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Intertemporal Labor Supply Substitution? Evidence from the Swiss Income Tax Holidays[†]

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This paper estimates intertemporal labor supply responses to two-year long income tax holidays staggered across Swiss cantons. Cantons shifted from an income tax system based on the previous two years' income to a standard annual pay as you earn system, leaving two years of income untaxed. We find significant but quantitatively very small responses of wage earnings with an intertemporal elasticity of 0.025 overall. High wage income earners and especially the self-employed display larger responses with elasticities around 0.1 and 0.25, respectively, most likely driven by tax avoidance. We find no effects along the extensive margin at all. (*JEL* H24, H26, J22, J23, J31, R23)

The intertemporal labor supply elasticity of substitution, traditionally called the Frisch elasticity, measures how much more people are willing to work when their wage increases temporarily. This elasticity plays a key role in amplifying the effects of technological shocks on labor supply and economic activity in calibrated macro real business cycle models. The intuition is the following. Suppose there is a temporary negative technological shock which reduces productivity (relative to trend). This shock reduces wages temporarily. If the Frisch elasticity is large, relatively modest technological shocks can translate into large labor supply responses and hence explain why downturns are accompanied by large falls in employment. Indeed, most calibrated macro real business cycle models require a very large Frisch elasticity in excess of 1 to generate realistic quantitative predictions (see, e.g., King and Rebelo 1999).

However, identifying the Frisch elasticity is empirically challenging as it requires exogenous time variation in net wage rates unrelated to labor supply or human capital

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accumulation decisions. As a result, recent studies have often used specific occupations, such as taxi drivers, where exogenous variation in wages is more plausible (see Reichling and Whalen 2012 and Chetty et al. 2013 for surveys and discussions). Using tax variation has long been a traditional source of exogenous variation to estimate *static* labor supply elasticities (see, e.g., Keane 2011, for a survey). However, tax variation typically does not provide temporary variation needed to estimate the Frisch elasticity.[1]

In this paper, we break new ground on this important issue by exploiting an unusual tax policy reform in Switzerland that generated large, salient, and well-advertised one- or two-year long income tax holidays staggered across the 26 Swiss cantons, which are the member states of the Swiss Confederation. The tax holiday, which exempts earnings from income taxation temporarily for everybody in the local economy (the cantonal level), is close to being the ideal experiment to estimate the Frisch elasticity. This has three additional advantages relative to previous work. First, our estimates are representative of the total population and do not focus on very specific, and potentially more elastic, occupations (such as taxi drivers). Second, we can identify the Frisch on an annual frequency, which is the relevant time frame for business cycle analyses (occupation-specific studies use much higher, often daily, frequencies). Third, while various frictions, such as jobs with fixed hours or high fixed costs of starting to work, may dampen the response relative to the standard frictionless model of labor supply, such frictions are also present when the economy responds to a temporary technology shock. Therefore, the "frictional Frisch" elasticity we estimate is also the relevant reduced-form parameter to evaluate the role of intertemporal labor supply in macro business cycle modeling.[2]

In the late 1990s and early 2000s, Switzerland switched from an income tax system where current taxes were based on the previous two years' income to a standard annual pay as you earn system. For example, in the old system, income taxes due in years 1997 and 1998 were both based on the average income over the two preceding years 1995 and 1996. This system of owing taxes based on prior year incomes was common in income tax systems before pay as you earn tax systems were put in place.[3] In the new system, taxes on income earned in year t are collected during year t with a tax return filed in year $t+1$ and an adjustment made through a tax refund or an extra tax payment if taxes already collected are not exactly equal to taxes owed.[4] This is the system used in all advanced economies today.

Swiss cantons transitioned in three waves in 1999, 2001, and 2003. Two cantons transitioned early in 1999, most cantons transitioned in 2001, and three cantons transitioned late in 2003. The transition happened for federal, cantonal, and municipal

[1] Important exceptions are Bianchi, Gudmundsson, and Zoega (2001); Sigurdsson (2018); and Stefansson (2019) who use a one-year income tax holiday in Iceland. We discuss the link between these studies and ours in detail below.

[2] Naturally, estimating separately the pure frictionless Frisch elasticity from the dampening effects of frictions could also be useful for other applications (see, e.g., Chetty et al. 2013).

[3] The United States transitioned in 1943, the United Kingdom transitioned in 1944. France, the last holdout, just transitioned in 2019. The Swiss system was further particular in that it used an average of two years to compute base income (instead of using a standard annual income base).

[4] In both the old and the new system, Switzerland does not use withholding at source and individuals are typically required to pay estimated taxes in quarterly installments (as is done in the US for income not subject to tax withholding such as self-employment income).

income taxes simultaneously in each canton. To illustrate the mechanism, take the example of the canton of Thurgau as depicted in panel A of Figure 1, which transitioned in 1999. In 1997 and 1998, income taxes (at the federal, cantonal, and municipal levels) were paid based on the average of 1995 and 1996 incomes. In 1999, income taxes (at the federal, cantonal, and municipal levels) were based solely on 1999 incomes. In 2000, income taxes were based solely on 2000 incomes, etc. To avoid double payment of taxes in 1999 and 2000, no tax was ever assessed on 1997 and 1998 incomes (which would have been paid in 1999 and 2000 under the old system). Therefore, this transition created a two-year long income tax holiday for incomes earned in years 1997 and 1998. Hence, cantons transitioning in 1999 had a tax holiday for years 1997–1998; cantons transitioning in 2001 had a tax holiday for years 1999–2000; and cantons transitioning in 2003 had a tax holiday for the years 2001–2002. An extra source of variation comes from the fact that some cantons used an annual system of assessment (instead of biennial) for the cantonal and municipal taxes. For these cantons, the transition generates only a *one*-year long tax holiday for local taxes.[5]

The tax holiday increased the net of tax rate (defined as 1 minus the marginal tax rate) by about 25–30 percent on average. Hence for example, with a Frisch elasticity of 1, which is toward the low end of estimates used in macro-calibrations, we should expect a 25–30 percent increase in earnings. The tax holiday timing was discussed at length in the press well before the transition took place, making it salient to the public, particularly for the last two waves of transitioning cantons. Various press articles discussed how working and earning more during the tax holiday (relative to later years) was fiscally advantageous.

To carry out our study, we use population-wide social security longitudinal earnings records from 1990 to 2010 matched to decennial Census data. These data allow us to obtain precise estimates exploiting fine geographical variation. Our strategy relies on a simple difference-in-differences method where we compare earnings outcomes over time and across localities that transitioned at different times. Because we have large data, we obtain smooth and precise time series for a number of earnings outcomes even when restricting the data to specific earnings or demographic groups. We find that series for different cantons move in a very similar way over time pre- and post-reform, giving us confidence that the parallel trend identification assumption holds. The graphical time series evidence shows clearly that bumps in earnings arise during the tax holidays for some subgroups, and can then be confidently interpreted as the causal effect of the tax holiday. We supplement the time series analysis by a longitudinal regression-based micro-level approach to tease out tax holiday effects on earnings systematically. Our analysis is limited to labor income because we do not have data on capital income (as the cantonal tax administrations did not systematically collect data on incomes earned during the tax holidays). Our main analysis focuses on prime-age individuals aged 20 to 60.[6]

[5] Take the example of Zürich which transitioned in 1999. In 1998, local taxes were based on 1997 incomes. In 1999, local taxes were based on 1999 incomes, so that the tax holiday for local taxes was just for 1998. Local income taxes (defined as cantonal plus municipal) make up over 80 percent of income taxes in Switzerland in aggregate.

[6] For the elderly, tax incentives interact with retirement decisions and the incentives created by the retirement system.

Panel A. Example: transition from old to new system

Year	1993 1994	1995 1996	1997 1998 (untaxed incomes)	1999	2000
Tax base for assessment period ×	Incomes realized in 1991 + 1992 (avg.)	Incomes realized in 1993 + 1994 (avg.)	Incomes realized in 1995 + 1996 (avg.)	Income realized in 1999	Income realized in 2000
Payment of tax liability owed for year ×	During 1993 and 1994	During 1995 and 1996	During 1997 and 1998	Provisional installments 1999, final assessment in 2000	Provisional installments 2000, final assessment in 2001

Panel B. Timing of the transition across regions

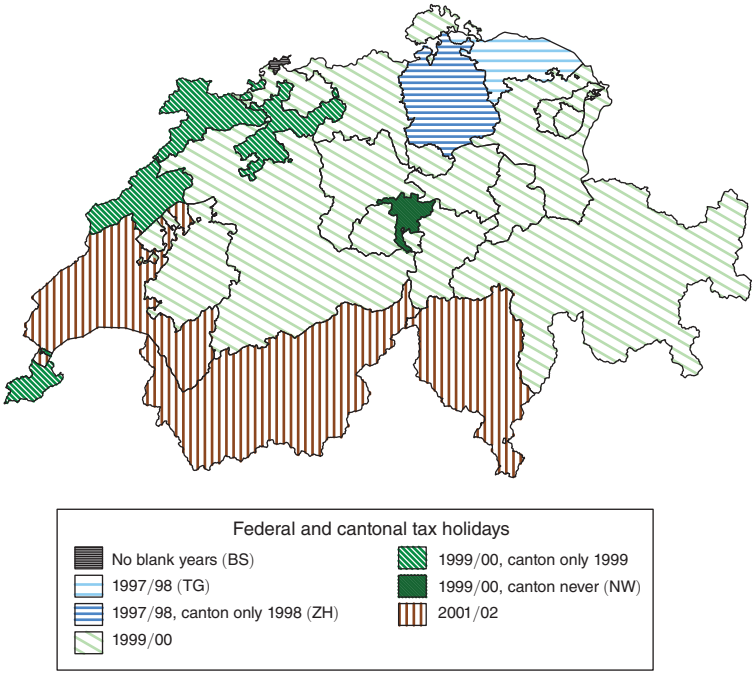

FIGURE 1. TRANSITION FROM OLD TO NEW SYSTEM ACROSS SWISS CANTONS

Notes: Panel A depicts an example of a transition from the old system of biennial retrospective taxation to the new system of annual pay as you earn taxation in 1999 (as in the canton of Thurgau TG). Under the old system, in 1997 and 1998, taxes are based on the average income across years 1995 and 1996. In 1999, taxes are due on current 1999 incomes. Hence, because of the transition, incomes earned in 1997 and 1998 are never taxed, creating a two-year tax holiday. Panel B depicts the timing of the transition across the 26 Swiss cantons. For the federal income tax, the tax holiday was either 1997/98 (2 cantons in blue horizontal stripes, Thurgau TG and Zürich ZH), 1999/00 (20 cantons in green diagonal stripes), or 2001/02 (3 cantons in brown vertical stripes). Generally, the tax holiday for the local (cantonal and municipal) income tax was the same as for the federal tax. However, for cantons that were using annual assessment periods (instead of biennial), the tax holiday for local taxes is only one year. These cantons are depicted with more stripes and darker colors: darker blue (1 canton Zürich ZH) and darker green (4 cantons). One canton (Nidwalden NW in very dark green) had no local tax holiday at all because it chose a different transition tax. One canton (Basel-Stadt BS in solid black) transitioned much earlier and hence had no tax holiday. Nidwalden and Basel-Stadt are excluded from our subsequent analysis leaving 24 cantons divided in 5 groups (light blue 1 canton, dark blue 1 canton, light green 15 cantons, dark green 4 cantons, brown 3 cantons).

We obtain five main results. First, we do not find any evidence of a response along the employment margin (extensive margin). This implies that the Frisch elasticity is very small along the extensive margin. Second, there is a small aggregate

response of wage earnings with an implied Frisch elasticity of 0.025 for aggregate wage earnings. The responses are larger higher up in the wage earnings distribution, with Frisch elasticities of 0.1 for the highest earners. We do not find responses along the hours of work margin. Third, there is a larger response of self-employment earnings that is present at different earnings levels (and not just the top). Overall, the Frisch elasticity for self-employment earnings is around 0.2. Fourth, effects are actually larger for men than for women, in contrast to the standard findings in the labor supply literature. The exception is married couples with children, where the elasticities are similar. Fifth, most of these responses are concentrated in the last wave of transitioning cantons with tax holidays in 2001–2002. Responses for earlier transitions such as 1997–1998 or 1999–2000 appear to be more muted. This latter effect might be due to learning as it might take time for the public to understand tax holidays and how to respond to them. Overall, our evidence suggests that responses are driven primarily by tax avoidance rather than real labor supply. As a result, our paper shows that the Frisch real labor supply channel due to labor market-wide temporary changes in net-wage-rates is quantitatively very modest and particularly so along the extensive employment margin. This casts doubt on quantitative calibrations of macro models that use very large Frisch elasticities to account for the large employment fluctuations over the business cycle.

Bianchi, Gudmundsson, and Zoega (2001); Sigurdsson (2018); and Stefansson (2019) are closest to our study, and exploit the one-year tax holiday in Iceland produced by a transition from an income tax based on prior year income to a pay as you earn income tax in 1987. Using a small survey dataset, Bianchi, Gudmundsson, and Zoega (2001) report large effects with an implied Frisch elasticity of 0.42 along the extensive margin. But it is difficult to disentangle the tax effects from the business cycle effect in this study as the tax holiday corresponded to the peak year of the business cycle in Iceland (see their Figures 1 and 2). Sigurdsson (2018) builds a population wide earnings dataset to study the same reform. Using labor supply participation patterns by age, he finds a much smaller extensive-margin Frisch elasticity 0.1. Exploiting variation in tax rates across income groups, he finds an intensive marginal Frisch elasticity of 0.4. Stefansson (2019), using a similar identification strategy, finds a smaller Frisch intensive elasticity of 0.07 and discusses the sensitivity of estimates with respect to the exact empirical specification. The key advantage of our analysis is that tax holidays in Switzerland happen at different times in different cantons.

This paper is organized as follows. Section I describes the reform and the variation we exploit. Section II describes the data we use. Section III describes our empirical results. Section IV concludes. The online Appendix includes more details on the data we use as well as a number of robustness checks that we only mention briefly in the main text.

I. The Tax Holiday Reform

A. *The Swiss Income Tax System*

Individual income taxes in Switzerland are quantitatively large and represent about $1/3$ of total tax revenue or about 9 percent of the Swiss GDP. Income taxes in

Switzerland are residence-based and levied at the federal, cantonal, and municipality level. The federal income tax is set by federal law, is uniform across cantons, and represents about one-sixth of total income tax revenue. Local taxes which include cantonal and municipal taxes are very large and represent about five-sixths of income tax revenue.[7] Cantonal taxes are set by cantonal law and municipalities simply apply a multiplier to the cantonal tax to determine municipal taxes. The cantons set their income tax schedule freely and municipalities choose their multiplier freely.[8] The federal tax is more progressive with very low tax rates on low- and middle-income taxpayers while local taxes often impose significant tax burdens through most of the income distribution. The top marginal tax rate combining all income taxes is typically in the 30–40 percent range (although it can go as low as the low 20s and go as high as the mid-40s in some municipalities).[9]

Married couples file together and are taxed based on total family income so that secondary earners face significant tax burdens, particularly if the income of the primary earner is high. The income tax base includes both labor and capital income, although this study will solely focus on labor income (including wage earnings and self-employment earnings) due to data availability constraints (incomes made in tax holiday years did not have to be reported to the tax administration). The cantonal tax administrations are responsible for the collection of the taxes at all three levels and taxpayers only file one tax return for all three taxes.

Old Tax System: Prior to the tax reform we are exploiting in this paper, Switzerland applied a biennial retrospective income tax system. For example, taxes paid in years 1997 and 1998 were based on average income in 1995 and 1996. In 1997, a tax return would be filed reporting incomes in 1995 and 1996. From this tax return, tax liability would be determined for both year 1997 and year 1998 (and was identical in 1997 and 1998) so that taxpayers only had to file a tax return every second year. Tax payments were typically made in quarterly installments each year. The drawback of this system is that if the economic situation of the taxpayer changes (due to marriage, divorce, job loss, etc.), the tax due might not correspond well with current income. A few cantons, including the large canton of Zürich, were actually using an annual period of assessment (instead of biennial) for the cantonal and municipal

[7] These statistics are taken from OECD (2016) and refer to year 1996 which is the year just before the reforms we study take place. Because the federal tax is more progressive, the relative share of federal income tax in total income taxes grows with income and can be as high as 50 percent for high-income earners.

