 2015](#); [Angrist, Caldwell, and Hall, 2021](#))—tend to report relatively large elasticities. In contrast, [Martínez, Saez, and Siegenthaler \(2021\)](#) study a two-year-long tax holiday in Switzerland and estimate a near-zero intensive margin elasticity and find no evidence of employment responses. Studies of the tax-free year in Iceland, however, find evidence of increased labor supply in response to a tax holiday ([Bianchi, Gudmundsson, and Zoega, 2001](#); [Sigurdsson, 2022](#); [Stefánsson, 2019](#)). [Sigurdsson \(2022\)](#) estimates a positive and significant Frisch elasticity on both the intensive and extensive margins, documenting how the hours and employment responses are driven by those with the ability to adjust. Still, the elasticity estimates are small relative to the elasticities required for calibrating real business cycle models to match aggregate data (e.g. [King and Rebelo, 1999](#)).

Although estimates vary considerably, an emerging consensus building on earlier work is that the Frisch elasticity is small (e.g. [Banerjee and Duflo, 2019](#)). While a small elasticity estimate may reflect inelastic preferences, there can be other explanations. These include lack of salience ([Chetty, Looney, and Kroft, 2009](#)), where inattentive workers fail to recognize the transitory wage increase that, e.g., a tax holiday generates, and prevalence of adjustment frictions ([Chetty, 2012](#)) that hinder workers in exploiting a temporary earnings opportunity. As the Frisch elasticity puts an upper bound on the steady-state labor supply elasticity, a near-zero Frisch elasticity has far-reaching implications, e.g., for calculating the welfare consequences of tax policy. It is therefore essential to understand why workers do not adjust in response to transitory wage increases. Shedding light on the relevance of salience and adjustment frictions is, however, difficult without having direct evidence of workers’ knowledge of the transitory wage increase, their labor supply responses, and the reasons for possible non-response.

This paper provides new evidence on these three aspects. To do so, I take advantage of a tax policy reform when in 1957 Norway replaced a retrospective tax system where workers paid taxes based on their income in the previous two years with a standard pay-as-you-earn tax system. Income earned in the transition period—between mid-1955 and throughout 1956—was never taxed.

Using data from a survey conducted by Gallup during the tax holiday among a representative sample of the Norwegian population, I report three main findings. First, the Norwegian tax

holiday was very salient. Four out of five adults report having known about the tax reform and understood that they had the opportunity to earn tax-free income during the transition period. While insiders in the labor market were more likely to take notice—men more than women and high-income earners more than those with low incomes—most people, in general, seem to have been aware of the reform.

Second, 20 percent of all adults, or 25 percent of those aware of the opportunity to earn tax-free income, adjusted their labor supply in response. The largest response rate was among men, young workers, and those living in rural areas. In addition to the intensive margin, the tax holiday seems to have also triggered some extensive margin responses, as a fraction of housewives and pensioners report to have adjusted their labor supply.

Third, when asked about the reason for not responding to this earnings opportunity, respondents explain that by factors that can be broadly defined as reflecting frictions in adjusting hours at work. Among those that knew about the tax reform but did not take advantage of it, the majority of workers say that the main reason is friction in increasing working time—such as hours constraints in the current job—or constraints in reallocating non-working time to hours at work—such as child-care obligations. Other reasons, including labor demand, health, or lack of understanding or motivation for working more constitute the remaining but small share of explanations.

To put these results in context, I use aggregate data on labor earnings in Norway and its neighboring country Sweden, which did not have a tax holiday at the same time, to estimate the Frisch elasticity. The earnings elasticity estimates range from 0.104 (SE 0.047) and 0.191 (SE 0.046), depending on the specification. This small elasticity estimate is quantitatively in line with existing evidence and falls in the middle between the estimates based on the Swiss tax holiday and the Icelandic tax-free year.

Taken together, my findings imply that in settings where the effect of behavioral optimization frictions—such as inattention to tax rates—is likely to be small due to the salience of incentives, and the utility cost of not adjusting labor supply is high, the estimated labor supply elasticities may still be small. Rather than workers' labor supply behavior being inelastic to such incentives, the reason seems to lie primarily in their inability to adjust their working time. These findings are consistent with a long-held view that frictions, such as adjustment costs (Cogan, 1981; Ham, 1982), hours constraints (Altonji and Paxson, 1988; Dickens and Lundberg, 1993), and costs of changing jobs (Altonji and Paxson, 1992), attenuate observed labor supply responses relative to optimal labor supply determined only by preferences.

This paper unfolds as follows. In Section 2 I describe the Norwegian tax holiday, its background, and the survey data. Next, in Section 3, I present evidence on the salience of the tax holiday, labor supply responses, and reasons for the non-response. In Section 4 I attempt to put this survey evidence in context by estimating the aggregate labor supply response to the tax holiday using cross-country analysis. Finally, I conclude the paper in Section 5. I relegate additional background material and complementary analysis to an appendix.

