

# Intertemporal Labor Supply Substitution?

## Evidence from the Swiss Income Tax Holidays\*

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### Abstract

This paper estimates the intertemporal labor supply (Frisch) elasticity of substitution exploiting an unusual tax policy change in Switzerland. In the late 1990s, 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 go system. This transition created a two-year long, salient, and well advertised tax holiday. This change occurred both for the Federal and local income taxes. Swiss cantons switched to the new regime at different points in time during the 1995–2003 period. Exploiting this variation in timing as well as heterogeneity in tax burdens across areas, and using population wide administrative social security earnings data matched with census data, we identify the Frisch elasticity. We find significant but quantitatively small responses of earnings consistent with a Frisch elasticity around .2. We find no responses along the extensive margin, even for groups less attached to the labor force such as the young, married women, or the elderly. Some groups, such as the self-employed and high income earners display larger responses. Part of the response is likely due to income shifting for tax avoidance purposes rather than actual labor supply change. Hence, our findings rule out large Frisch elasticities that are conventionally used to calibrate business cycle macro models.

**Keywords:** Tax holidays, Labor supply, Frisch elasticity, Intertemporal labor supply elasticity, Income shifting, Income taxes, Tax avoidance

**JEL:** E65, H24, H26, J22

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# 1 Introduction

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. Indeed, calibrated macro real business cycle models require a very large Frisch elasticity in excess of one to generate realistic quantitative predictions (see e.g., King and Rebelo, 1999). The intuition is the following: Suppose there is temporary negative technological shock which reduces productivity (relative to trend). This shock reduces wages temporarily creating an intertemporal substitution in labor supply. If the Frisch elasticity is large, relatively modest technological shocks can translate into large labor supply responses and hence can account for significant fluctuations in output over the business cycle and why downturns are accompanied by large falls in employment. 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 accumulation decisions (see Reichling and Whalen, 2012, for a survey and discussion). 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 recent survey). However, tax variation typically does not provide temporary time variation needed to estimate the Frisch elasticity.<sup>1</sup> 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 2-year long income tax holidays. The tax holiday, defined as exempting earnings from income taxation temporarily in the local economy (the cantonal level), is close to being the ideal experiment to estimate the Frisch elasticity.

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 go system. For example, in the old system, income taxes due in years 1997 and 1998 were 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 withholding systems were put in place.<sup>2</sup> In the new system, taxes on income earned in year  $t$  are collected during year  $t$  with a tax return filed in year

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<sup>1</sup>An important exception is Bianchi et al. (2001) who use a 1-year income tax holiday in Iceland. We discuss the link between this study and our paper in detail below.

<sup>2</sup>The US transitioned in 1943, the UK transitioned in 1944. France is the last hold-out among advanced economies and is transitioning in 2018. 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). 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).

$t + 1$  and an adjustment made through a tax refund or an extra tax payment if taxes already collected are not exactly equal to taxes owed. This is the system now used in most countries.

However, the transition did not take place at the same time in all cantons, which are the 26 member states of the Swiss Confederation. Cantons transitioned in three waves in 1999, 2001, and 2003. Two cantons (including the economically large Zurich canton) transitioned early in 1999, most cantons transitioned in 2001, and three cantons transitioned late in 2003. The transition happened for federal, cantonal, and municipal income taxes. To illustrate the mechanism, take the example of the canton of Thurgau, 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 tax holiday for 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 years 2001-2002. An extra source of variation comes from the fact that some cantons, such as Zurich, used an annual system of assessment (instead of biennial) for the cantonal and municipal taxes. For these cantons, the transition generates only a 1-year long tax holiday for local taxes.<sup>3</sup>

Local income taxes (defined as cantonal plus municipal) are very large in Switzerland and account for about 5/6 of total income taxes (with the remaining 1/6 coming from the Federal income tax). There is significant variation in the level and progressivity of local income taxes both across cantons but also within cantons as each municipality sets its own tax level as a percent of the cantonal tax. Therefore, this rich variation in timing and intensity of the tax holiday across localities in Switzerland provides a unique opportunity to identify its effects on individual behavior and estimate the Frisch elasticity. Finally, 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 2 waves of transitioning cantons. Various press articles discussed how working and earning more during the tax holiday (relative to later years) was fiscally advantageous. Furthermore, some cantons such as Zurich, held a popular referendum on when the transition should take place.

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<sup>3</sup>Take the example of Zurich 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.

Individuals can respond to the tax holiday through real labor supply responses but also through tax avoidance responses (e.g., shifting realized compensation without shifting actual labor supply). In this study, we also try to distinguish between real vs. tax avoidance responses.

To carry out our study, we use population wide social security earnings records matched to 2010 Census data covering a long range of annual earnings from 1990 to 2010. 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 which transitioned at different times (or had different treatment intensity due to differences in local tax levels). 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 quantiles 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 spikes in earnings arise during the tax holidays in some cases, and can then be confidently interpreted as the causal effect of the tax holiday. 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).