[8] The Swiss federation comes perhaps closest to the ideal Tiebout model of local public finance with many studies analyzing tax competition and tax-induced mobility across municipalities and cantons. Liebig, Puhani, and Sousa-Poza (2007); Schmidheiny (2006); Brülhart et al. (2016); and Martínez (2016) study mobility across Swiss Cantons in response to local income or wealth taxes. Kirchgässner and Pommerehne (1996), Eugster and Parchet (2019), Parchet (2019), and Brülhart and Parchet (2014) study tax competition in the setting of tax rates by municipalities and cantons.

[9] Online Appendix Figure A1 depicts the average income tax rate (summing across federal and local income taxes) by municipality for a single taxpayer with an annual income of 100,000 Swiss Francs (CHF). This is about the ninetieth percentile of the labor earnings distribution among workers as of 1999. 1 CHF is approximately equal to US$1.

taxes. In these cantons, incomes earned in year t were taxed in year $t+1$ and returns had to be filed every year. The federal tax was still biennial in these cantons.[10]

New Tax System: In the new system, Switzerland uses a standard pay as you earn annual income tax system whereby incomes earned in year t are taxed in year t through estimated payments. Individuals pay estimated taxes typically in quarterly installments. In contrast to other countries, Switzerland has not adopted tax withholding at source under the new system. This makes income taxes quite salient as individuals pay installments directly to the government. After the end of year t, an income tax return is filed in year $t+1$ which lists all income sources and computes the exact tax. Any difference between the exact tax owed and the taxes already paid during year t generates a tax refund or an extra tax payment.

B. *Description of the Tax Holiday Transition*

Discussions about switching to a modern pay as you earn annual income tax system had taken place since the 1980s. In December 1990, two federal laws were passed encouraging (but not forcing) cantons to make the transition from the old system to the new system by 2001 and allowing the federal income tax to change alongside with cantonal taxes.[11] However, the cantons were free to adopt the new system whenever they wanted. Two cantons, Zürich and Thurgau, decided to switch early in 1999 while most cantons waited until 2001. Three cantons were not yet ready by 2001 and hence postponed the transition to 2003.[12] Importantly, when a canton decided to transition in a given year, the transition applied to all taxes at the federal, cantonal, and municipal levels.[13]

How does the transition generate tax holidays? Suppose a canton wants to transition in 1999. This specific example is illustrated in panel A of Figure 1. In 1997 and 1998, income taxes under the old system are based on the average income for years 1995 and 1996. In 1999, income taxes have to be based on 1999 incomes. This means that incomes earned in 1997 and 1998 are never taxed, hereby creating a two-year-long tax holiday. Taxpayers do pay taxes every year during the transition but no tax is ever paid on the incomes earned in the two years before the transition.

As mentioned above, a few cantons (including Zürich) used an annual assessment period (instead of biennial) for their cantonal and municipal taxes. For such cantons, there is a *single* tax holiday year for local taxes and two tax holiday years for the federal tax. Let us illustrate this with the case of Zürich that transitioned in 1999. In 1997, local taxes in Zürich are based on 1996 incomes while federal taxes are based on the average of 1995 and 1996 incomes. In 1998, local taxes are due based on 1997 incomes while federal taxes are again based on the average of 1995 and 1996

[10] One canton, Basel-Stadt, had always had a standard pay as you earn income tax system for its local taxes and hence did not need to transition except for the federal tax.

[11] The two laws were the cantonal tax harmonization law (StHG) which was scheduled to become effective on January 1, 1993 and the new federal tax law (DBG) scheduled to become effective on January 1, 1995.

[12] Due to the biennial structure of the old system, the change could only take place in an odd year such as 1999, 2001, 2003. No canton was ready to consider switching in 1995 or 1997.

[13] Hence, the federal tax was not uniform across cantons during the transition as cantons transitioned during different years. This departure from uniformity was allowed by the new federal tax law (DBG) enacted to encourage the transition.

incomes. In 1999, both local and federal taxes are based on 1999 incomes. Hence, 1997 and 1998 are tax holiday years for federal taxes but only 1998 is a tax holiday for local taxes. Hence, the tax holiday for local taxes in Zürich is reduced to a single year. Four of the 20 cantons transitioning in 2001 are also in this situation and have a tax holiday for local taxes only for year 2000 (and 1999–2000 for federal taxes).

Panel B of Figure 1 depicts a map of the cantons in Switzerland and summarizes the timing of the transition across cantons. For the federal income tax, the tax holiday was either 1997/1998 (cantons in blue with horizontal stripes), 1999/2000 (cantons in green with diagonal stripes), or 2001/2002 (cantons in brown with vertical stripes). Generally, the tax holiday for the local (cantonal and municipal) income tax was the same as for the federal tax. However, for cantons which were using *annual* assessment periods (instead of biennial), the tax holiday for local taxes is only one year. These cantons are depicted in darker blue and darker green with higher frequency stripes. One canton (Nidwalden in very dark green) had no local tax holiday at all due to a different form of transition. One canton (Basel-Stadt in black) always had a pay as you earn local tax system and transitioned to the annual pay as you earn system for the federal tax in 1995.[14] We will use this color-coding in all our subsequent analysis.

C. *Tax Constraints on Responses to Tax Holidays*

Extraordinary Incomes: All transitioning cantons specified that extraordinary incomes earned during the holiday would remain taxable. Extraordinary income included one-time lump-sum payments, irregular capital incomes, lottery winnings, and extraordinary business incomes due to accounting changes. Importantly, for labor earnings, income increases due to promotions, job changes, or more hours worked were not considered extraordinary income. Bonuses and shared profits were not considered extraordinary profits if they were specified in the contract and had also been paid in prior or later years. In sum, any real labor supply response (and corresponding compensation) was not extraordinary income and hence was fully exempt during the tax holiday. Tax avoidance through income shifting remained possible as it was difficult for the tax administration to assess whether income earned during the tax holiday was "extraordinary" especially in the case of the self-employed. Cantons differed in the reporting requirements for incomes earned in tax holiday years. Some cantons only collected information on extraordinary incomes (and did not require reporting of tax exempt ordinary income). As a result, income tax data cannot be used to study the reform. This is why we cannot study capital income.

Self-Employment Reporting: Self-employment earnings were reported to the social security administration through the income tax system. Therefore, in the old system, self-employment earnings are reported on a biennial basis as well (in most cantons) but with an additional delay of one year. The social security administration transitioned to the new pay as you earn system uniformly across all cantons in 2001 for

[14] For this transition, the federal tax in 1995 was based on the maximum tax liability under the old and the new system. Therefore, this transition did not generate a clean tax holiday for the federal tax. As such, our analysis will not try to estimate the effects of this early transition in Basel-Stadt.

self-employment earnings. Starting in 2001, self-employment earnings are reported on an annual pay as you earn basis in *all* cantons. Self-employment earnings for 1999 and 2000 were never registered in the social security system and hence benefited as well from a social security contribution holiday but we cannot observe and hence analyze them. This timing corresponded to the tax holiday in 20 cantons (cantons in green in panel B of Figure 1). Cantons with earlier or later tax holidays had to collect self-employment earnings information during their tax holidays specifically (in the same way they collected information on extraordinary incomes). For these cantons, we therefore observe self-employment earnings during their income tax holiday and we study them specifically (see online Appendix Section A.1 for complete details).

In contrast, wage earnings were always reported in real time to the social security administration independently of the income tax system. Because of such different reporting, we separate the analysis of wage earnings from the analysis of self-employment earnings.

Betwixt Assessments: Under the old system, large changes in economic circumstances such as permanent entry or exit (typically defined as lasting 2 or more years), a permanently large change in income, or migration to another canton, would trigger temporary pay as you earn taxation (called betwixt assessments) until the end of the tax period. This temporary pay as you earn taxation would be based on the new (annualized) income. The rationale for betwixt assessments was to accommodate large changes in economic circumstances, and especially alleviate the hardship of having to pay retrospective taxes after a large fall in income.[15] Betwixt assessments disappear under the new system but could still happen during the tax holidays. We discuss in detail in online Appendix Section A.1 how this betwixt assessment system works and we summarize here how this system interacts with the tax holidays.

Extensive Margin.—Permanent entry in the labor force in the old system and during the tax holiday generates a betwixt assessment. Entry earnings during the tax holiday are taxed only once during the tax holiday, while in the old system, such entry earnings would have been taxed a second time during the following tax period (as regular taxes were retrospective). Hence, entry earnings during the tax holiday also benefit from a tax cut: one-time taxation instead of double taxation. But this double tax alleviation is likely not as salient. Therefore, the tax holiday might have a muted effect on accelerating entry of young workers. However and most important, a *temporary* entry (lasting less than 2 years) would not trigger a betwixt assessment. Hence, as long as an extensive margin response to the tax holiday was temporary, which is the expected response to a temporary tax change, then the tax holiday applied.[16]

A permanent exit from the labor force, such as retirement, triggers a betwixt assessment during the tax holiday so there is no change in the tax treatment of

[15] The vast majority of betwixt assessments were for decreases in income rather than increases in income. Over the tax periods 1979/1980–1997/1998, incomes under betwixt, pay as you earn assessments were on average 16 percent lower than those under regular assessment, i.e., those based on past income.

[16] If a taxpayer expects the entry to be temporary, no betwixt assessment is made. If however the entry is then extended, the tax administration would charge betwixt assessment taxes retrospectively. This is why, in the old system, the tax administration encouraged new workers to declare their new situation and start paying taxes immediately (to avoid having to pay back later).

pre-retirement earnings during the tax holiday. There are however complex effects on the treatment of pension income. As we do not have pension income data, we focus on prime workers aged 20–60 to exclude retirement from our analysis (the legal retirement ages were 62 for women and 65 for men at that time).

Migration.—Migration to another canton also triggered a betwixt assessment under the old system and during the tax holiday. Upon moving, retrospective tax liability in the canton of origin stopped and was replaced by pay as you earn on a annualized basis in the new canton of residence. As a result, taxpayers could not benefit from moving to tax holiday cantons. Furthermore, moving away from a tax holiday canton would terminate the tax holiday, hereby reducing incentives to move during a tax holiday. Our data show no statistically significant evidence of reduced migration into tax holiday cantons, but the point estimates on migration among top earners are indeed negative (online Appendix Table A3).

Intensive Margin.—Large changes in earnings could also trigger betwixt assessments in the old system and during the tax holidays. However, such changes had to be both permanent (two years or more) and significant (change in occupation or a quantitatively very large change in earnings or hours).[17] Any temporary change in earnings (lasting less than two years) to take advantage of the tax holiday would not trigger a betwixt assessment. Most permanent changes in earnings (such as a promotion or job change within the same industry, or taking a secondary job) would not trigger a betwixt assessment as long as they were not very large.

D. *Salience of the Reform*

Behavioral responses to the tax holiday can happen only if the public is well informed about the reform and understands that it generates a tax holiday. Hence, it is important to provide evidence on how salient the tax holiday was.

The federal laws passed in the early 1990s had established that all cantons would eventually transition. Each canton could freely decide when to transition and the exact form that the transition would take. The decision was taken by cantonal legislatures. In 14 cantons, such as Zürich, the new tax laws were put to a popular referendum, either by default, by wish of the cantonal legislature, or because a party or group of individuals forced a referendum by collecting a predetermined number of signatures. In the cases where a referendum was held, by default the resident population in a canton received voting documentation by mail. We have gathered this documentation for each canton. The voting documentation included information on the transition in an easy to understand language and in many cases the incidence of the tax holiday was further explained by a graphical illustration (see panel B of online Appendix Figure A2 for an example). In about one-half of all cases, the votes took place during the first tax holiday year (see online Appendix Figure A3). In all cases, the vote was always strongly in favor. Turnout ranged between 26 and 60 percent (see online Appendix Table A1 for complete details on the vote timing and

[17] For hours, the change typically had to be of more than 20 hours per week (e.g., going from full-time to less than half-time).

turnout by cantons). However, the actual referendum or legislative vote was the last step in a longer process. Typically, the transition was in the public debate for many months before the decision was officially taken through the referenda or legislature votes. The public was generally officially informed in the middle of the first tax holiday year although the public debate often started before the first tax holiday year. In sum, we expect more information and hence larger behavioral responses for the second year of the tax holiday.

Let us describe in more detail the transition process in each of the three waves of cantons depicted in panel B of Figure 1.

Early Transitions: Two cantons, Zürich and Thurgau, transitioned early in 1999. Zürich held a popular referendum on transitioning in 1999 on June 8, 1997. As Zürich has a single 1998 tax holiday year for cantonal taxes, the public was officially informed about the 1998 tax holiday more than 6 months before the start of 1998, leaving time to anticipate and prepare for the reform. Thurgau decided its transition in 1999 on June 30, 1997. This means that Thurgau residents knew for sure by the middle of 1997 that 1997 and 1998 would be tax holiday years. Hence, we should expect a larger behavioral response for 1998 than for 1997 in Thurgau.

2001 Transitions: Most cantons were expected to transition in 2001. These decisions were typically made during calendar year 1999, with votes held into calendar year 2000. This implies that in many cases the information was made official during the first tax holiday year of 1999 and before the start of 2000, the second tax holiday year. Most of the referenda held in 2000 were mandatory referenda, and the large share of yes votes show that the new tax laws were uncontested. Taxpayers could therefore expect the new system to be put in place. Hence, we should expect a larger response in the second tax holiday year. As Zürich and Thurgau had already transitioned with tax holidays, we expect that the public was even better informed for this large group of cantons.

2003 Transitions: The three cantons VD, VS, and TI which transitioned late in 2003 decided to transition at this date typically in 2000 or 2001. The reason these cantons transitioned late was mostly that their information technology systems were not yet ready. Legally, these cantons claimed that they needed to make some changes in their cantonal laws to incorporate the new requirements and that due to some of the changes the transition period was extended until January 1, 2003. As most cantons had already transitioned, the nature of the transition and the tax holidays it creates is likely to have been even more salient for these cantons.

Press Coverage: Another way to assess salience is to examine press coverage of the transition and in particular how often tax holidays were mentioned. There were many press articles discussing the tax reform and the tax holiday it creates (see panel A of online Appendix Figure A2 for an example with a salient graphical illustration).