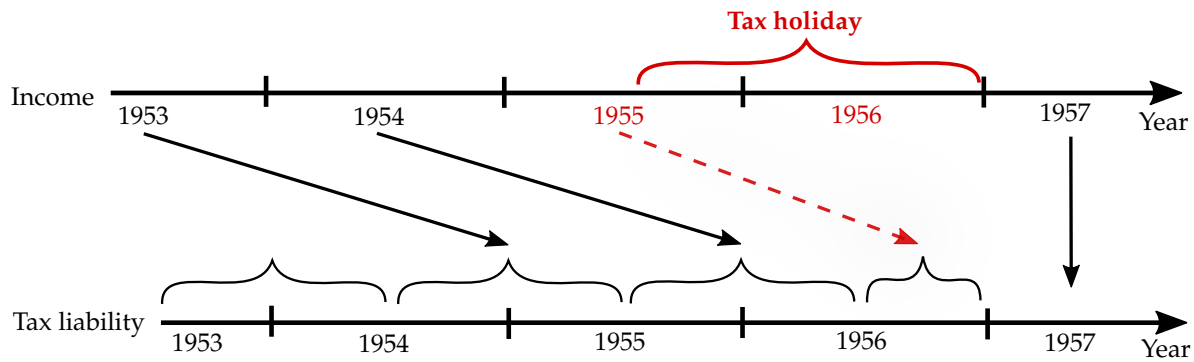


Figure 1: Tax holiday: Transition between tax systems

Notes: The figure illustrates the transition from the old tax system with retrospective taxation and a fiscal year from July to June, to a new system in 1957 with annual pay as you earn and a fiscal year from January to December. According to the retrospective tax system, taxes paid in July 1955 to June 1956 were based in income earned in 1954. Taxes paid in July to December 1956 were based on half of earnings in 1955. Taxes paid in 1957 and onwards were based on earnings in the same year. As a result, all income earned in 1956 and half of income earned in 1955 were never taxed.

## 2 Background and Data

### 2.1 The Tax Holiday Reform

On June 30, 1955, the Norwegian Parliament passed a reform to the law on capital- and labor income taxes, changing the timing of tax collection. According to the tax law in place from 1911, taxes were levied each year based on income in the previous year. This transition had been in preparation for some time, starting in 1953 when a special directorate—*Directorate for Taxation of this year's income*—was established to prepare the practical and legal aspects of the transition (Pedersen, 2013).

The reform was seen to benefit both the government and the taxpayers. Many taxpayers faced trouble paying their outstanding taxes on previous years' earnings due to various situations, such as unemployment, wage reductions, or retirement. As a result, many taxpayers fell into arrears, regularly around 10 percent, whose taxes for the most part were irrecoverable (Pedersen, 2013). These large tax arrears were a burden on the government and municipalities. From the government's perspective, a pay-as-you-earn system was therefore considered to be likely to lead to increased realized tax revenue.

The transition to the pay-as-you-earn tax system took place on January 1, 1957. When the new tax laws were passed and the reform was announced, the government also set rules about how the transition would take place—*Overgangsreglene*. These specified that income earned during the transition period would not be taxed. The reason for this was to prevent taxes from being paid simultaneously on two years of income during the transition. Figure 1 illustrates the transition between the two tax systems and the tax holiday that resulted from the reform. Prior to the reform, the taxation was retrospective and the fiscal year was between July 1st and June 30th.<sup>1</sup> Income taxes paid during the fiscal year 1955/56 were based on earnings in 1954. Due to the change in the fiscal year, income taxes paid in the second half of 1956 were based on half of the income earned

<sup>1</sup>Appendix A provides a more detailed description of the Norwegian tax system around the time of the reform.

in 1955. From 1957 onwards taxes were paid on income in the same year as it was earned. This transition, therefore, resulted in a tax holiday where all income earned in 1956 and half of income earned in 1955 were never taxed.

For most Norwegians, this reform generated a strong incentive to temporarily increase labor supply, either through longer hours or labor market entry. The average tax rate paid on income earned in 1954, the year before the tax holiday, was 13.8% on all labor income and 17.2% when measured only in terms of taxable income after deductions and exemptions (Statistisk Sentralbyrå, 1957). As documented in Appendix Table A.1, the tax schedule consisted of a flat municipal tax that varied across municipalities and a progressive government tax. For the income year 1954, the average marginal tax rate was 21.1%.

The Norwegian authorities were supportive of people taking advantage of this reform. As was explained and conveyed in the media, there was nothing legally—or morally—against increasing working time or effort this year and seizing the opportunity to earn tax-free income.<sup>2</sup> However, the authorities emphasized that misreporting income as if earned in 1955 or 1956 which should be taxed in other years would not be tolerated. The tax authority stated that it would actively investigate any evidence of such behavior and untaxed income due to such misreporting behavior would be taxed at a rate as high as 100%.

While the government did announce that earnings would be exempt from taxes from July 1955 until December 1956 and that taking advantage of this was viewed positively, the government did impose restrictions on how much earnings could increase until marginal income was taxed. The rules specified that earnings in 1955 and 1956 could only increase by 20% from the earnings in 1954 and 1957, whichever was higher, but that this restriction would only apply to those earning 18,000 NOK or more in either 1955 or 1956. In practice, this was therefore unlikely to bind for most taxpayers as those earning 20,000 NOK before the reform were in the top 95th percentile of the earnings distribution (see Appendix Figure A.1).

To give an example of the opportunity that individuals had for earning tax-free income, let us consider three individuals: A, B, and C. Taxpayer A earns the equivalent of the average income in 1954 of 8,400 NOK. This average taxpayer could increase earnings to 18,000 NOK, or more than double her or his earnings during the tax holidays, without paying any taxes on this marginal income. Still, as part of the retrospective tax system that was being phased out, in 1955 and 1956 workers would pay taxes on their earnings from 1954 and half of 1955. Another taxpayer B was a high-income earner, earning 20,000 NOK in 1955. This taxpayer could increase her or his earnings by 20%, or to 24,000 NOK, without paying tax on these earnings. The third individual C was out of the labor force before the tax holiday. This individual could enter the labor market during the tax holiday, and earn up to 18,000 NOK without paying taxes, before leaving the labor market again.