Figure 2 depicts the number of press articles mentioning the word "Bemessungslücke" (blank year) and the French term "brèche fiscale," or other expressions used to refer to the reform in German and French by year and most

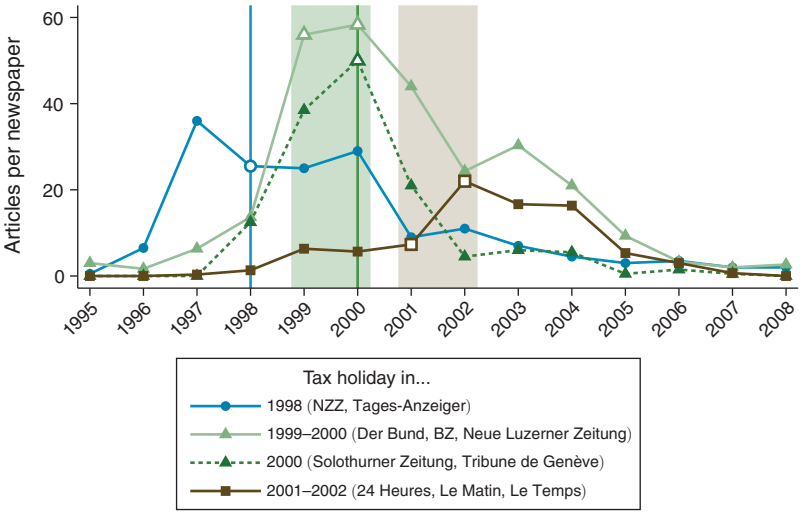

FIGURE 2. PRESS ARTICLES REFERRING TO THE TAX HOLIDAYS

Notes: This figure depicts the number of press articles mentioning the word "Bemessungslücke" (blank year) and the French term "brèche fiscale," or other expressions used to refer to the reform in German and French (Gegenwartsbesteuerung, Gegenwartsbemessung, postnumerando, praenumerando, brèche de calcul, trou de taxation, taxation biannuelle, taxation annuelle) by year and most major newspapers. The figure displays four series: (i) the series in blue circles is for two Zürich-based newspapers, (ii) the series in light green triangles for three Bern- and Lucerne-based newspapers, (iii) the dashed series in dark green triangles for two Geneva- and a Solothurn-based newspapers, (iv) the series in brown squares for three Vaud- and Valais-based newspapers. In the series, the dots corresponding to tax holidays are bigger and are blanked out (as tax holidays are called blank years in French and German). The tax holiday periods are also depicted in shaded colors. Local press interest in the tax holiday typically peaked during the years when the actual tax holidays happened locally.

major newspapers.[18] The figure displays four series: (i) the series in blue circles for two Zürich-based newspapers, (ii) the series in light green triangles for three Bern- and Lucerne-based newspapers, (iii) the series in dark green triangles for two Geneva- and a Solothurn-based newspapers, (iv) the series in brown squares for three Vaud- and Valais-based newspapers. The tax holiday for Zürich is depicted in blue, the tax holiday for Bern and Lucerne is depicted in light green, the tax holiday for Geneva and Solothurn is depicted in dark green, and the tax holiday for Valais and Vaud is depicted in light brown (in the series, the symbols for the tax holiday years are also blanked out). The figure shows that press interest in the tax holiday peaked during the years when the actual tax holidays happened. Interestingly, the figure shows that these peaks corresponded to the regions where the blank year was in place. This suggests that at least for the second blank year and especially for the second wave of the reform (1999/2000), salience can be assumed to have been large.

[18] We constructed these graphs by scraping the newspaper archive Swissdox, which contains a full text archive of most newspapers in Switzerland. The sample is restricted to large daily newspapers whose archive covers the relevant time period (i.e., starts in 1998 or earlier). The following German- and French-speaking newspapers fulfill these sample restrictions and are based in the regions shown in the graph: *24 Heures* (since 1997), *Berner Zeitung* (since 1998), *Der Bund* (since 1994), *Le Matin* (since 1997), *Le Temps* (since 1998), *Neue Luzerner Zeitung* (since 1998), *Neue Zürcher Zeitung* (since 1993), *Solothurner Zeitung* (since 1996), *Tages-Anzeiger* (since 1995), and *Tribune de Genève* (since 1997).

The fact that the transitions were formally passed by the cantonal legislatures and discussed in the press does not automatically insure that all taxpayers were perfectly informed. Many people do not follow local legislative activity nor read the press systematically. Indeed, empirical work has shown that taxpayers often have imperfect information about tax systems even when tax systems have been fairly stable (see, e.g., Fujii and Hawley 1988). However, the tax holiday was a simple concept to understand: earnings during the tax holiday are free of all income taxes. This does not require understanding the intricacies of the income tax code nor the marginal tax rate schedule. Nevertheless, it remains possible that taxpayers, while informed of the tax holiday, do not infer that increasing labor supply is advantageous, or may view such a behavior as gaming the system.

II. Data

We use two main data sources for our empirical analysis.[19]

Matched SSER-Census Data: Our main dataset merges the 1990, 2000, and 2010 population censuses of Switzerland with longitudinal social security annual earnings records (SSER) covering the period 1981–2010. The main match is done in 2010 using social security numbers. The 1990 and 2000 censuses do not contain social security numbers and were matched with the 2010 census using probabilistic methods based on sex, day of birth, marital status, nationality, religion, place of residence and other variables. About 8 percent of our 2010 matched data cannot be matched to the earlier censuses, for instance because multiple possible matches.[20]

Both datasets cover the full population. In the SSER data, employed or self-employed individuals generate one record per job per year that details the starting and ending month of an employment relationship along with the total earnings over that time period. Labor earnings are uncapped, and include variable pay components such as bonuses and stock options. We match these records to census data because the social security data do not contain geographical information which is key for our empirical design. Panel A in Table 1 presents descriptive statistics of the matched data pooling all years from 1990 to 2010.

Because virtually everybody generates a record at some point in his or her life, our matched dataset contains 98 percent of the resident population aged 20–60 in 2010. As we move back in time, the sample coverage of persons aged 20–60 gets slightly smaller because certain individuals that lived in Switzerland in these earlier years died or emigrated and hence are not present in the 2010 census. Online Appendix Figure A6 shows that we could match SSER and the census 2010 for 93 percent of all individuals aged 20–60 living in Switzerland in 2000, the time around which the reforms we analyze took place.[21] For 86 percent of individuals,

[19] The online Appendix provides a more complete description and also presents additional analysis based on the Swiss labor force survey (SLFS), the equivalent of the US Current Population Survey.

[20] This relies on the "Swiss National Cohort" project presented in detail in Spoerri et al. (2010). See online Appendix Section A.2 and Figures A5, A9, A10, and A11 for details.

[21] In online Appendix Figure A7, we compare the employment rate of 20–64-year-old Swiss men and women in our data with the employment rate of these groups according to the labor force survey described below. The employment rates are slightly higher in our data than they are in the labor force survey. This is likely due to the fact that people with very low but positive earnings in a given year have social security income in that year but may not

Table 1—Descriptive Statistics

	Mean	SD	p1	p99	Observations
	(1)	(2)	(3)	(4)	(5)
Panel A. Matched SSER-Census					
Share employed (percent)	85.3	35.4	0.0	100	70,494,024
Share self-employed (percent)	8.5	27.8	0.0	100	70,494,024
Annual wage earnings (CHF)	46,835.5	54,287.3	0.0	208,602	70,494,024
Annual self-employment earnings (CHF)	4,747.7	30,827.8	0.0	110,500	70,494,024
Average tax rate (percent)	11.3	6.0	0.0	27	58,508,349
Marginal tax rate (percent)	21.1	9.0	0.0	40	58,508,349
Individual characteristics in 2000					
Age	39.85	11.087	20	60	3,380,599
Female	0.50	0.500	0	1	3,380,599
Married	0.60	0.490	0	1	3,380,599
Children aged 0–5	0.23	0.553	0	2	3,117,109
Children aged 6–15	0.43	0.801	0	3	3,117,109
Swiss national	0.87	0.332	0	1	3,380,599
Tertiary education	0.23	0.421	0	1	3,039,550
Secondary education	0.60	0.491	0	1	3,039,550
Panel B. Employer Survey (*LSE*)					
Earnings in October (CHF)	6,426.3	3,670.3	372.2	21,135.3	5,901,025
Hourly wage in October (CHF)	37.8	16.3	17.1	102.7	5,901,023
Hours worked in October	159.1	43.0	13.3	199.3	5,901,025
Share of workers with bonus $>$ 5k (percent)	11.3	31.7	0.0	100.0	5,901,025

Notes: The table presents mean, standard deviation (SD), and the first (p1) and ninety-ninth (p99) percentile of the main variables used in the empirical analysis. We focus on individuals aged 20–60 in every year, excluding foreign workers who do not pay regular taxes in Switzerland. All cantons in Switzerland are included. Panel A is based on the matched social security and census data (SSES-Census). The sample in the upper half covers all person-year observations between 1990 and 2010 from individuals who are still alive and Swiss residents by 2010. The lower half of panel A shows descriptives of individual characteristics in 2000. *Share employed* (*Share self-employed*) is the fraction of individuals in the sample with positive earnings (self-employment earnings) during the year. The average and the marginal tax rate are computed for employed persons only. Tax rates include federal, cantonal, and municipal income taxes. Panel B is based on the Employer Survey (Wage Structure Survey, *LSE*) and thus focuses on employed persons only. The sample covers all worker-year observations from all surveys between 1994 and 2010 (the survey is carried out every two years). Public sector employees are excluded. *Monthly earnings* refer to the month of October in each year and include regular salaries and overtime and other variable pay components (e.g., bonuses). Hourly wages refer to month of October and incorporate regular pay but exclude overtime and variable pay components (e.g., bonuses). Hours of work are based on the month of October and refer to contractual (i.e., normal) hours worked for workers with monthly wages and to actual hours worked for workers paid by the hour. See online Appendix Section A.2 for more information on these data and variables.

we additionally have information from the census 2000. The census contains relevant personal characteristics such as educational background, learned and current occupation, individuals' marital status, the presence of children, and a household identifier that allows calculating household income. With the exception of household income and marital status that we impute for individuals we cannot match (see online Appendix Section A.2), analyses using these characteristics are thus based on a slightly smaller sample.

Our matched dataset has an important drawback that should be noted: the earnings records in 1998 are incomplete due to recording failures in some of the local social security offices. The share of wage earners for which records are missing is about 5–6 percent. The problem of missing records is not equally distributed across cantons. In

be recorded as participating in the labor force in the labor force survey, which measures the fraction of individuals employed in the second quarter of the year.

the longitudinal micro-level analyses below, we thus have to discard data from 1998. We impute the missing data in the graphical macro-level analyses (see below).

Employer Survey (LSE): The Swiss wage structure surveys (*Lohnstrukturerhebung* LSE) have been conducted every two years by the Swiss Federal Statistical Office (FSO) since 1994. They are a large stratified random sample of private and public firms with at least three full-time-equivalent workers from the manufacturing and service sectors in Switzerland.[22] They cover between one-sixth (1996) and one-half (2010) of total employment in Switzerland. The mandatory surveys contain extensive information on the individual characteristics of workers and provide reliable (employer-reported) information on hours worked per worker. They contain detailed salary information broken down into pay components, including bonus payments per worker. The main drawbacks of these data are that (i) they cannot be used to study the extensive labor supply margin; (ii) they only provide the geographical location of the work location (and not the residence location) which creates measurement error for individuals who do not live in the same canton they work; (iii) they are biannual and hence do not cover every single year (although the even years are always the second year of the tax holiday and hence the ones where the information is best and the expected response largest). We address the second problem by excluding zip codes where more than 25 percent of workers live in another canton group. Approximately 10 percent of all observations in the surveys are dropped due to this restriction. The commuting patterns by zip code are computed from the census in 2000. We use the wage structure surveys to examine how the tax holiday affected wage rates and variable pay components. Panel B of Table 1 presents descriptive statistics of the employer survey data pooling all years from 1994 to 2010.

III. Empirical Results

In this section, we present our empirical results. We divide cantons into various groups as depicted in Figure 1: (1a) 1 canton (Thurgau) which transitioned early in 1999 with tax holiday in 1997–98, (1b) 1 canton (Zürich) which transitioned early in 1999 with tax holiday in 1998 only for local taxes (and 1997–98 for the federal tax), (2a) 16 cantons which transitioned in 2001 with a tax holiday in 1999–2000 for both the federal and local income taxes, (2b) 4 cantons which transitioned in 2001 with a tax holiday in for 2000 only for local income taxes (and 1999–2000 for the federal tax), (3) 3 cantons which transitioned late in 2003 with tax holiday in 2001–2002. We always use the same colors and shaped symbols to depict each group: (1a) light blue circles, (1b), dark blue circles, (2a) light green triangles, (2b) dark green triangles, (3) brown squares. We sometimes combine groups (1a) and (1b) into a single group (1) and groups (2a) and (2b) into a single group (2).

First, we examine the levels of tax rates to establish the magnitude of the first stage generated by the tax holidays. Second, we analyze aggregate effects on employment and earnings using basic time series. Third, we present an event study longitudinal micro-econometric framework to quantitatively estimate the elasticities. Fourth, we

[22] The data exclude the agricultural sector. We exclude public administration, public education, and the public health sectors from the analysis since they are not fully covered in the early waves.

examine additional outcomes such as hours of work, wage rates, and bonuses using the wage structure surveys.

A. *First Stage Effect and Parallel Trend Identification*

First Stage Effect on Tax Rates: First, we examine the levels of average and marginal tax rates so that we can establish the size of the first stage in terms of tax rate reductions. Figure 3 displays the average income tax rate (panel A) and marginal income tax rate (panel B) averaged across workers in our sample by year and groups of cantons from 1990 to 2010. Tax rates were compiled by Parchet (2018) and include federal, cantonal, and municipal income taxes. The average tax rate is the total income tax divided by gross income.[23] We treat married individuals and singles separately. We use tax rates for singles without children in case a person is single. For married individuals, we match spouses exploiting the household identifier in the census 2000 and then use the sum of earnings across both spouses using the social security data to compute household income and the corresponding income tax. We impute household income for married individuals that could not be matched to the census.[24] We then compute tax rates based on household income using tax rates for married individuals with two children for married persons. If the couple has no children below age 20 according to census data, we use tax rates for married individuals without children.[25] Averages across municipalities and cantons are employment weighted. The cantons are divided in five groups based on when the tax holiday took place as described above following panel B of Figure 1. In the series, the dots corresponding to tax holidays are bigger and are blanked out (as tax holidays are called "blank years" in French and German). This graphical representation will be used in all subsequent reduced-form graphs. For each of the groups, we represent the corresponding tax holiday periods using the vertical shading and the same color code.

Tax rates are naturally zero during tax holidays. Cantons with a single year tax holiday (groups 1b and 2b) also have a *federal* tax holiday the preceding year explaining the lower tax rate. Yet, the effect is small as federal income tax revenue is less than 20 percent of total income tax revenue. Substantively, two points are worth noting. First, tax rates and especially marginal tax rates are fairly high on average. Average tax rates are around 10–13 percent while marginal tax rates are around 20–25 percent. Obviously, the change in average and especially marginal tax rates are even larger for groups with above-average household incomes (such as men or married women). Second, the graph shows that, over the period 1990–2010, the variation in tax rates (either average or marginal) due to the tax holidays dwarfs other variations due to tax reforms.

Therefore, the tax holiday generates large intertemporal substitution wage effects as income earned during the tax holiday escapes the income tax. On an annual basis, there is no direct income effect as income taxes are due every year. Indeed, the

[23] See online Appendix Section A.2.4 for more information on the tax data used in the analysis.

[24] We impute spousal income based on an out-of-sample prediction. To this end, we regress spousal income on a set of predictors of spousal income using the sample of individuals with non-missing household identifier in 2000. The predictors are a full set of interactions between age, gender, and a categorical variable of an individual's own labor income, as well as nationality, canton effects and year effects.

[25] These imputations might have a small impact on the precision of our estimates.

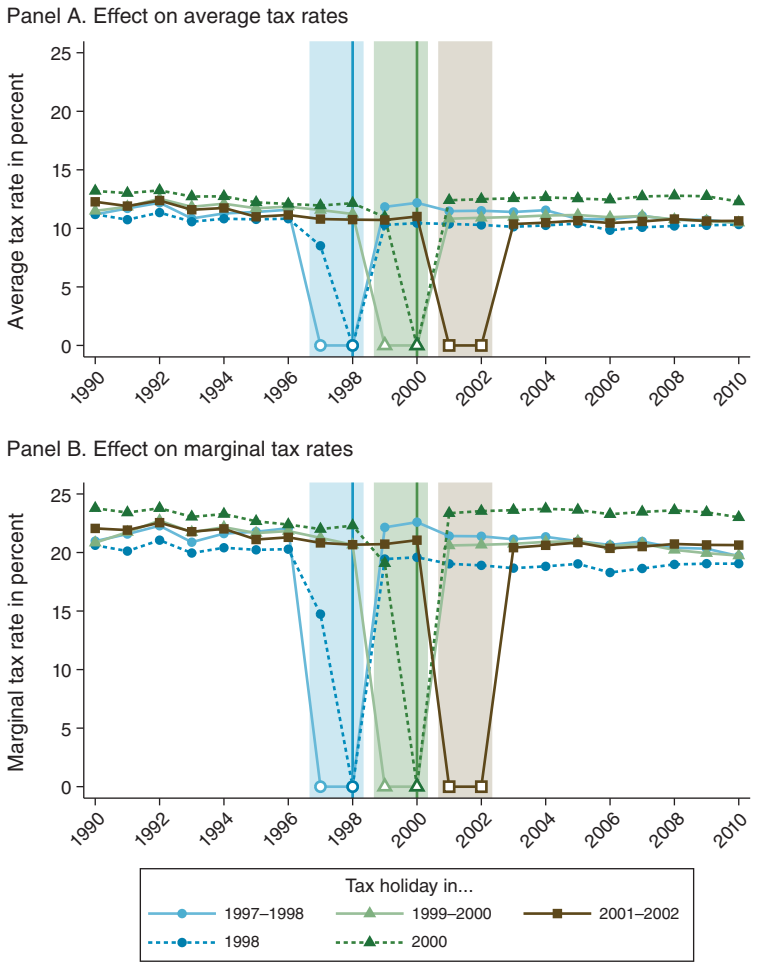

FIGURE 3. FIRST STAGE EFFECT OF TAX HOLIDAYS ON TAX RATES

Notes: This figure displays the average income tax rate (panel A) and average marginal income tax rate (panel B) for employed persons in our sample by year and groups of cantons from 1990 to 2010. Tax rates include federal, cantonal, and municipal income taxes. Years denote the year in which the corresponding income is earned (not when the tax is paid). The average tax rate is the total income tax divided by gross income. Averages across municipalities and cantons are employment weighted. The cantons are divided in five groups based on when the *cantonal* tax holiday took place. (1a) light blue circles: tax holiday in 1997–1998 (1 canton), (1b) dashed dark blue circles: tax holiday in 1998 (1 canton), (2a) light green triangles: tax holiday in 1999–2000 (15 cantons), (2b) dashed dark green triangles: tax holiday in 2000 (4 cantons), (3) brown squares: tax holiday in 2001–2002 (3 cantons). In the series, the dots corresponding to tax holidays are bigger and are blanked out (as tax holidays are called blank years in French and German). For each of the groups, we represent the corresponding tax holiday periods using the vertical shading and the same color code. Tax rates are naturally zero during tax holidays. Cantons with a single year tax holiday (groups 1b and 2b) also have a *federal* tax holiday the preceding year explaining the lower tax rate but it is a small effect as federal income tax revenue is only one-sixth of total income tax revenue.

reason for the tax holiday is precisely to avoid double taxation during the transition. Aggregate annual income tax collections do not display any discontinuity during the tax holiday and transition years (see online Appendix Figure A4). Therefore, the tax reform comes very close to a pure intertemporal substitution effect that could generate large labor supply responses along both the intensive and extensive margin. Naturally, various frictions on the labor market might dampen the responses, which

is why we often refer to our estimates as "frictional Frisch" elasticities. The reform could also generate tax avoidance responses such as shifting income into tax holiday years. Such avoidance might be easier for the self-employed.

Parallel Trends across Groups of Cantons: Our key identification assumption is that, absent the tax holidays, the various canton groups would have evolved similarly in terms of employment and earnings. Below, we present evidence of parallel trends in the labor supply outcomes that we study in this paper. Here, we provide evidence that cantons also follow similar business cycles. Figure 4 displays the official Swiss unemployment rates by year and groups of cantons from 1990 to 2010. The yearly unemployment rate is defined as the average of monthly unemployment rates. The official unemployment rate is the ratio of individuals registered at the Swiss public employment service (registered unemployment) to workers plus registered unemployed. The Swiss wide unemployment rate is also depicted with a thick red line.[26] Two points are worth noting on Figure 4.

First, the unemployment rates differ across canton groups in level but not in trend. Levels are higher in the late transitioning canton group (3) in brown squares and lower in the cantons groups (1a) and (2a) in light blue circles and light green triangles. However, all canton groups follow exactly the same business cycle so that the parallel trend assumption holds almost perfectly. The first tax holiday of 1997–1998 (in blue circles) happens at the very end of the mid-1990s recession when the economy starts to recover. The second tax holiday of 1999–2000 (in green triangles) happens during an economic boom when unemployment is falling fast. The last tax holiday of 2001–2002 (in brown squares) happens when the unemployment rate starts to tick up again. Second, the figure shows that nothing visible happens to the unemployment rate during the tax holidays in the treated cantons. This is consistent with our subsequent findings of no response along the extensive margin.

B. *Aggregate Difference-in-Difference Analysis*

We start by plotting basic employment and earnings statistics by year and by groups of cantons focusing on the sample of working age individuals aged 20–60 in the relevant year. Hence, these statistics are repeated cross-sectional statistics. In all these graphs, the tax holiday years are denoted by the vertical shaded bars and we use the same color coding as in Figure 3 on tax rates.[27] Unlike wage earnings, self-employment earnings are not observed for all years during the transitions (see above). Therefore, we start with wage earnings only and defer the analysis of self-employment to the end of this section.

[26] As is well known, the unemployment rate in Switzerland is low (it ranges from 1 percent to 5 percent) because in recessions immigrant workers who become unemployed leave the country. As being counted as unemployed requires official registration, it is possible also that some resident unemployed are not registered, especially for short unemployment spells.

[27] As mentioned above, about 5 percent of wage records are missing in 1998 (due to some local offices failing to transmit their data correctly to the central office). To correct for this, we re-estimate series by year and group in a refined sample that excludes the local offices affected by the 1998 missing data. We then impute 1998 values in the full data assuming that the 1998 value relative to the average of 1997 and 1999 is the same in the refined sample and in the full sample. See online Appendix Section A.2 and Figure A8 for details. We have checked using other years that this method delivers accurate results.

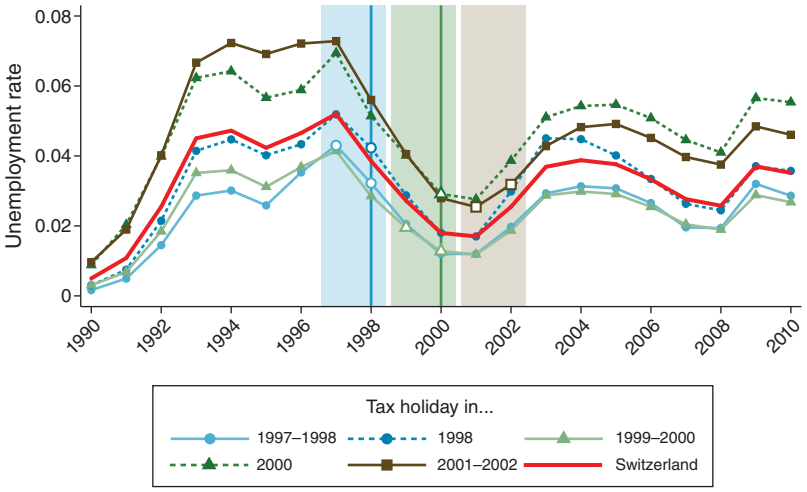

FIGURE 4. PARALLEL TRENDS IN UNEMPLOYMENT RATES ACROSS CANTONS

Notes: This figure displays the official unemployment rate by year and groups of cantons from 1990 to 2010. The cantons are divided in five groups based on when the *cantonal* tax holiday took place. (1a) light blue circles series: tax holiday in 1997–1998 (1 canton), (1b) dark blue dashed circles: tax holiday in 1998 (1 canton), (2a) light green triangles: tax holiday in 1999–2000 (16 cantons), (2b) dark green triangles: tax holiday in 2000 (4 cantons), (3) brown squares: tax holiday in 2001–2002 (3 cantons). The Swiss wide unemployment rate is depicted by the thick red line. The yearly unemployment rate is the average of monthly official unemployment rates. The official unemployment rate counts individuals registered at the Swiss public employment service (registered unemployment).

Wage Employment Rates: Panel A of Figure 5 displays the wage employment rates from 1990 to 2010 in the five groups of cantons. The sample in each year is defined as all individuals aged 20–60 in the year (and who are still alive and Swiss residents in 2010, when we match to the 2010 census). The wage employment rate is computed as the fraction of individuals in the sample with positive wage earnings during the year. Two findings are worth noting.

First, all groups of cantons follow fairly parallel trends over the full period. The parallelism is not exactly perfect, especially in the very long run. For example, employment rate grows about 3 points less in group (2b) in dashed dark green triangles than in other groups. However, the trends are close to parallel in the medium run around the tax holidays. This implies that for each group of cantons, the other groups constitute decent control groups.[28] In the micro-level longitudinal regression framework below, we control for these longer term differences in earnings trends by controlling for linear time trends per canton.

Second, there is no evidence of any relative increase in employment rates during the tax holidays represented by the blanked out symbols in the shaded areas.[29] This implies that the temporary tax holidays did not affect labor supply along the

[28] Online Appendix Figure A12 depicts employment rates separately for males and females and shows that differential trends are driven entirely by women with almost perfect parallelism for men.

[29] The only exception is group (1a) in light blue circles, the sole canton of Thurgau, that displays a very slight bump in 1998 but this bump is not particularly significant as bumps of similar magnitude appear in 2000 and 2002 as well for this canton. Online Appendix Figure A12 shows that such bumps are driven by women with no bumps at all for men.

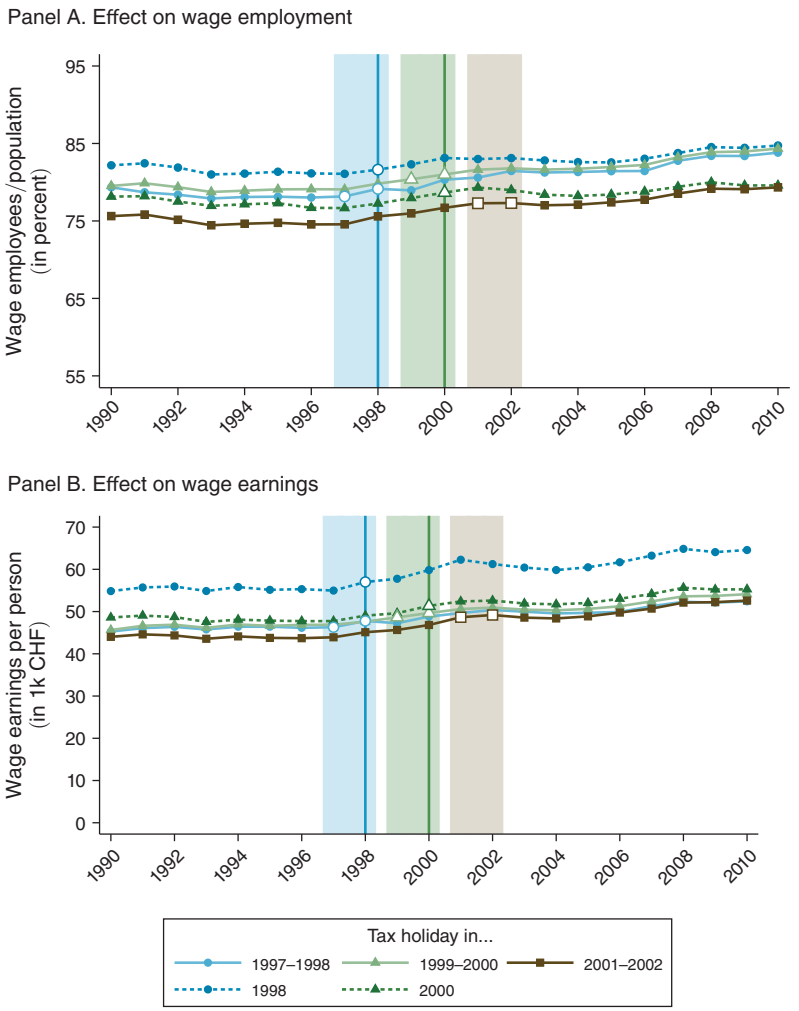

FIGURE 5. EFFECTS OF TAX HOLIDAYS ON WAGE EMPLOYMENT AND EARNINGS

Notes: This figure displays the employment rate of wage earners (panel A) and average wage earnings (panel B) by year and groups of cantons from 1990 to 2010. The sample in a given year t is all individuals aged 20–60 in year t who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census). The wage employment rate is computed as the fraction of individuals in the sample with positive wage earnings during the year. Average wage earnings in panel B include non-workers and are expressed in 1,000s of 2010 CHF (adjusted for inflation). The cantons are divided in five groups based on when the *cantonal* tax holiday took place. (1a) light blue circles: 1 canton with tax holiday for cantonal taxes in 1997–1998 (1 canton), (1b) dashed dark blue circles: 1 canton with tax holiday for cantonal taxes in 1998 (1 canton), (2a) light green triangles: 15 cantons with cantonal tax holiday in 1999–2000, (2b) dashed dark green triangles: 4 cantons with cantonal tax holiday in 2000, (3) brown squares: 3 cantons with cantonal tax holiday in 2001–2002. For each of the groups, we represent the corresponding tax holiday periods using the vertical shading and the same color code. In the series, the dots corresponding to tax holidays are bigger and are blanked out (as tax holidays are called blank years in French and German).

extensive margin. To put these findings in perspective, because the cut in the average tax rate is around 12 percent (panel A of Figure 3), a Frisch elasticity of 1 along the extensive margin (a low end value of the estimates commonly used in macro calibrations) should generate an increase in employment rate of 11 percent, i.e., around 8 points. This would create an enormous spike in the empirical series of panel A of

Figure 5. Therefore, our very simple aggregate time series evidence can clearly rule out such large Frisch elasticities empirically.

Quantitatively, column 1 of Table 2 shows estimates derived from a basic OLS regression based on the aggregate time series by group depicted in panel A of Figure 5. We regress the time series for the 5 groups of cantons on year dummies, group dummies, and an indicator that is equal to 1 during the tax holiday years: for two years in cantons that have two-year long tax holidays for cantonal and municipal taxes, and for one year for cantons whose cantonal tax holiday only lasted one year. This analysis is very transparent and provides conservative standard errors. The first row is the first stage effect on the net of tax rate. The second row is the reduced form on the wage employment rate, expressed as a percent effect relative to the average employment rate during the tax holiday. The third row estimates the Frisch elasticity by taking the ratio of row 2 to row 1 and computing the standard error using the delta method. There is no significant effect on wage employment rates (-0.07 percent effect) and the resulting elasticity is extremely small and precisely estimated: -0.005 (0.021).[30]

We have done two robustness checks. First, we have redefined employment as annual earnings above some modest positive threshold of 10,000 CHF instead of any positive earnings (1 CHF is approximately equal to US$1). It is conceivable that some individuals who intend to temporarily enter (or not to leave) the labor force during the tax holidays might not be able to target exactly the calendar year. Therefore, using a higher threshold for employment can help capture these effects as well. The absence of any response carries over unchanged when using the higher 10,000 CHF threshold (see online Appendix Figure A14 comparing panels A and B). Second, we have repeated the analysis using the Swiss Labor Force Survey (SLFS), the equivalent of the US Current Population Survey (see online Appendix Section A.2.3 for a description of the data source). Panel A of online Appendix Figure A15 displays the employment rate using the SLFS. The figure is noisier due to smaller sample size but it does not display any tax holiday effects on the employment rate consistent with our results using Social Security data.

We show in online Appendix Table A3 that the tax holiday did not generate any significant responses along various other dimension of extensive labor supply: number of jobs and number of months employed. The effect on months employed is marginally significant but very small in magnitude (0.02 months or 0.15 percent extra months).

Wage Earnings: Panel B of Figure 5 displays the average wage earnings from 1990 to 2010 in the five groups of cantons. The sample is the same as in panel A and includes zeros. We thus capture both extensive and intensive margin responses. Earnings are expressed in 1000s of 2010 CHF (adjusted for inflation). Two points are worth noting.

First, overall, the trends are close to parallel in all three groups, with a much higher level in the Zürich (canton group (1b) in dashed dark blue circles). Note

[30] Online Appendix Figures A12 and A13 display the employment rates separately for men, women, and married women by year and groups of cantons from 1990 to 2010. None show visible effects during the tax holidays. Online Appendix Table A2 displays the corresponding OLS estimates. They are insignificant and very close to zero, even among married women with children, the group expected to be the most elastic.