The tax holiday offered a particularly strong incentive for couples where one of the spouses was out of the labor market. In normal times the couple was taxed on the joint earnings, but the

---

<sup>2</sup>See, e.g., article on page 7 in *Aftenposten* on March 1, 1955.

lower-earning spouse could ask for his or her income to be taxed independently. If individuals B and C in the example above are married couples, the tax reform allows spouse C to enter the labor market and earn 18,000 NOK without paying taxes. Under this scenario, in 1957 the couple pays taxes on only 20,000 NOK instead of 48,000 NOK if it had not been for the tax holiday. This was emphasized in the media and in job advertisements, which were targeted at housewives, encouraging them to enter employment and earn tax-free income during the tax holiday.<sup>3</sup>

## 2.2 Data

During the tax holiday, Norwegian workers were not required to file taxes, as they did before the tax reform and would do after the tax reform.<sup>4</sup> In official Norwegian statistics on taxable income, the tax holiday period has a gap. As explained in *Statistisk Sentralbyrå* (1960): “*The reduced statistics for 1956 is due to the fact that at the transition to the new method of tax payment (‘pay as you earn’) there was no assessment of personal taxpayers for this year.*” As a result, there exist no individual-level tax data from this period that would allow for estimating a labor supply elasticity.

Fortunately, however, there exists survey data from this period that exactly allows for gaining insights into the salience of the tax holiday, labor supply responses, and reasons for possible non-responses. *Norsk Gallup Institutt AS*, which was part of the Gallup International Association, conducted a survey during the tax holiday. The survey was conducted in April 1956 among a random representative sample of the Norwegian population aged 18 and older. The sample size was 2,300 men and women, or about 0.1 percent of the adult population. Despite many efforts, the raw individual-level data from this period could not be found in the archives of *Norsk Gallup Institutt*. I am therefore restricted to reporting group averages computed by Gallup.

## 3 Survey Evidence

This section presents descriptive empirical evidence based on survey data. First I present evidence on the salience of the tax holiday, then evidence on labor supply responses, and lastly evidence on the reasons that people gave for not taking advantage of this transitory opportunity.

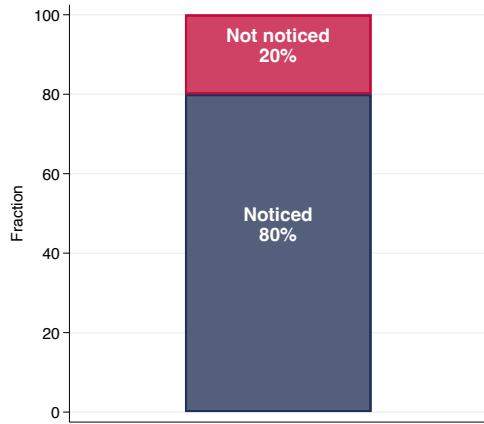
### 3.1 Salience

A central assumption in labor and public economics is that agents optimize fully with respect to wages and tax policies. Under this assumption, empirically estimated responses to wage or tax changes reflect the true behavioral elasticities. Accumulating work has documented how individuals respond imperfectly to incentives, highlighting the importance of the salience of taxes and various incentives in explaining differences in responses (Chetty, 2009; Chetty et al., 2009).

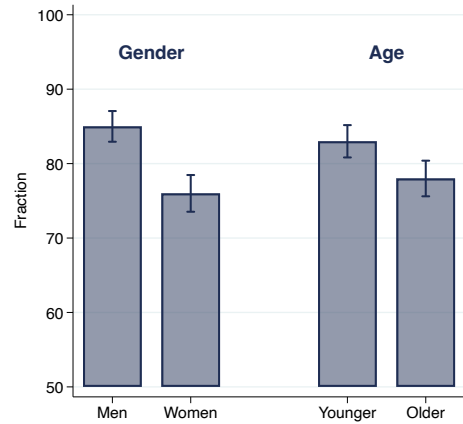
---

<sup>3</sup>See, e.g., article on page 2 in *Bergens Tidende* on August 24, 1955. In addition, many job advertisements in newspapers in 1955 and 1956 highlight this intensive for housewives.

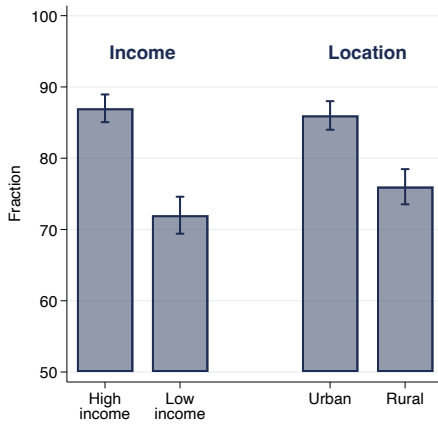
<sup>4</sup>This is different to what was required in Iceland and Switzerland during their respective tax holidays, where people were required to report their income to be eligible for the tax exemption (Martínez et al., 2021; Sigurdsson, 2022).