Table 2—Regression Analysis of Tax Holiday Effects on Labor Supply: Macro Estimates

Variables:	Wage employees/ population (in percent)	Wage earnings per person	Wage earnings per person	Self-employment earnings
Sample:	All	All	High earners	Self-employed
	(1)	(2)	(3)	(4)
$\%\Delta[1-\tau]$	12.9	27.0	46.1	26.5
$\%\Delta y$	−0.07	0.71	2.00	7.70
	(0.27)	(0.47)	(0.75)	(3.28)
Frisch elasticity η^F	−0.005	0.026	0.043	0.291
	(0.021)	(0.017)	(0.016)	(0.124)
Observations	105	105	105	80
Canton group fixed effects	Yes	Yes	Yes	Yes
Period fixed effects	Yes	Yes	Yes	Yes

Notes: The table presents estimates of the labor supply effects of the tax holiday based on regressions of the aggregate time series of the 5 groups of cantons (shown in Figures 5 and 6) on year dummies, canton group dummies, and an indicator which is 1 in the year in which municipal and cantonal taxes are zero. OLS standard errors are reported. The estimation sample covers the years 1990–2010 in columns 1–3 and 1987–2010 in column 4. The outcome in column 1 is the share of wage earners in the population of adults aged 20–60 (in percent). The outcome in columns 2 and 3 is the average annual wage per person, including non-workers. The outcome in column 4 is average self-employment earnings (self-employment earnings of all individuals with positive self-employment earnings in a given year). Columns 1 and 2 are estimated using the full sample of adults aged 20–60. Column 3 focuses on wage earners with average annual labor earnings above 100,000 CHF in 1994–1996. Column 4 is based on all individuals that have positive self-employment earnings. $\%\Delta[1-\tau]$ is the percent change in the net of tax rate due to the tax holiday. Column 1 considers the average tax rate (relevant for the extensive margin) while columns 2–4 consider the marginal tax rate (relevant for the intensive margin). For each individual, $\%\Delta[1-\tau]$ is computed based on hypothetical marginal or average tax rates on the actual income earned during the tax-free years in the tax system in place prior to the tax holidays. $\%\Delta y$ indicates the implied percent change in the outcome by dividing the estimated effect, the coefficient of the indicator of the tax holiday, by the average level of the outcome variable in the year of the tax holiday. The Frisch elasticity η^F is estimated by dividing $\%\Delta y$ by the estimated percent change in net of tax rates ($\%\Delta[1-\tau]$) created by the tax holiday for the respective group.

that there is a very slight catching up trend in wage earnings for late transitioning cantons (group 3, brown squares). This implies that the identification strategy of comparing cantons around the tax holidays is a defensible one.

Second, there are small bumps in earnings in 1998 for early transitioning cantons (blue series in circles) and for late transitioning cantons with tax holidays in 2001–2002 (brown series in squares). These bumps are consistent with a behavioral response to the tax change. However, the magnitude of the bumps is fairly modest, maybe around 1 point of average earnings at most for a marginal tax rate cut of over 20 percent (Figure 3, panel B), which would translate into Frisch elasticities of 0.05 at most. Furthermore, the series in green triangles with tax holiday years in 1999 and 2000 (that include 19 out of the 24 cantons we analyze) do not display visible bumps. Conversely, the canton of Zürich (group (1b) in dashed dark blue circle) does display a false bump in 2001, that is likely driven by high profits and compensation in the finance industry that year. Quantitatively, column 2 of Table 2 shows that the corresponding elasticity estimate combining all 5 series are modest 0.026 (0.017) and not even significant, clearly ruling out an elasticity estimate above 0.06.[31]

[31] Online Appendix Table A2 presents results by demographic subgroups. The elasticity of male wage earnings is marginally significant 0.037 (0.019) but the female wage earnings elasticity is not 0.018 (0.020) even when the sample is restricted to married women for children 0.027 (0.032).

Responsive Groups: High Wage Earners and the Self-Employed: We consider next two groups likely to display larger responses: high wage earners and the self-employed.

High Wage Earners.—Panel A of Figure 6 zooms in on high wage income earners. The sample is further restricted to individuals with annual labor earnings above 100,000 CHF on average in the period 1994–1996, a couple of years before the reform started. The figure shows a clear and significantly larger response of wage earnings for this group than in the full population (panel B of Figure 5). The tax holiday bumps in the early and late transitioning cantons are larger and even middle transitioning groups (2a) and (2b) in green triangles display a visible bump in 2000. The bump is largest for the late transitioning cantons of around 5 percent excess earnings during the 2001–2002 tax holidays. Column 3 of Table 2 shows that the corresponding elasticity estimate combining all five series is a highly significant 0.043 (0.016).[32]

Self-Employment Earnings.—Panel B of Figure 6 displays average self-employment earnings by year and groups of cantons from 1990 to 2010 among the self-employed (defined as individuals with positive self-employment earnings in a given year). As discussed earlier, self-employment earnings are measured on a biennial basis before 2001 and self-employment earnings in 1999 and 2000 are subject to a social security tax holiday and hence unobserved in the data. As a result, we do not observe self-employment earnings during the tax holidays for the middle-transitioning cantons in green triangles. There are clear spikes in self-employment earnings during the tax holiday both in the early transitioning cantons (1997–1998) and in the late transitioning cantons (2001–2002). Trends are fairly (albeit not perfectly) parallel so that the tax holiday spikes stand out. In particular, self-employment earnings in the late transitioning cantons (group 3) which experience the largest tax holiday spikes do not fully revert back after the tax holiday relative to groups (1) and (2a). However, group (3) and group (2b) remain fully parallel throughout the full period (except for the tax holiday spikes).

Column 4 of Table 2 shows that the elasticity estimate combining all series is sizable and significant 0.29 (0.12). Therefore, the evidence shows that self-employment earnings respond much more than wage earnings, likely because they have more flexibility to adjust their labor supply or through tax avoidance, in line with the previous literature.

C. *Individual-Level Longitudinal Analysis*

While our simple repeated cross-section analysis shows transparent evidence of no-response along the extensive margin and some response along the intensive margin, particularly for high wage earners and the self-employed, it is useful to develop a simple individual-level micro-econometric framework to estimate the size of the corresponding behavioral elasticities. We estimate two complementary regression

[32] Complete results by income groups based on the time series are presented in online Appendix Table A4 and show an elasticity of 0.085 (0.030) in the top earnings group above 200,000 CHF.

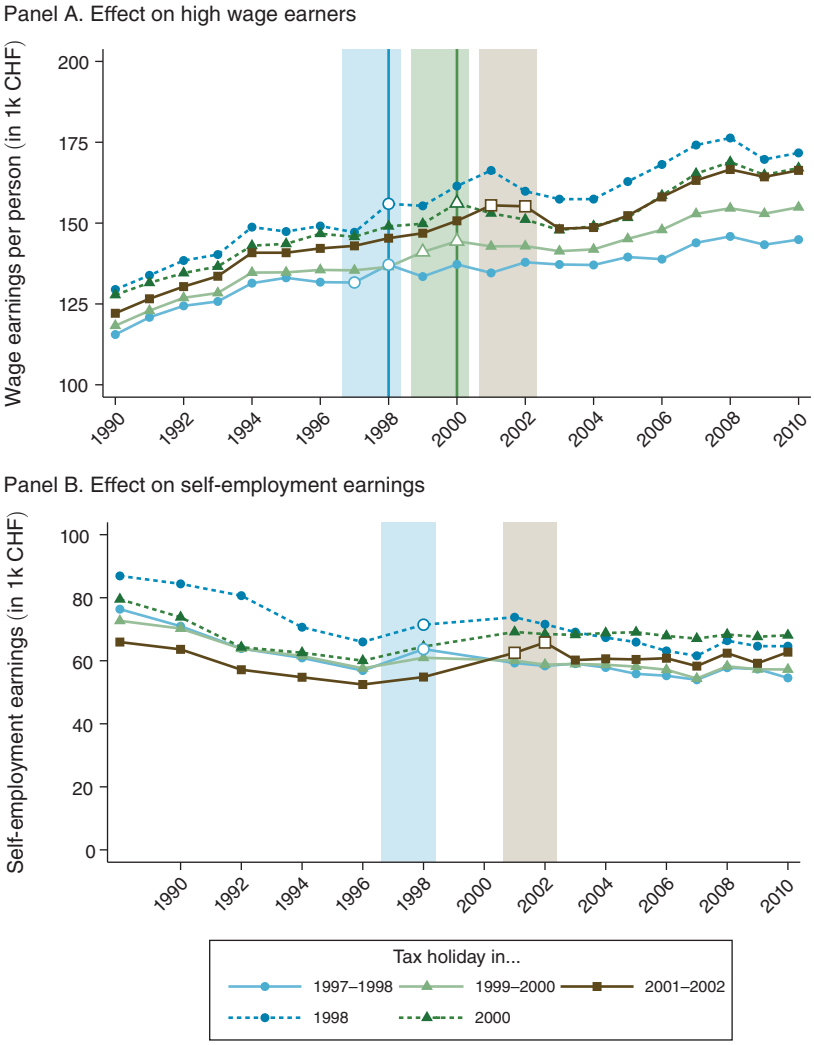

FIGURE 6. EFFECTS OF TAX HOLIDAYS ON HIGH WAGE EARNERS AND SELF-EMPLOYMENT EARNINGS

Notes: This figure displays average wage earnings for high earners (panel A) and average self-employment earnings for the self-employed (panel B) by year and groups of cantons from 1990 to 2010. Panel A is for all wage earners with average annual labor earnings above 100,000 CHF in 1994–1996. Panel B is for all self-employed (individuals with positive self-employment earnings in a given year). Earnings are expressed in 1,000s of 2010 CHF (adjusted for inflation). Self-employment earnings are observed biennially before 1999 (1998 on the figure is the average of 1997 and 1998 self-employment earnings, etc.) and annually after 2000. Self-employment earnings in 1999 and 2000 are subject to a social security tax holiday and hence unobserved in the data. The cantons are divided into groups based on when the *cantonal* tax holiday took place. For each of the groups, we represent the corresponding tax holiday periods using the vertical shading and the same color code. In the series, the dots corresponding to tax holidays are bigger and blanked out (as tax holidays are called blank years in French and German).

models. To quantify the Frisch elasticity implied by the tax holidays effects, we use a regression of labor supply outcomes on the individual log net of tax rate, instrumenting the net of tax rate with an indicator of the tax holiday in the respective canton. We study the validity of this instrumental variable (IV) approach and the

timing of the response by estimating the reduced-form effect of the tax holiday on labor supply using an event study.

There are four key advantages of these micro-level analyses. First, they allow us to focus on a panel of individuals (instead of comparing repeated cross sections as we did so far) and include controls such as individual fixed effects, canton specific linear time trends, and life-cycle effects. Second, they allow us to analyze the precise time pattern of the reduced-form response to tax holidays: intertemporal labor or income shifting might produce a deficit in earnings in years surrounding the tax holidays. Such effects in adjacent years are difficult to see in the repeated cross-section graphs as the tax holidays in an adjacent year for one group is the tax holiday year for another. Third, they deliver more precise and direct quantitative estimates of the frictional Frisch elasticity parameters than the crude estimates coming out of the time series graphs. Fourth, they tie the labor supply response of individuals directly to the individual-level change in tax burden.

IV Design: The IV approach is based on the following regression model:

$$Y_{it} = \alpha_i + \alpha_t + \delta \cdot \log(1 - \tau_{it}) + X_{it}\beta + \epsilon_{it}, \tag{1}$$

where Y_{it} is an outcome for individual i in year t, α_i and α_t represent person and year fixed effects, respectively. Controls X_{it} include age and gender controls (age and age squared by gender) and linear time trends by canton of residence. Following the standard in the literature, the linear time trends exclude the tax holiday years and hence capture the canton specific trend outside of the tax reform (as the time series graphs showed, some groups of cantons do have slightly different time trends). The variable τ_{it} represents the tax rate of individual i in year t, computed as explained in Section IIIA. The tax rate is the *average* tax rate when we study extensive margin labor supply responses and the *marginal* tax rate when we study intensive margin responses. Further, δ represents the semi-elasticity of the outcome with respect to the net of tax rate and can be rescaled to recover the Frisch elasticity. To provide a causal effect of the net of tax rate on labor supply, we instrument $\log(1 - \tau_{it})$ with a dummy equal to 1 if the canton of residence of individual i has a cantonal tax holiday.

Event Study: To provide a transparent illustration of the timing of the reduced-form effect in the IV model, we estimate individual-level event study regressions that show the reduced-form effect of the tax holiday on the outcome in the years around the cantonal tax holiday. We consider the following specification:

$$Y_{it} = \alpha_i + \alpha_t + \sum_{k=-4}^{4} \delta_k \cdot TH_{ct}^k + X_{it}\beta + \epsilon_{it}\,, \tag{2}$$

where Y_{it}, α_i, α_t, and X_{it} are defined as in equation (1). The important covariates are TH_{ct}^k for $k = -4, \ldots, 4$, which represent a sequence of event study dummies that are equal to one k years away from the first year of the federal tax holiday in canton c. Formally, $TH_{ct}^k = \mathbf{1}(t = t_c^* + k)$ where t_c^* is the first year of the tax holiday in canton c. The coefficients of interest are the dummies δ_k for $k = -4, \ldots, 4$

that capture the deviation in the outcome k years away from the first tax holiday year for the specific individual. Since we exclude the dummy for two years before the tax holiday, $k = -2$ serves as the reference period. Note, $k = 0$ is the first year of the tax holiday and $k = 1$ is the second year of the tax holiday. For cantons with a single local tax holiday year (groups 1b and 2b), the local tax holiday year is set at $k = 1$ (there is no local tax holidays in $k = 0$ for this group but there is a federal tax holiday). Setting the reference period equal to $k = -2$ allows us to test for possible income shifting from the year before into the first year of the tax holiday ($k = -1$). To absorb the effects outside of the estimation window of the event study, we additionally control for two dummies for $k \leq -5$ and $k \geq 5$.

Identification and Sample: Our specification with time and individual dummies is identified because different cantons experience tax holidays at different times. The key identification assumption of this micro-level estimation framework is that treated and untreated cantons would have followed parallel outcome trends (in terms of employment and earnings) if the tax holiday had not taken place once we control for individual fixed effects, life-cycle effects, and linear time trends by canton of residence. Importantly, the plausibility of this identifying assumption can be tested with the event study design by checking whether the dummy coefficients well before the reform $k = -4, -3$ and well after the reform $k = 3, 4$ are equal to zero. The event study also reveals whether earnings in the years adjacent to the tax holiday are depressed ($k = -1$ and $k = 2$), e.g., due to retiming of income. We do not generally find evidence that this is the case, which means that the results are very similar in our IV design if we control for tax holiday effects in the years adjacent to the tax holidays.

We estimate both models based on a sample that covers the years 1994–2006 (approximately four years around the tax holiday years) and excludes 1998 (as a fraction of the data are missing in a nonrandom way). As a result, we also exclude the two early transitioning cantons which had tax holidays in 1998.[33] We focus on workers aged 22–55 in 1996 that we follow longitudinally. We drop workers older than 62 in later years to avoid interactions with retirement behavior. Individuals are assigned to cantons based on where they lived in 1996 over the total sample period to avoid picking up the effects of strategic relocation decisions of individuals as a response to the tax holiday.[34]

First Stage: To illustrate the timing of the first stage, we first estimate the event study model (equation (2)) using net of tax rates as outcome variables. In these regression, Y_{it} is the log of 1 minus the average income tax rate ($\log(1 - ATR_{it})$) for extensive responses and the log of 1 minus the marginal income tax rate ($\log(1 - MTR_{it})$) for intensive responses. Panel A of Figure 7 depicts estimates of the effects of the tax holiday on these outcomes from four years to before the tax holidays ($k = -4, -3, -2, -1$ with $k = -2$ set at zero by normalization),

[33] We have experimented trying to incorporate 1998 in the event study regressions. In the end, short of dummying out 1998 entirely, which is equivalent to excluding 1998 as we do, we were not able to obtain stable pretrends due to the highly specific and nonrandom way the data are missing in 1998.