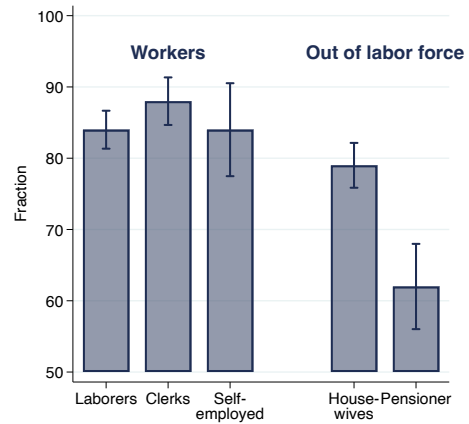
(a) All



(b) Gender and age



(c) Income and location



(d) Employed and non-employed

**Figure 2: Salience of the tax holiday: Fraction of people that noticed the earnings opportunity**

Notes: Panel (a) plots the share of people that responded yes (*Noticed*) to a question of whether they had noticed that due to a transition to a pay-as-you-earn tax system, everyone had the opportunity to earn tax-free income that year, and the share that responded no to the question (*Not noticed*). Panels (b), (c), and (d) plot the share of a given subgroup that noticed. The group splits by age and income are relative to the median. Whiskers show the 95 percent confidence interval calculated based on a normal approximation. See Appendix B for exact wording of the question in Norwegian and English translation.



In addition to providing suitable natural experiments for estimating Frisch elasticities, a clear advantage of ‘tax holidays’ is the salience of the tax reform in comparison to other more usual, but perhaps less noticeable, tax reforms. However, even though tax holidays are undoubtedly salient events, direct information on how a large fraction of the population is aware of them has previously remained unknown.

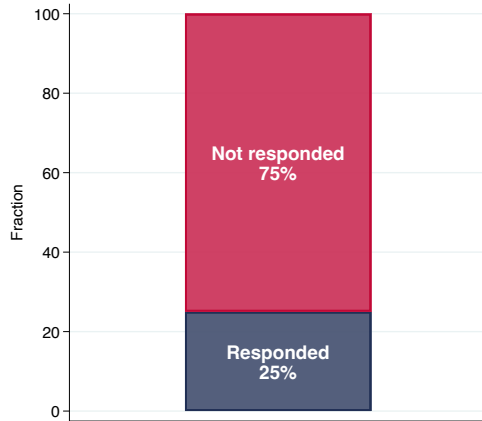
Figure 2 plots the share of people that was aware of the earnings opportunity that the tax holiday created. More precisely, it presents the share of the population and subgroups that replied yes to the following survey question: *“Because of a transition to a pay-as-you-earn tax system, there is an opportunity for everyone this year to earn tax-free money. Did you notice this provision?”*<sup>5</sup> The figure illustrates that the Norwegian tax holiday was very salient and noticed by most adults. Figure 2a documents that among those 18 years and older, 80 percent took notice of this opportunity. Figure 2b and 2c report the same statistic for subgroups of the population. Figure 2b documents that men were on average more likely to notice the opportunity than women and younger workers were somewhat more likely to be aware of the tax holiday than those that were older. Figure 2c documents that low-income workers were considerably less likely to notice the opportunity than those with higher income—72 percent compared to 87 percent—and those that lived in urban areas more than those living in rural areas. Interestingly, those lower-income workers that could benefit more from the reform in both absolute and relative terms were less likely to be aware of it. This might explain in part why previous studies have documented larger labor supply responses to tax holidays among high-wage earners (e.g. Martínez, Saez, and Siegenthaler, 2021; Sigurdsson, 2022). Lastly, Figure 2d reports the fraction of people aware of the reform among groups inside and outside the labor force. Among employed workers—laborers, clerks, and self-employed workers—the rate of notice is similar and around 85 percent. For those outside the labor force, the rate is somewhat lower. While among housewives 80 percent were aware of the reform, the share is 60 percent among pensioners.

While responses to the survey question suggest that a lion’s share of people were aware of the tax holiday, the question is not designed for the purpose of measuring salience. The way the question was asked may lead to an overestimate of the true salience due to acquiescence bias—i.e. the tendency for survey respondents to agree and react positively to statements—and conformity bias—i.e. the tendency for survey respondents to respond in a way to ‘look good’ in the eyes of those conducting a survey. It is therefore possible that fewer people were aware of the tax holiday than measured by the survey. In addition, there may be important differences between taking notice of the tax holiday and understanding the reform in full. Therefore, while the survey provides novel information on salience and responses to tax holidays, it is important to acknowledge its drawbacks.

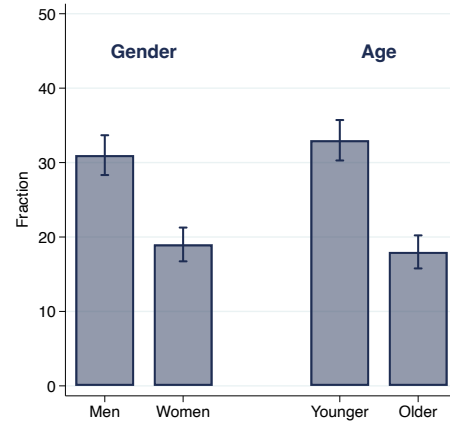
---

<sup>5</sup>Appendix B provides an overview of the survey questions and exact wording in Norwegian, which I translate to English.

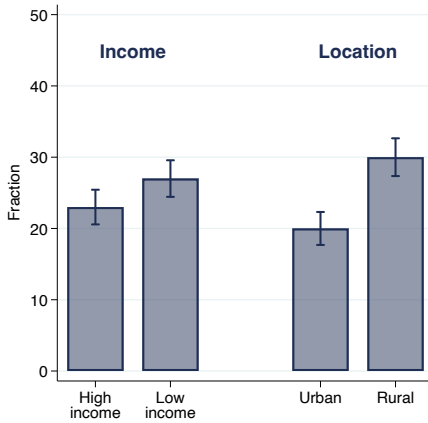




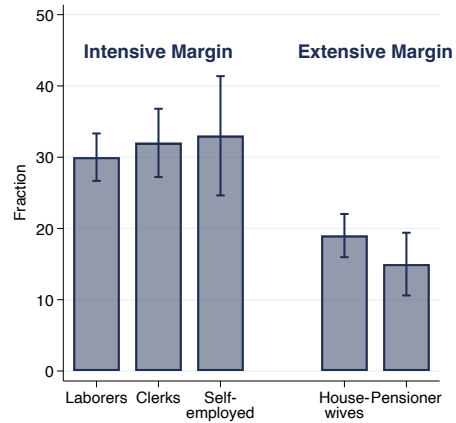
(a) All



(b) Gender and age



(c) Income and location



(d) Employed and non-employed

Figure 3: Labor supply response: Fraction of people that responded to the earnings opportunity

Notes: Panel (a) plot the share that responded yes (*Responded*) to a question of whether they had acted to take advantage of the fact that due to a transition to a pay-as-you-earn tax system, everyone had the opportunity to earn tax-free income that year, and the share that responded no to the question (*Not responded*). Numbers presented are the share of adults aware of the reform. Panels (b), (c), and (d) plot the share of a given subgroup that responded. This question was asked conditional on answering yes to the question of whether the individual was aware of the tax holiday. The group splits by age and income are relative to the median. Whiskers show the 95 percent confidence interval calculated based on a normal approximation. See Appendix B for exact wording of the question in Norwegian and English translation.

### 3.2 Labor Supply Response

Figure 3 plots the share of people that increased their labor supply in response to the tax holiday. More precisely, among adults aware of the reform, the figure presents the share that replied yes to the following survey question: “Have you personally acted to take advantage of these provisions for tax-freedom, e.g. by taking an additional job, working overtime, or similar?”. As reported in Figure 3a, 25 percent of those aware of the transitory earnings opportunity—or 20 percent of all surveyed adults—took advantage of it. As in the case of salience, Figures 3b and 3c report this rate of response among subgroups of the population. Figure 3b reports that conditional on being aware of the opportunity, men were substantially more likely to take advantage of it than women—31 percent of men compared to 19 percent of women. Figure 3b also reports that younger workers are more likely to respond than older workers—33 percent compared to 18 percent. Figure 3c reports that low-income workers responded on average similarly, if anything slightly more strongly, than those with higher incomes. Figure 3c also reports geographic differences in responses, documenting that workers in rural areas are more likely to respond than those in urban areas, despite being less likely to have known about the reform.

Figure 3d reports responses separately for those employed—i.e. intensive margin labor supply—and those that were out of the labor force—i.e. extensive margin labor supply. A much larger fraction of workers that responded to the tax holiday were employed and adjusted their hours on the intensive margin, e.g. by working overtime, or by taking an additional job. But among the employed, there is a small difference in responses, with self-employed responding most and laborers the least, which is in line with findings from other tax holidays (Martínez, Saez, and Siegenthaler, 2021; Sigurdsson, 2022).

While smaller than among those employed, there is still a share of workers that were out of the labor force who adjusted their labor supply. Among housewives, 19 percent of those aware of the reform and 15 percent of all housewives say that they have acted to respond to this transitory earnings opportunity. Similarly, 15 percent of pensioners aware of the reform adjusted their labor supply, and 9 percent of the total. In comparison, Sigurdsson (2022) estimates a small extensive margin Frisch elasticity for those around retirement age and a zero elasticity for the prime-age population, finding that extensive-margin responses are almost entirely driven by the youngest cohorts, some of which were at schooling age. Martínez, Saez, and Siegenthaler (2021) estimate a zero Frisch elasticity on the extensive margin in a population that excludes cohorts close to retirement age and at schooling age but includes housewives.<sup>6</sup>

### 3.3 Reasons for Non-Response

Despite offering a once-in-a-lifetime opportunity to earn tax-free income, 75 percent of people aware of the opportunity did not take advantage of it by increasing their labor supply. A valuable

---

<sup>6</sup>Mui and Schoefer (2021) show how large changes in the incentive to work—such as a tax holiday—can generate small extensive margin elasticities, while small changes in wages induce a relatively large share of workers to enter the labor market and therefore generate large extensive margin elasticities, consistent with business cycle evidence.