[34] However, as shown in the last column of online Appendix Table A3, the evidence that individuals deferred moving across cantons because of the tax holiday is limited.

into the tax holiday ($k = 0, 1$) and after the tax holiday ($k = 2, 3, 4$). The vertical bars represent 95 percent cluster-robust confidence intervals clustered at the level of the 106 commuting zones in Switzerland.

Two points are worth noting. First, there are large first stage effects during the tax holidays as we expect. The first stage effect for the net of marginal tax rate is about 22 percent while the first stage effect for the net of average tax rate is about 11 percent, consistent with our earlier aggregate time series in Figure 3. Second, the coefficients are very close to zero outside of the tax holidays. This confirms that the tax holidays created a very large first stage effect on net of tax rates.

Effects on Wage Earnings: Panel B of Figure 7 depicts reduced-form event study estimates of the effects of the tax holiday on the extensive and intensive margin of labor supply. The dependent variable Y_{it} in the model *Extensive margin* is an indicator equal to 1 if a person has positive wage earnings in a given year. The dependent variable Y_{it} in the model *Intensive margin* is annual wage earnings of employees (excluding individuals with no wage earnings in a given year) expressed in 2010 CHF. This effect is scaled post-estimation by mean wage earnings in the estimation sample so as to express the effects in percent. The graph depicts 95 percent cluster-robust confidence intervals.

The results confirm our earlier impressions from the time series. There is no effect along the extensive margin and there is a small effect along the intensive margin, of about 1 percent and significant. Combining this reduced-form effect with the first stage effect of a bit more than 20 log points leads to a Frisch elasticity of about 0.04 along the intensive margin, a quantitatively small estimate consistent with our earlier time series analysis but more precisely estimated.[35]

Heterogeneity: An intriguing question is why are the Frisch elasticity estimates so small. To cast light on this, it is valuable to explore heterogeneity.

Figure 8 uses the reduced-form event study to illustrate heterogeneity in the intensive margin response across gender, education, and level of earnings. Panel A depicts estimates for males and females separately. Effects appear to be quite larger for males than for females consistent with our time series analysis. Panel B breaks down the sample by education: workers with a tertiary (i.e., university) degree versus workers without a tertiary degree. The effects are about twice as large for workers with tertiary degrees. Panel C breaks down the sample by wage earnings levels measured as average total labor income in the 1994–1996 period. We consider two groups: high earners with over 100K CHF on average and low earners with less than 100K CHF. The effect appears much larger for the high earners. For this group, estimates suggest that earnings are lower just after the tax holiday, consistent with retiming of income into the tax holiday with depressed earnings afterward although the estimates are fairly imprecise (and not significantly negative).

Table 3 presents the estimates and corresponding Frisch elasticities based on the IV regression (equation (1)). The table displays the effect of the tax holiday on wage employment and wage earnings for male and female separately in four

[35] Online Appendix Figure A16 shows that excluding controls generates similar but considerably noisier estimated event study series.

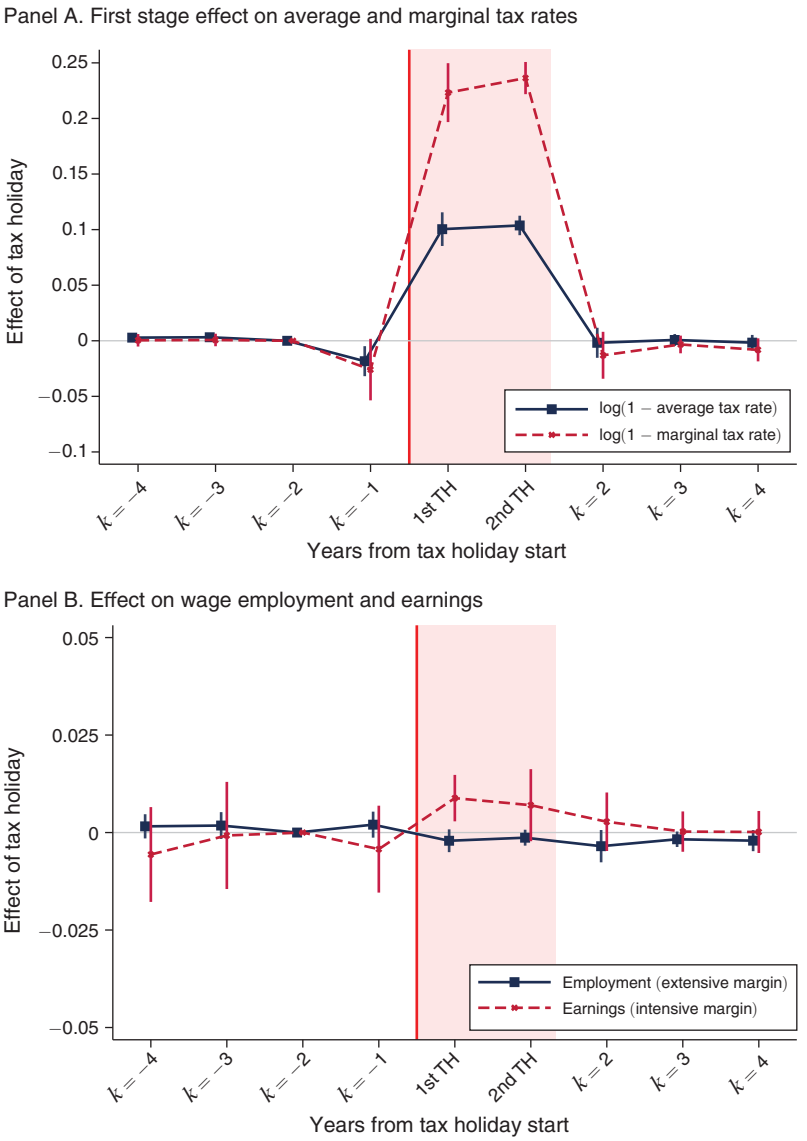

FIGURE 7. EVENT STUDY ESTIMATES OF THE EFFECT ON WAGE EARNERS

Notes: Panel A shows estimates of the effects of the tax holidays on the log net of tax rate (first stage). Panel B shows estimates of the effects on employment and wage earnings per employee (reduced form effect). The figure is based on the event study model (equation (2)). The estimation sample covers the years 1994–2006 (± 4 years around the tax holiday years), excludes 1998, and comprises 19 cantons which transitioned in 2001 and 3 cantons which transitioned in 2003. We focus on workers aged 22–55 in 1996 and drop workers older than 62 in later years. Tax holiday years are shaded and denoted by first TH and second TH on the x-axis. The dependent variables in panel A are $\log(1-\tau)$, where τ represents the average and the marginal tax rate, respectively. The latter estimation is restricted to individuals with positive wage earnings in a given year. In panel B, the dependent variable in the model *Extensive margin* is an indicator equal to 1 if a person has positive wage income in a given year. The dependent variable in the model *Intensive margin* is real wage earnings (excluding non-workers). The effect is scaled post-estimation by mean outcome in the estimation sample so that effects can be interpreted as percent change. Individuals are assigned to cantons based on where they lived in 1996. In panel B, we control for age and age squared by gender and for linear time trends by canton of residence in 1996 (the linear time trends omit the treatment years). The vertical bars represent cluster-robust 95 percent confidence intervals.

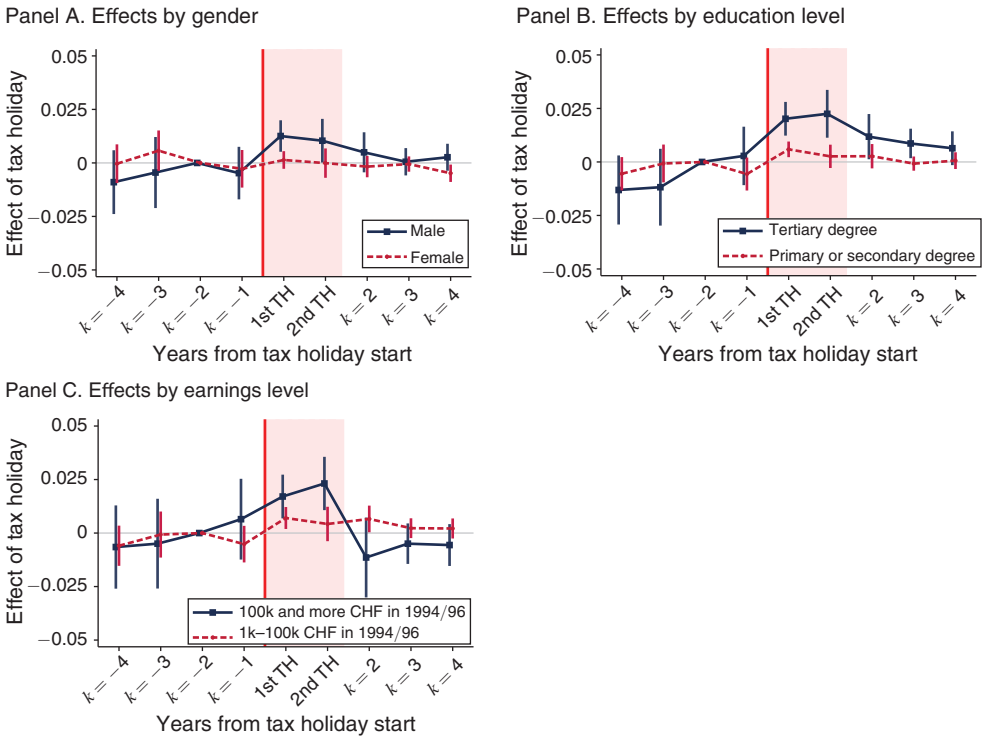

FIGURE 8. HETEROGENEITY OF WAGE EARNINGS RESPONSES

Notes: This figure shows estimates of the effects of the tax holidays on wage earnings per employee for different subpopulations following the same longitudinal event study regression strategy as in panel B of Figure 7. Effects are expressed as a fraction of mean wage earnings. Tax holiday years are shaded and denoted by first TH and second TH on the *x*-axis. Panel A compares males and females. Panel B compares workers depending on their highest educational attainment in 2000 (tertiary degree is higher education degree). Panel C compares individuals depending on their average annual labor earnings over the period 1994–1996. Individuals are assigned to cantons based on where they lived in 1996. In each case, we control for age and age squared by gender and for linear time trends by canton of residence in 1996 (the linear time trends omit the treatment years). The vertical bars represent cluster-robust 95 percent confidence intervals.

columns. Panel A displays detailed results for the full sample. The first row depicts the semi-elasticity of outcomes: the effect of the log-net of tax rate on the level of the outcome of interest. The second row depicts the first stage effect of the tax holiday dummy on the log net of tax rate. The third row reports the corresponding (frictional) Frisch elasticity estimates. The extensive elasticity is very close to zero (-0.01 for men and -0.02 for women) consistent with Figure 7. The intensive elasticity is positive and small. It is significant and larger for men (0.04) than for women (0.01) consistent with the event study in Figure 8.

Panels B and C consider the subgroups of married individuals with children and married individuals without children respectively. The extensive elasticities are always very close to zero (and never positive). Interestingly on the intensive margin, the elasticity for married women with children is higher (0.05) than without children (0.01) while the elasticities for married men are similar with and without children, and also similar to the overall sample of men in panel A. In all cases, the estimated intensive elasticities are quantitatively very small (never above 0.05). Panels D and E split the sample by education: those with a tertiary degree versus those without. Again, the

Table 3—Effects of Tax Holiday on Participation and Earnings of Employees

Variables:	Employee 0/1	Average wage earnings	Employee 0/1	Average wage earnings
Sample:	Men	Men	Women	Women
	(1)	(2)	(3)	(4)
Panel A. Entire sample				
$\log(1-\tau_{it})$	−0.008	3,792	−0.015	323
	(0.005)	(606)	(0.007)	(251)
Effect of TH on $\log(1-\tau_{it})$	0.115	0.248	0.106	0.238
	(0.002)	(0.004)	(0.002)	(0.004)
Frisch elasticity η^F	−0.01 (0.005)	0.04 (0.006)	−0.02 (0.009)	0.01 (0.005)
Observations	12,905,961	10,878,290	13,241,977	9,470,890
Panel B. Married with children				
$\log(1-\tau_{it})$	−0.000	4,275	0.000	1,824
	(0.005)	(743)	(0.011)	(275)
Frisch elasticity η^F	0.00 (0.005)	0.04 (0.007)	0.00 (0.015)	0.05 (0.008)
Panel C. Married no children				
$\log(1-\tau_{it})$	−0.028	3,603	−0.006	301
	(0.005)	(554)	(0.004)	(160)
Frisch elasticity η^F	−0.03 (0.006)	0.03 (0.005)	-0.01 (0.006)	0.01 (0.003)
Panel D. Tertiary education				
$\log(1-\tau_{it})$	−0.004	6,295	−0.016	809
	(0.007)	(808)	(0.007)	(387)
Frisch elasticity η^F	0.00 (0.007)	0.05 (0.006)	−0.02 (0.008)	0.01 (0.005)
Panel E. Non-tertiary education				
$\log(1-\tau_{it})$	−0.017	2,681	−0.015	264
	(0.005)	(376)	(0.008)	(191)
Frisch elasticity η^F	−0.02 (0.006)	0.04 (0.004)	−0.02 (0.010)	0.01 (0.004)

Notes: The table presents the effect of the tax holiday on the labor supply of employees. It shows estimated semi-elasticities and corresponding Frisch elasticities derived from individual-level IV regressions of labor supply outcomes on person and year fixed effects and $\log(1-\tau_{it})$, where τ is the average tax rate in column 1 and the marginal tax rate in the other columns (equation (1)). $\log(1-\tau_{it})$ is instrumented with an indicator variable which is 1 in the year in which municipal and cantonal taxes are zero due to the tax holiday. Additional controls include age and age squared by gender and canton-specific linear time trends (the linear time trends omit the treatment years). The effect of the tax holidays (TH) on $\log(1-\tau_{it})$ (the first stage) is reported for the full sample in panel A. The estimation sample covers the years 1994–2006 (excluding 1998) and comprises all cantons which transitioned in 2001 or 2003. We focus on workers aged 20–55 in 1996 and drop workers older than 62 in later years. The dependent variable in columns 1 and 3 is an indicator whether a person has positive wage earnings in a given year. The dependent variable in columns 2 and 4 is average wage earnings of persons with positive wage earnings in a given year. Columns 1 and 2 focus on men, columns 3 and 4 on women. Panel A reports effects for all men and women. Panels B and C report effects for married individuals with or without at least one child aged 15 or less. Panels C and D report effects depending on individuals highest educational attainment in 2000 (as reported in the census 2000). Individuals are assigned to cantons based on where they lived in 1996. Standard errors are clustered on the level of commuting zones.

extensive elasticities are always very close to zero. On the intensive margin, the elasticities are actually the same for those with tertiary degree both for men and women but still always quite small (0.04 for men and 0.01 for women). The larger effect for the highly educated found in panel C of Figure 8 can be explained by a first stage that is twice as large for the highly educated due to the progressivity of the tax system.

Table 4 uses the IV model to present the estimates and corresponding elasticities dividing the sample by five labor income groups (by panel) based on average income in 1994–1996. As in Table 3, it presents the estimates of the tax holiday effect and

corresponding elasticities on wage employment and wage earnings for male and female separately in four columns. None of the elasticities along the extensive margin are significantly positive. Estimates are very close to zero and generally with a negative sign. This implies that there is no evidence of a positive extensive margin response for any income group. For the intensive margin, the table shows that elasticities are growing with earnings. They are zero at the bottom for the group with annual earnings in the 1–25K CHF range. For males, they grow to 0.03 and significant in the next two groups (25–50K and 50–100K), 0.04 for the group 100–200K, and 0.08 (0.015) for the top group with earnings above 200K. For females, the elasticity estimates are very small (0.02 or less) for all groups except the top group that has an elasticity of 0.09 (0.046). Therefore, the table confirms our previous findings that responses are larger at the top of the wage earnings distribution. Conceivably, higher earners have more flexibility to retime their compensation perhaps through bonuses as we show below. Even at the top though, the elasticities remain quantitatively small at or slightly below 0.1.