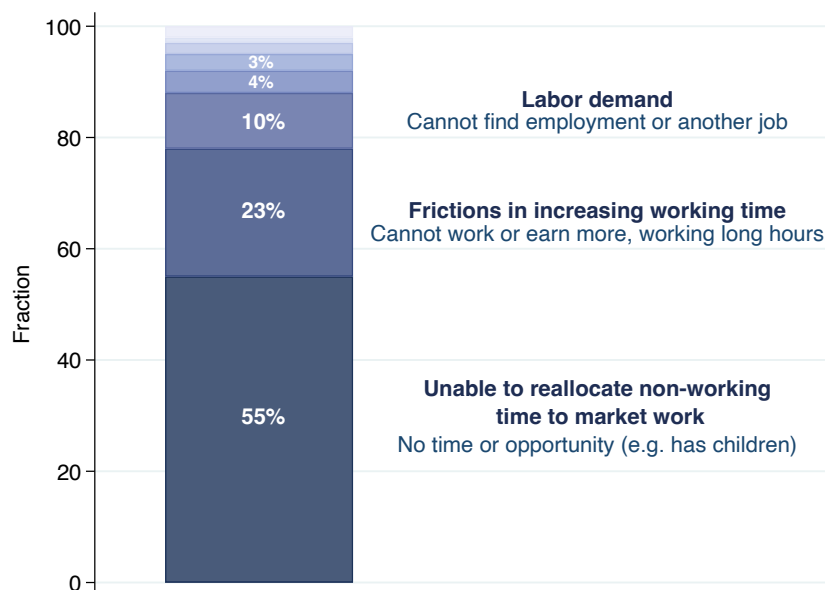


Figure 4: Reasons for not responding

Notes: The figure documents the reasons for non-response to the opportunity to earn tax-free income. Numbers are shares of adults aware of the reform but who report not to have adjusted their labor in response. 55% say they have no time or opportunity, e.g. because of children. 23% say they cannot work more than they currently do, or they are already working long hours or overtime. 10% say they cannot find employment or another job, or that firms do not want workers of their type or age. 4% say they have not thought about working more, or cannot justify not responding. 3% are not able to work more because of disability or sickness. 2% say they think a tax holiday will not be the reality and they will be taxed in the end. 1% do not respond because they do not pay taxes. 2% give other reasons for not responding. See Appendix B for the exact wording of the question in Norwegian and English translation.

piece of information is why they did not adjust their labor supply in response, knowing that the increase in the net-of-tax wage, and therefore the utility cost of not responding, was large.

Figure 4 reports reasons that those surveyed gave for not responding, answering the following question: “Why have you not acted to earn tax-free money?” The question was open-ended and answers are categorized by Gallup into 9 groups, plus a residual group. The largest share of people—55 percent—say that the reason is that they do not have the time or the opportunity to work more, for example as they have children that they need to take care of. In other words, these workers seem to not respond as they face constraints in reallocating non-working time to market work.<sup>7</sup> The second most common reason, given by 23 percent of respondents, is that they cannot work more hours or earn more income within their current work arrangement, or that they already work long enough hours which prevents them from working overtime. That is, their current arrangement of work and non-working activities imposes frictions, broadly defined, in increasing working time. The third most common reason for non-response is that 10 percent say that they cannot find employment or more work, including an additional job. This includes pensioners that say that they cannot find work as firms do not want to hire older workers (5

<sup>7</sup>Preferences likely factor into how people choose to allocate their time between work and non-working time, both leisure and home production. People may differ in how sensitive their non-working time is to changes in wages, e.g., depending on preferences and family structure.

percent). In other words, 10 percent of people seem to not respond due to factors that appear to reflect a lack of labor demand. The remaining 12 percent give a variety of reasons, including bad health (3 percent), already not paying taxes (1 percent), have not given much thought to how to adjust (4 percent), a belief that they will be taxed at the end (2 percent), or give a variety of other reasons (2 percent).

In sum, a majority of adults that aware of the tax holiday did not increase their labor supply in response to the incentive it created because of constraints imposed by their private life and frictions faced on the labor market.

## 4 Aggregate Implications

A long-held hypothesis is that optimization frictions, such as hours constraints, may explain heterogeneity in empirical estimates of labor supply elasticities. The findings in the current paper suggest that frictions in the labor market and constraints due to family circumstances are important in explaining small labor supply responses in situations where changes in taxes are very salient and known to most people, implying that the effect of inattention to tax rates is small (Chetty et al., 2009), and the change in the net-of-tax wage is high, implying that the utility cost of not responding is high (Chetty, 2012).

Evidence from other tax holidays indicates that adjustment frictions may be important in explaining small but heterogeneous responses to transitory wage changes. Sigurdsson (2022) documents substantial heterogeneity in labor supply responses to the tax-free year in Iceland depending on the flexibility of jobs and non-work-related commitments. Martínez, Saez, and Siegenthaler (2021) estimate a near-zero elasticity in response to the tax holidays in Switzerland but they document significant responses in certain occupations and among self-employed workers, who may have more flexibility in adjusting their hours than the average Swiss worker.

To shed some light on the aggregate implications of the Norwegian tax holiday and put the survey evidence into context, I attempt to estimate a Frisch elasticity using the tax holiday as a natural experiment. To do so, I use aggregate data to conduct a cross-country difference-in-differences analysis. A prerequisite for such analysis is a suitable counterfactual for Norway. That is, a country with a similar business cycle as Norway and facing the same aggregate shocks, but where there was no tax holiday. One such candidate is the neighboring country Sweden. Norway is not only close to Sweden geographically—bordering Sweden to the East—but also economically. Around the time of the tax holiday, the structure of the two economies was in many ways similar and the two countries were the major trading partner of each other and shared other main trading countries. This implies that the two countries are likely to experience similar macroeconomic shocks. Appendix Figure A.2 documents the co-movement of GDP growth in Norway and Sweden before, during, and after the tax holiday. Overall GDP growth in the two countries was highly positively correlated (0.77) during the 50s and 60s. As the figure documents, a year that stands out is the tax holiday year 1956 when the growth rate rose in Norway but was unchanged from

the year before in Sweden. Since the 1970s, the foundations of the two economies have drifted more apart, not the least following the discovery of oil in Norwegian waters in 1969, making the Norwegian business cycle heavily influenced by fluctuations in the oil price. In addition, Sweden went through the same kind of transition to a pay-as-you-earn system in 1947, which may have influenced the Swedish economy in the late 1940s.<sup>8</sup>

For the Frisch elasticity estimation, I use aggregate data from both countries. Appendix Figure A.3 plots the marginal tax rates and labor earnings in Norway and Sweden around the tax holiday. Panel (a) plots the average marginal tax rates, documenting slightly higher and rising taxes in Sweden compared to Norway. Any annual changes are, however, very small compared to the tax holiday. Panel (b) plots the evolution of growth rates of labor earnings per person in Norway and Sweden according to National Accounts. In line with the two countries having a common business cycle, labor earnings move similarly in the two countries. Apart from during the tax holiday, when the earnings growth is high in Norway but lower and declining in Sweden.