Figure 9 explores the heterogeneity in the size of the Frisch elasticity estimates by occupation, and how the elasticity is related to average earnings in the occupation (panel A) and share of workers with overtime in the occupation (panel B). We divide individuals using a two-digit classification of occupations used by the Swiss administration. Within each occupation, we estimate the Frisch elasticity using equation (1). We focus on the overall (extensive plus intensive margin) Frisch elasticity by including non-workers with labor earnings of zero. The occupation for each person is defined as of 2000 when the social security data are matched to the census in 2000. Non-employed individuals are assigned to occupations based on the reported learned occupation. Each dot on the panels represents an occupation. The size of the dot is scaled to the number of workers in the corresponding occupation. Three results are worth noting.

First, we find that Frisch elasticities differ significantly across industries from slightly negative values (around −0.03) to small positive values (around 0.07). Most occupations have small and positive elasticities (in the range 0–0.02). Some high skill occupations such as engineers, entrepreneurs, legal professions, or professors have among the highest elasticities (around 0.06–0.07). In all cases though, elasticities are modest in size and always below 0.1. Second and consistent with our previous results in Table 4, panel A of Figure 9 shows that there is a clear positive relationship between average earnings in the occupation and the size of the estimated Frisch elasticity. Quantitatively, the plotted regression line shows that each extra 1,000 CHF is associated with an increase of the Frisch elasticity by 0.001. Third, panel B shows that occupations where a larger share of workers do overtime also have higher estimated Frisch elasticities. Quantitatively, a 10 percentage point increase in the share of workers with overtime is associated with a 0.013 increase in the Frisch elasticity. This suggests that workers in occupations where overtime work is more common have more flexibility to adjust upward their labor supply during the tax holiday. This also suggests that part of the response we obtain may reflect real labor supply responses.[36]

[36] Following Sigurdsson (2018), we have also explored whether responses are larger in industries with a higher variation in effective weekly working times perhaps because workers have more flexibility of adjust their hours of work in such industries. However, we did not find any significant relationship.

Table 4—Labor Supply Effects by Pre-Holiday Labor Income Groups

Variables:	Employee 0/1	Average wage earnings	Employee 0/1	Average wage earnings
Sample:	Men	Men	Women	Women
	(1)	(2)	(3)	(4)
Panel A. 1–25k CHF				
$\log(1-\tau_{it})$	−0.005	−444	−0.031	−835
	(0.018)	(1,239)	(0.010)	(490)
Frisch elasticity η^F	−0.01 (0.025)	−0.01 (0.025)	−0.04 (0.012)	−0.03 (0.018)
Panel B. 25–50k CHF				
$\log(1-\tau_{it})$	−0.006	1,670	−0.006	867
	(0.008)	(481)	(0.005)	(207)
Frisch elasticity η^F	−0.01 (0.010)	0.03 (0.008)	−0.01 (0.006)	0.02 (0.004)
Panel C. 50–100k CHF				
$\log(1-\tau_{it})$	−0.015	2,243	−0.009	495
	(0.004)	(408)	(0.006)	(323)
Frisch elasticity η^F	−0.02 (0.004)	0.03 (0.004)	−0.01 (0.006)	0.01 (0.003)
Panel D. 100–200k CHF				
$\log(1-\tau_{it})$	−0.015	7,159	−0.011	2,522
	(0.007)	(994)	(0.015)	(1,576)
Frisch elasticity η^F	−0.02 (0.007)	0.04 (0.006)	−0.01 (0.015)	0.02 (0.010)
Panel E. More than 200k CHF				
$\log(1-\tau_{it})$	−0.003	31,469	−0.061	30,519
	(0.008)	(5,814)	(0.044)	(15,173)
Frisch elasticity η^F	0.00 (0.010)	0.08 (0.015)	−0.09 (0.062)	0.09 (0.046)

Notes: The table presents the effect of the tax holiday on the labor supply of employees. It shows estimated semi-elasticities and corresponding Frisch elasticities derived from individual-level IV regressions of labor supply outcomes on person and year fixed effects and $\log(1-\tau_{it})$, where τ is the average tax rate in column 1 and the marginal tax rate in the other columns (equation (1)). $\log(1-\tau_{it})$ is instrumented with an indicator variable which is 1 in the year in which municipal and cantonal taxes are zero due to the tax holiday. Additional controls include age and age squared by gender and linear time trends by canton (the linear time trends omit the treatment years). The estimation sample covers the years 1994–2006 (excluding 1998) and comprises all cantons which transitioned in 2001 or 2003. We focus on workers aged 22–55 in 1996 and drop workers older than 62 in later years. The dependent variable in columns 1 and 3 is an indicator whether a person has positive wage earnings in a given year. The dependent variable in columns 2 and 4 is average wage earnings of persons with positive wage earnings in a given year. Columns 1 and 2 focus on men, columns 3 and 4 on women. Individuals are assigned to panels A–E based on their average annual labor income in the 1994–1996 period. Individuals are assigned to cantons based on where they lived in 1996. Standard errors are clustered on the level of commuting zones.

Effects on Self-Employment Earnings: Figure 10 depicts the reduced-form effects on self-employment earnings using the event study model (equation (2)). We focus on workers aged 20–55 in 1996 who are self-employed at least once during the estimation period. The dependent variable is annual self-employment income per person (including 0 if there is no self-employment earnings in a given year). The effect is scaled post-estimation by mean self-employment earnings in the estimation sample.[37]

Panel A depicts two series: the full sample of self-employed and self-employed with average labor income over 100K CHF in the 1994–1996 period. The effects on

[37] Because self-employment earnings are observed an a biannual basis before the transition, each pre-event period represents two years (instead of one). Furthermore, because self-employment is not observed in 1999 and 2000, we skip these years in the event study. Cantons with tax holidays in 1999/2000 do not have a tax holiday and hence are always pure controls in the event study. For cantons with tax holidays in 2001/2002, the event period just

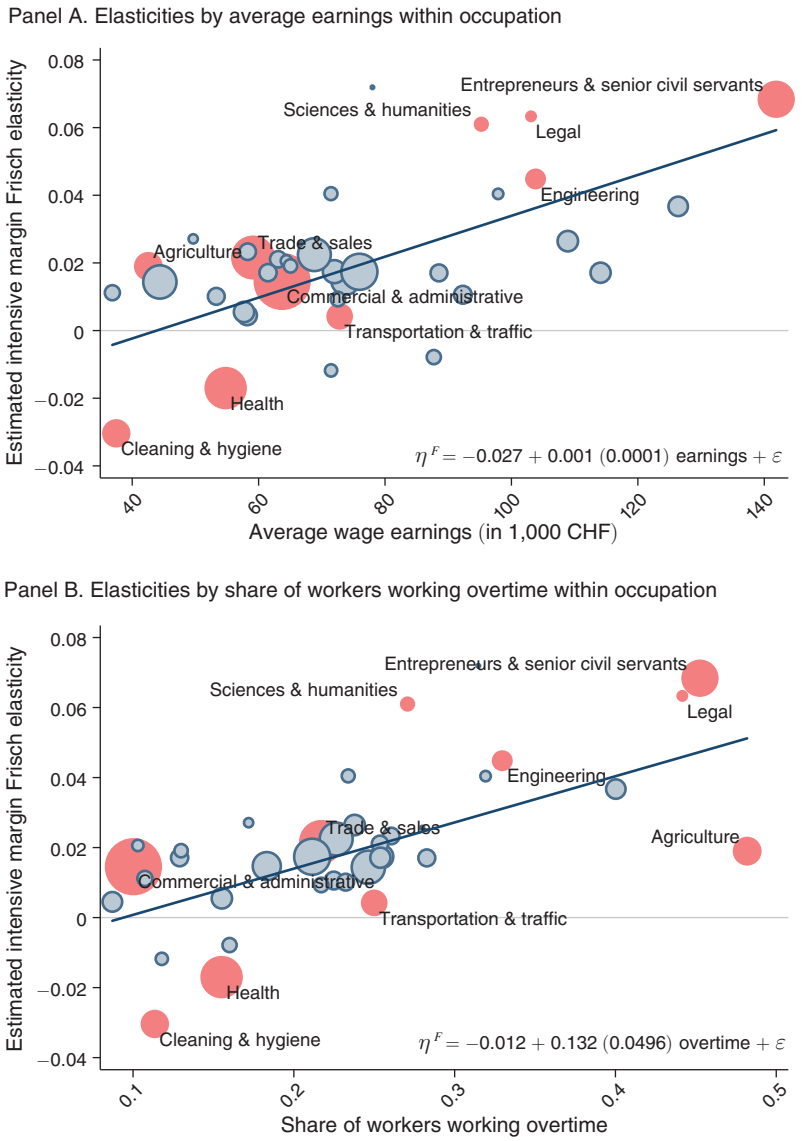

FIGURE 9. FRISCH ELASTICITIES FOR WAGE EARNERS BY OCCUPATION CHARACTERISTICS

Notes: This figure shows estimates of the Frisch elasticity for wage earners by occupation. Individuals are assigned to two-digit occupations using the Swiss classification of occupations. Occupation labels refer to the circles highlighted in red. In panel A, elasticities are plotted against the average annual wage earnings in the specific occupation in 2000. In panel B, elasticities are plotted against the share of workers working overtime in the specific occupation (defined as the share of workers usually working at least 45 weekly hours in the census 2000). Occupation is defined as of 2000 when the social security data are matched to the census in 2000. Non-employed individuals are assigned to occupations based on learned occupation. The Frisch elasticities are derived from occupation-specific individual-level IV regressions of annual wage earnings per person (including non-workers) on person and year fixed effects and $\log(1-\tau_{it})$, where τ is the marginal tax rate (equation (1)). $\log(1-\tau_{it})$ is instrumented with an indicator variable which is 1 in the year in which municipal and cantonal taxes are zero due to the tax holiday. We control for age and age squared by gender and canton-specific linear time trends. The size of the dot reflects the sample size of each estimation. In both panels the regression line of the elasticity estimates on the x-axis variable is depicted and the coefficient is reported.

before the tax holiday ($k = -1$) is 1997/1998. For cantons with tax holidays in 1997/1998, the first event period after the tax holiday ($k = 2$) is 2001 (panel B of Figure 6 depicts the data availability situation).

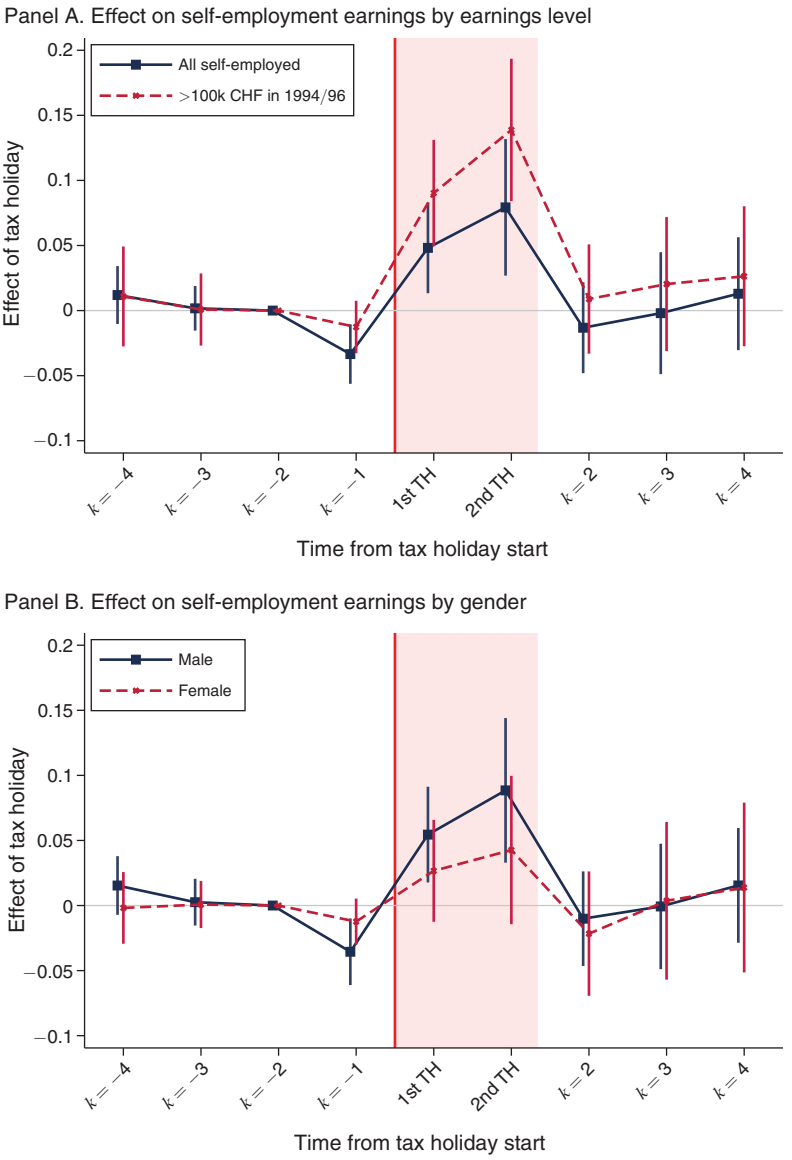

FIGURE 10. EVENT STUDY ESTIMATES OF THE EFFECT ON SELF-EMPLOYMENT EARNINGS

Notes: This figure shows estimates of the effects of the tax holidays on self-employment earnings per person for different subpopulations following the same longitudinal event study regression strategy as in panel B of Figure 7. The estimation sample covers the years 1990–2010 in the data (including 1998 but excluding 1999–2000 when self-employment is not observed) and comprises one canton that transitioned in 1999, two groups of cantons which transitioned in 2001, and three cantons which transitioned in 2003. We focus on workers aged 20–55 in 1996 that are self-employed at least once in the estimation period. We exclude workers older than 62 in later years. Tax holiday years are shaded and denoted by first TH and second TH on the x-axis. On the x-axis, k represents tax periods. The periods were biannual before the tax holiday (when self-employment was reported and taxed in two year periods) and are annual after the tax holiday. The dependent variable is annual self-employment income per person (including zeros if there is no self-employment earnings in a given year). The effect is scaled post-estimation by mean self-employment earnings in the estimation sample. Panel A compares the effect for the full sample versus individuals with an average annual labor income that exceeds 100K in the 1994–1996 period. Panel B compares men and women. The vertical bars represent cluster-robust 95 percent confidence intervals.

self-employment earnings are much larger than for wage earnings: there is excess self-employment of about 7 percent during the tax holiday years, and larger in the second year of the tax holiday. For high self-employment earners, the effects are even larger about 10 percent. Panel B compares men and women. It shows striking heterogeneity by gender: effects for men are more than twice as high as for women (around 10 percent for males versus about 5 percent for females). The conventional wisdom is that female labor supply is more elastic than male labor supply. Therefore, a possible explanation for our findings is that they reflect tax avoidance rather than genuine labor supply responses. Consistent with this tax avoidance scenario, we also observe a slight dip after and especially before the tax holiday that could be explained by retiming of income. Note however that the dips are small relative to the overall size of the response during the tax holiday.

Table 5 summarizes the effect of the tax holiday on self-employment earnings. It shows estimated semi-elasticities and corresponding Frisch elasticities derived from IV regressions. For the main sample of self-employed in panel A, the estimated elasticity is 0.21 and very significant. The elasticity is much larger for men (0.24) than for women (0.07). The elasticity for high earners is almost the same (0.23) as in the full sample (0.21). Therefore, the larger response for high earners from Figure 10 corresponds primarily to a larger first stage for high earners: high earners get a bigger marginal tax rate break due to the progressivity of the income tax schedule. Panel B of Figure 5 shows that married self-employed have slightly higher elasticities than overall but married women do not display however larger elasticities than women in general, consistent again with a tax avoidance scenario. Panel C and D show that elasticities are larger for the self-employed with tertiary education than for those with no tertiary education. Strikingly, women with no tertiary education display a zero elasticity (the point estimate is -0.05 but insignificant) while tertiary educated women have an elasticity of 0.17.

Overall, the elasticity for the self-employed (0.21) is much larger than for wage earnings (less than 0.05). The elasticities for the self-employed are also spread throughout income groups (while elasticities for wage earners increase sharply with earnings). Consistent with wage earners, we also find higher elasticities for men than women for self-employment earnings.

Robustness: Online Appendix Table A5 shows that the baseline elasticity estimates for wage earnings (along the extensive and intensive margin) and for self-employment earnings based on the IV estimation are robust along a number of dimensions: (i) excluding the control variables included in the baseline, (ii) adding control variables absorbing effects of the tax holiday in the year before and after the tax holiday, thus accounting for possible effects of the tax holidays on income shifting, (iii) controlling further for the cantonal unemployment rate, (iv) discarding observations with imputed place of residence, (v) identifying the effect only from the response in the second cantonal blank year (controlling for the effect in the first), (vi) identifying the effect only from the response in late-coming cantons with tax holidays in 2001 and 2002, and (vii) using fully uncapped earnings (instead of capping annual earnings at 2.5 million CHF). In all cases, the estimates are similar to the baseline estimates discussed above. A noteworthy exception is that the Frisch elasticity for the self-employed becomes somewhat larger (0.36) if

Table 5—Effects of Tax Holiday on Self-Employment Earnings

Variables:	Earnings per self-employed	Earnings per self-employed	Earnings per self-employed	Earnings per self-employed
Sample:	All	Men	Women	High earners
	(1)	(2)	(3)	(4)
Panel A. Entire sample				
$\log(1-\tau_{it})$	7,452	10,804	1,096	30,322
	(1,784)	(2,421)	(870)	(4,709)
Effect of TH on $\log(1-\tau_{it})$	0.222	0.225	0.217	0.352
	(0.004)	(0.003)	(0.004)	(0.003)
Frisch elasticity η^F	0.21 (0.052)	0.24 (0.054)	0.07 (0.054)	0.23 (0.035)
Observations	8,805,304	5,794,110	3,011,194	953,023
Panel B. Married				
$\log(1-\tau_{it})$	9,948	14,690	767	31,079
	(2,048)	(2,895)	(781)	(5,334)
Frisch elasticity η^F	0.25 (0.051)	0.28 (0.056)	0.05 (0.051)	0.23 (0.038)
Panel C. Tertiary education				
$\log(1-\tau_{it})$	15,491	19,371	5,335	30,772
	(2,387)	(3,356)	(1,230)	(5,529)
Frisch elasticity η^F	0.25 (0.039)	0.26 (0.045)	0.17 (0.039)	0.20 (0.035)
Panel D. Non-tertiary education				
$\log(1-\tau_{it})$	3,978	6,833	−625	29,880
	(1,712)	(2,372)	(995)	(6,983)
Frisch elasticity η^F	0.17 (0.073)	0.22 (0.076)	−0.05 (0.088)	0.34 (0.079)

Notes: The table presents the effect of the tax holiday on earnings of self-employed. It shows estimated semi-elasticities and corresponding Frisch elasticities derived from individual-level IV regressions of labor supply outcomes on person and year fixed effects and $\log(1-\tau_{it})$, where τ is the marginal tax rate. $\log(1-\tau_{it})$ is instrumented with an indicator variable which is 1 in the year in which municipal and cantonal taxes are zero due to the tax holiday (equation (1)). Additional controls include age and age squared by gender and linear time trends by canton (the linear time trends omit the treatment years). The effect of the tax holidays (TH) on $\log(1-\tau_{it})$ (the first stage) is reported for the full sample in panel A. The estimation sample covers the years 1990–2010 (excluding 2001 and 2002 when self-employment earnings is not measured). We focus on workers aged 22–55 in 1996 that are self-employed at least once in the estimation period. We exclude workers older than 62 in later years. The dependent variable is annual self-employment income per person with positive self-employment income in a given year. Column 1 uses the full sample, 2 focuses on men, 3 on women, and 4 on high-income self-employed, defined as individuals with an average total labor income of at least 100,000 in the 1994–1996 period. Panel A reports effects for all men, women, and high-income individuals, respectively. Panel B reports effects for individuals married in 1996. Panels C and D report effects depending on individuals highest educational attainment in 2000 (as reported in the census 2000). Individuals are assigned to cantons based on where they lived in 1996. Standard errors are clustered on the level of commuting zones.

we identify the effect only from the second tax holiday year. In general, however, the table shows that the IV estimates for the main outcomes are robust to various alternative specifications.

D. *Additional Results*

Decomposing Earnings: Hours of Work and Wage Rates: In the standard model of labor supply and demand, the tax holiday creates a positive labor supply response in the form of increased hours of work. This positive labor supply effect might in turn reduce the wage rate if labor demand is not perfectly elastic. This will dampen the effect on total earnings. Therefore, it is important to examine separately the

effects on hours of work and wage rates. Hours of work and wage rates are not measured in the social security data but are measured in the labor force survey and the wage structure survey. Here, we present evidence from the wage structure surveys.[38] Because the wage structure surveys are repeated cross sections with no panel dimension, we cannot replicate the longitudinal analyses used in the last section. Instead, we present simple times series patterns following the strategy of Section IIIB.

Figure 11 depicts hours of work (panel A) and hourly wage rates (panel B) by year and group of cantons using the wage structure surveys 1994–2010 carried out biannually.[39] Hours of work and hourly wages are based on the month of October in each year. Hours worked refer to contractual (i.e., normal) hours worked for workers with monthly salaries and to actual hours worked (and hence including overtime) for workers paid by the hour. Wage rates incorporate regular pay but exclude overtime and variable pay components (e.g., bonuses). In both panels, the sample in each year is limited to workers aged 20–60, excluding public sector employees (not systematically covered in the survey) and foreign workers that do not pay regular taxes in Switzerland. We group cantons into three groups depending on the tax holiday timing (with no distinction between one-year versus two-year long tax holidays as the wage survey is biannual). Geographical information in the wage structure survey is based on place of work while tax treatment is based on residence. To reduce the number of cases where a person works in one group of cantons but resides in another one, we exclude zip codes in which more than 25 percent of workers live and work in different groups of cantons according to the census in 2000 (see Section II).

Both panels display fairly stable parallel trends before and after the reform. Panel A does not show any visible response of hours of work to the tax holiday. Hours of work do not seem to spike at all during the tax holidays in treated cantons relative to other groups of cantons. Panel B shows some evidence of an impact of the tax holiday on wage rates. There is no visible bump in wage rates for the two groups of cantons transitioning early (series in blue circles and green triangles) but there is a bump in hourly wage rates at the time of the tax holiday for the cantons transitioning late in 2001–2002 (series in brown squares). This positive effect is the reverse of a labor demand effect driving wages down during the tax holiday. It suggests instead that workers might be able to manipulate their wage rate to drive up their earnings and take advantage of the tax holiday.[40] Quantitatively, regression analysis presented in online Appendix Table A6 based on the depicted series shows that the tax holiday increases hours of work by 0.1 percent (not significant) and hourly wage rates by 0.5 percent (not significant either).[41]

[38] The labor force survey is much smaller and hence produces noisier series. These series are presented in online Appendix Figure A15 and show results that are consistent with the larger wage structure survey, in particular no detectable effect on hours of work.

[39] We show in online Appendix Figure A17 that total monthly earnings in the wage structure survey display some evidence of response to the tax holiday consistent with our findings from the social security data.

[40] To test this hypothesis, we show in online Appendix Figure A18 that the hourly wage response is stronger and clearer in all three groups of cantons when the sample is restricted to workers more likely to be well informed about the tax holiday (workers in occupations "examining, advising, attesting").

[41] Quantitative effects on hours of work are marginally significant for workers in occupations "examining, advising, attesting" although modest in size (0.7 percent). Effects on wage rates are larger and very significant for this group (4.3 percent) (online Appendix Table A6).

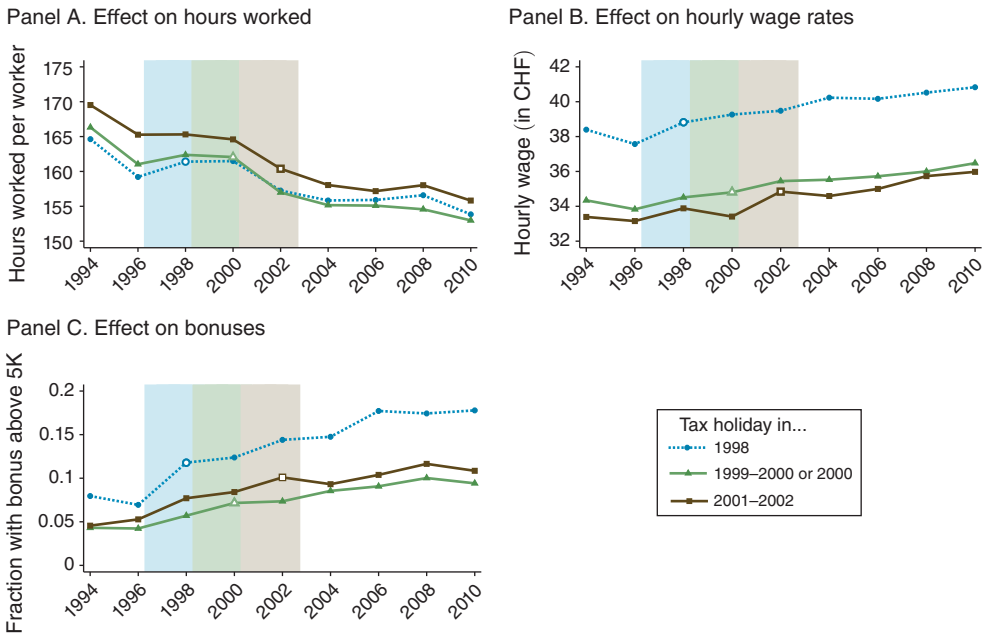

FIGURE 11. EFFECTS ON HOURS, WAGE RATES, AND BONUSES FROM THE EMPLOYER SURVEY

Notes: This figure uses the wage structure surveys (LSE) carried out biannually to depict hours of work (panel A), hourly wage rates (panel B), and likelihood of having a bonus above 5,000 in 2010 CHF (panel C) by year and group of cantons. Hours of work and hourly wages are based on the month of October in each year. Hours worked refer to contractual (i.e., normal) hours worked for workers with monthly salaries and to actual hours worked for workers paid by the hour. Wage rates incorporate regular pay but exclude overtime and variable pay components (e.g., bonuses). In both panels, the sample in each year is limited to workers aged 20–60 excluding public sector employees and foreign workers who do not pay regular taxes in Switzerland. We consider 3 groups of cantons: (i) 2 cantons which transitioned in 1999 with a tax holiday for 1998 or 1997–1998 (in blue circles). (ii) 19 cantons which transitioned in 2001 with a tax holiday for 2000 or 1999–2000 (in green triangles). (iii) 3 cantons which transitioned in 2003 with tax holiday in 2001–2002 (in brown squares). (Former groups (1a) and (1b) and groups (2a) and (2b) have been pooled together given sample size in the survey data.) The dots corresponding to tax holidays are blanked out (as tax holidays are called blank years in French and German).

Overall, the decomposition of earnings into wages and hours of work shows that labor demand cannot explain the small earnings effects. In contrast to the labor demand channel story, we have found that wage rates respond if anything positively to the tax holiday. Therefore, the change in net of tax wage rates due to the tax holiday is not dampened through a labor demand reduction in wage rates. The lack of effects on hours of work we have found confirms that the Frisch labor supply elasticity is very small.

Effects on Bonuses: Finally, we look at bonuses, which is an earnings component that is more flexible than regular wages and salaries and hence might be used to shift earnings toward the tax holiday years. Bonus data are available in the wage structure survey. Panel C of Figure 11 displays the fraction of employees with bonuses above 5,000 CHF (among all employees including those with no bonus) by year and groups of cantons from 1996 to 2010 using the same sample as in panels A and B. It shows mild evidence of a bonus bump during the tax holidays in each of the three groups, most visible in the cantons that transitioned late in 2001–2002.

Quantitatively, regression analysis based on the depicted series shows that the likelihood of receiving a bonus increases by almost 10 percent during the tax holiday and this effect is marginally significant (see column 4 in panel A of online Appendix Figure A6).

Therefore, this evidence suggests that workers are able to shift bonuses to take advantage of the tax holiday. The absence of hours of work effects along with some positive effects on wage rates and bonuses suggests that the response might be from tax avoidance rather than actual labor supply behavior.

IV. Conclusion

Our paper has estimated the intertemporal labor supply (Frisch) elasticity of substitution exploiting temporary income tax holidays in Switzerland. Importantly, our estimate captures the macro-level Frisch elasticity taking as given all existing frictions on labor supply adjustments. This is the relevant parameter to assess the employment effects of real business cycles but it could differ from a micro-level and frictionless Frisch elasticity.

Overall, we can draw the following conclusions. First, there is no evidence at all of responses along the extensive margin, even for subgroups likely to be more elastic such as women. Second, there is a small aggregate response of wage earnings which is largest at the top of the wage earnings distribution. The overall Frisch elasticity for wage earners is 0.025 overall and comes close to 0.1 for high wage earners. Third, there is a larger response of self-employment earnings that is present at all earnings levels (and not just the top) with a Frisch elasticity around 0.25. Fourth, effects are concentrated among men with smaller effects for women in contrast to the standard findings in the labor supply literature. Fifth, most of these responses are visible for the last wave of transitioning cantons with tax holidays in 2001–2002. Responses for earlier transitions such as 1997–1998 or 1999–2000 appear to be more muted. This latter effect might be due to learning as it might take time for the public to understand tax holidays and how to respond to them.

Our results are consistent with a large body of work in public economics showing that real labor supply responses to taxation are generally modest but that whenever taxpayers have easily accessible tax avoidance opportunities, they tend to exploit them (see e.g., Saez, Slemrod, and Giertz 2012 for a survey of this literature). In the specific case of tax avoidance through intertemporal substitution, the literature has uncovered a number of cases of strong timing responses before anticipated increases in tax rates, such as the realization of capital gains (Auerbach 1988, Saez 2017) or stock-option exercises (Goolsbee 2000). Closest to our application, Best and Kleven (2018) study a tax holiday for a 1 percent tax on real estate transaction in Britain and find a very large 20 percent increase in transactions in part due to retiming. Importantly, large responses happen when frictions are very small, i.e., taxpayers can freely decide to time the transaction. For wage earners in Switzerland, frictions in labor supply adjustments are likely large enough to prevent any sizable response, except perhaps among high wage earners who may have more ability to retime their earnings (through bonuses for example). The self-employed can more easily retime their earnings through the tax avoidance channel. It is also possible that a response to a tax *increase* (instead of decrease) would have generated larger

elasticities: labor supply might be easier to adjust downward than upward (employees can always decide to quit unilaterally for example). Perhaps the loss resulting from a tax increase looms larger than the gains from a tax decrease through behavioral loss aversion effects.

Intriguingly, some studies have found larger real labor supply responses to tax cuts in specific related contexts. The Iceland tax holiday generated larger effects than the Swiss tax holiday (Bianchi, Gudmundsson, and Zoega 2001, Sigurdsson 2018, and Stefansson 2019). Tazhitdinova (2020) finds a large response to taking small second jobs after they became tax-free in Germany in 2003. The Swiss labor market is very flexible according the *Global Competitive Index* created by the World Economic Forum. Therefore, an intriguing possible explanation is that both the Iceland and Germany tax breaks were presented by the government and hence perceived by the public as an encouragement and opportunity to work more, hereby reducing the informational and social frictions to labor supply adjustment.[42] In contrast, the Swiss tax holiday was presented as a modernization of the tax system and gaming the reform was discouraged (with taxation of extraordinary incomes, for example).

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[42] In the US context, Kleven (2019) shows that the very salient welfare reform of the 1990s had a very large impact on labor supply of single mothers while the less salient but economically large Earned Income Tax Credit expansions did not.

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