To estimate a labor supply elasticity, I begin by estimating the following regression:

$$y_{t,c} = \gamma_c + \delta_t + \beta \cdot \text{Tax-Holiday} + \mu_{t,c} \quad (1)$$

where  $y_{t,c}$  is the log difference in total labor earnings per person,  $\gamma_c$  and  $\delta_t$  are country and year fixed effect, respectively, and *Tax-Holiday* is an indicator for the tax holiday, indicating both the treated country (Norway) and the treatment period. To obtain an elasticity, the differential change in earnings can be scaled by the difference in the change in marginal tax rates in Norway and Sweden generated by the tax holiday. The tax holiday reduced the average marginal tax rate in Norway from 21.1 percent to zero, while the average marginal tax rate in Sweden was reduced only by 0.1 percent that year. To obtain a point estimate with standard errors, I instead estimate the elasticity using the following regression

$$y_{t,c} = \gamma_c + \delta_t + \varepsilon \cdot \Delta \log(1 - \tau_{t,c}) + \nu_{t,c} \quad (2)$$

where the change in the net-of-tax rate,  $\Delta \log(1 - \tau_{t,c})$ , is instrumented by the *Tax-Holiday* indicator.

Table 1 presents the regression estimates. As the data is annual I am unable to separate between the first half of 1955, before the tax holiday, and the second half, when the tax holiday began. I address this in two ways: (i) by setting the *Tax-Holiday* indicator to one for Norway in 1956, but zero otherwise, and excluding the year 1955, and (ii) by including the year 1955 but setting the *Tax-Holiday* indicator to 0.5 in that year. In addition, I present difference-in-difference estimates with only pre-reform years as the reference period as well as estimates where both years before and after the tax holiday constitute the reference years.

---

<sup>8</sup>Before 1947, Sweden had a similar retrospective tax system as Norway. Laws replacing that system with a modern pay-as-you-earn tax system were passed in 1945 and the transition to the new system took place on January 1, 1947. Similar to the transition that took place in Norway a decade later, there was a tax holiday during 1945-1946. On income earned in 1945, a tax to the central government was only paid on half of that year's earnings but no tax to municipalities. Earnings in 1946 were never taxed. For more discussion, see [Lundin \(2003\)](#).

Table 1: Frisch elasticity estimates

	(1)	(2)	(3)	(4)
Elasticity ( $\varepsilon$ )	0.191** (0.046)	0.131** (0.040)	0.165** (0.058)	0.104* (0.047)
Reduced form ( $\beta$ )	0.041** (0.010)	0.033*** (0.006)	0.040** (0.010)	0.030*** (0.008)
First stage ( $\Delta \log(1 - \tau_{t,c})$ )	0.215*** (0.011)	0.250*** (0.039)	0.245*** (0.052)	0.291*** (0.072)
Include 1955	No	No	Yes	Yes
Reference period	Before	Before & After	Before	Before & After

*Notes:* The table presents estimates of Frisch elasticity based on cross-country difference-in-differences. The first row presents the elasticity estimate (equation (2)), the second row presents estimates of the differential earnings growth (equation (1)), and the third row presents the estimate of the differential change in net-of-tax rates (equation (1)). Columns (1) and (2) exclude the year 1955 when there was a tax holiday for half of the year. Columns (3) and (4) include the year 1955, setting the *Tax-Holiday* indicator to 0.5 in 1955, 1 in 1956, and 0 otherwise. Specifications in odd-numbered columns use four years before the tax holiday as the reference period in the difference-in-difference estimation, but even-numbered columns include both four years before and four years after as the reference period. Standard errors are in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Estimates of regression (1) yield reduced-form estimates ( $\beta$ ) between 0.030 and 0.041, depending on specification. This coefficient estimate implies that the earnings growth in Norway during the tax holiday was between 3 and 4 percentage points higher than in Sweden. The coefficient  $\varepsilon$  in regression (2) gives an estimate of the Frisch elasticity, which I estimate to be between 0.104 (SE 0.047) and 0.191 (SE 0.046), depending on specification.<sup>9</sup> These estimates are based on aggregate time series and therefore not directly comparable to micro-data estimates. However, the magnitudes are broadly in line with estimates of labor supply responses to the Icelandic tax-free year (Bianchi, Gudmundsson, and Zoega, 2001; Sigurdsson, 2022; Stefánsson, 2019), finding modest but significant Frisch elasticity estimates, but larger than estimates based on tax holidays in Switzerland (Martínez, Saez, and Siegenthaler, 2021) and Argentina (Tortarolo, Cruces, and Castillo, 2020), finding elasticities close to zero. As discussed in Sigurdsson (2022), these differences in labor supply estimates across countries can be rationalized by country differences in labor market flexibility.

## 5 Conclusion

There is a long-standing debate in economics over the magnitude of the Frisch elasticity of labor supply. While macroeconomic models require large elasticity to match aggregate data, conventional wisdom based on microeconomic estimates is that the Frisch elasticity is small. Furthermore, prominent recent research implies that it might be close to zero. While small empirical estimates may reflect that the underlying preferences are inelastic, they may also imply a high

<sup>9</sup>In Appendix C I also conduct a back-of-the-envelope calculation of the Frisch elasticity for Norway using earlier labor supply estimates and other parameter estimates from the literature. These calculations rely on, among others, estimates from Aarbu and Thoresen (2001) who exploit a Norwegian tax reform in 1992 that substantially increased the net-of-tax rate for high-income earners. This calculation implies a Frisch elasticity of 0.34.

prevalence of optimization frictions, such as inattentiveness or hours constraints.

In this paper, I have shed new light on the reasons for small labor supply responses to temporary wage changes by studying a tax holiday in Norway. In this setting, the transitory incentive to adjust labor supply is very salient and most people are aware of it. In addition, the utility cost of not adjusting in response, as measured by the drop in tax rates, is large. Still, only a third of the employed adults responded by increasing their hours and earnings. In line with the long-held view that adjustment frictions make observed labor supply responses differ from those determined by preferences, most adults that did not take advantage of this earnings opportunity explain their non-response by factors that can be categorized as frictions, broadly defined. Either friction in the labor market or constraints in exchanging their non-working time for hours at work.

## References

- AARBU, K. O. AND T. O. THORESEN (2001): "Income responses to tax changes—evidence from the Norwegian tax reform," *National Tax Journal*, 319–335.
- ALTONJI, J. G. AND C. H. PAXSON (1988): "Labor supply preferences, hours constraints, and hours-wage trade-offs," *Journal of labor economics*, 6, 254–276.
- (1992): "Labor supply, hours constraints, and job mobility," *Journal of Human Resources*, 27, 256–279.
- ANGRIST, J. D., S. CALDWELL, AND J. V. HALL (2021): "Uber vs. Taxi: A Driver's Eye View," *American Economic Journal: Applied Economics*, 13, 1–37.
- BANERJEE, A. V. AND E. DUFLO (2019): *Good economics for hard times: Better answers to our biggest problems*, Penguin UK.
- BIANCHI, M., B. R. GUDMUNDSSON, AND G. ZOEGA (2001): "Iceland's Natural Experiment in Supply-Side Economics," *American Economic Review*, 91, 1564–1579.
- CHETTY, R. (2009): "The simple economics of salience and taxation," Tech. rep., National Bureau of Economic Research.
- (2012): "Bounds on elasticities with optimization frictions: A synthesis of micro and macro evidence on labor supply," *Econometrica*, 80, 969–1018.
- CHETTY, R., A. LOONEY, AND K. KROFT (2009): "Salience and taxation: Theory and evidence," *American Economic Review*, 99, 1145–77.
- COGAN, J. F. (1981): "Fixed Costs and Labor Supply," *Econometrica: Journal of the Econometric Society*, 945–963.
- DICKENS, W. T. AND S. J. LUNDBERG (1993): "Hours Restrictions and Labor Supply," *International Economic Review*, 169–192.
- FARBER, H. S. (2015): "Why you can't find a taxi in the rain and other labor supply lessons from cab drivers," *The Quarterly Journal of Economics*, 130, 1975–2026.
- FEHR, E. AND L. GOETTE (2007): "Do workers work more if wages are high? Evidence from a randomized field experiment," *American Economic Review*, 97, 298–317.
- HAM, J. C. (1982): "Estimation of a labour supply model with censoring due to unemployment and underemployment," *The Review of Economic Studies*, 49, 335–354.
- KING, R. AND S. REBELO (1999): "Resuscitating real business cycles," *Handbook of Macroeconomics*, 1, 927–1007.
- LUCAS, R. E. AND L. A. RAPPING (1969): "Real wages, employment, and inflation," *Journal of political Economy*, 77, 721–754.
- LUNDIN, T. (2003): *Deklarationen 100 år och andra tillbakablickar*, Rikskatteverket Stockholm, chap. Källskattereformen och det Skattefria Året, 83–86.
- MACURDY, T. E. (1981): "An empirical model of labor supply in a life-cycle setting," *Journal of Political Economy*, 89, 1059–1085.
- MARTÍNEZ, I. Z., E. SAEZ, AND M. SIEGENTHALER (2021): "Intertemporal Labor Supply Substitution? Evidence from the Swiss Income Tax Holidays," *American Economic Review*, 111, 506–546.



- MUI, P. AND B. SCHOEFER (2021): "Reservation raises: The aggregate labor supply curve at the extensive margin," Tech. rep., National Bureau of Economic Research.
- PEDERSEN, A. O., ed. (2013): *Jubileumsberetning - NKK 100 år*, Norges kemner-og kommuneøkonomers forbund.
- SIGURDSSON, J. (2022): "Labor Supply Responses and Adjustment Frictions: A Tax-Free Year in Iceland," Working paper, Stockholm University.
- STATISTISK SENTRALBYRÅ (1957): "Tax Statistics for the Income Years 1955 and 1956," *Norgen Offisielle Statistikk*, XI.
- (1960): "Tax Statistics for the Income Years 1956 and 1957," *Norgen Offisielle Statistikk*, XII.
- STEFÁNSSON, A. (2019): "Labor supply response to a tax holiday: The take-home from a large and salient shock," Mimeo, Uppsala University.
- TORTAROLO, D., G. CRUCES, AND V. CASTILLO (2020): "It takes two to tango: Labor responses to an income tax holiday in Argentina," Working paper, University of Nottingham.