We obtain four main results. First, we find significant but quantitatively small responses of earnings consistent with a Frisch elasticity around .2. Second, we find no responses along the extensive margin, even for groups less attached to the labor force such as the young, married women, or the old. This result strongly contradicts the common view in the macro-economic literature that the Frisch elasticities along the extensive margin are large. Third, some groups, such as the self-employed, high income earners, and older workers display larger responses. Fourth, part of the response is due to tax avoidance rather than actual labor supply change. Overall, our findings definitely rule out large Frisch elasticities that are conventionally used to calibrate business cycle macro models.

There is a large literature in both micro and macro-economics estimating the Frisch elasticity. Reichling and Whalen (2012) provide a recent survey. The labor economics strand of the literature adopts a micro-approach while the macro economics strand adopts a macro-approach. The vast majority of studies using the micro-approach exploit variation in wages (rather than taxes). They find a range of estimates going from 0 to around 1. However, this wage variation is rarely exogenous and is typically connected with human capital accumulation decisions. For example, a person might forego temporarily a higher

wage in order build up human capital possibly confounding intertemporal substitution effects. Some recent studies have used quasi-exogenous variation in wage rates for specific groups of workers and typically at a very high *daily* frequency and hence less relevant for business cycle analysis than our annual frequency analysis. In the case of taxi drivers, Camerer et al. (1997) find a negative Frisch elasticity which is not consistent with rational intertemporal behavior. This could be explained by income targeting on a daily basis. These findings, however, have been challenged by Farber (2005, 2015). Oettinger (1999) finds that stadium vendors labor supply is quite responsive to variations in demand. Fehr and Goette (2007) provide randomized variation to wages of cycling messengers and find a positive but fairly modest Frisch elasticity.

Closest to our study, Bianchi et al. (2001) 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. Bianchi et al. (2001) report large effects but it is difficult to disentangle the tax effects from the business cycle effect as the tax holiday corresponded to the peak year of the business cycle. Furthermore, in contrast to Switzerland, the tax holiday in Iceland applied uniformly with no geographical or time variation across the country. As tax holidays in Switzerland happen in cantons, which can be seen as local economies, our estimates at the cantonal level can recover a macro-level Frisch elasticity and hence are also relevant for the macro-literature on the Frisch elasticity.

Ziliak and Kniesner (1995); Saez (2003); Looney and Singhal (2006) use anticipated changes in tax rates associated with changes in tax bracket and family composition to estimate intertemporal labor supply elasticities and find fairly large responses. However, as Dokko et al. (2008) argues, this type of variation mixes up both substitution and income effects, particularly if tax filers face credit constraints or are partly myopic in their decision making. A key advantage of our setting is that the tax holiday is a large and salient change. Furthermore, it does not create an income effect for myopic individuals as income taxes are due every year. Hence, our set-up cleanly identifies substitution effects.

This paper is organized as follows. Section 2 describes the reform and the variation we exploit. Section 3 describes the data we use. Section 4 describes our empirical results. Section 5 concludes.

## 2 The Tax Holiday Reform

### 2.1 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% of the Swiss GDP. Income taxes in Switzerland are

levied at the federal, cantonal, and municipality level. Federal taxes are set by federal law and are uniform across cantons and represent about 1/6 of income tax revenue. Local taxes which include cantonal and municipal taxes are very large and represent about 5/6 of income tax revenue.<sup>4</sup> 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. This creates large geographical variation in tax burdens (conditional on income) both across and within cantons.<sup>5</sup> 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% range (although it can go as low as the low 20s and go as high as the mid-40s in some municipalities). To illustrate this variation, Figure 2 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 CHF (this about the 80th percentile of the labor earnings distribution among workers) as of 1999. The figure shows that the average tax rate varies between 10% in the lowest tax areas up to 25% in the highest tax areas.

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. The cantonal tax administrations are responsible for the collection of the taxes at all three levels, such that 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 so that taxpayers only had to file a tax return every second year. Tax payments were typically made in quarterly installments

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<sup>4</sup>These statistics are taken from OECD (2016) and refer to year 1996 which is the year just before the reforms we study take place. Statistics for 2015 (the latest year available) are fairly similar.

<sup>5</sup>Indeed, the Swiss federation comes perhaps closest to the Tiebout ideal model of local public finance with many studies analyzing tax competition and tax induced mobility across municipalities and cantons. Liebig et al. (2007); Schmidheiny (2006); Brülhart et al. (2016); Martinez (2016) study mobility across Swiss Cantons in response to local income or wealth taxes. Kirchgassner and Pommerehne (1996); Eugster and Parchet (2011); Parchet (2014); Brülhart and Parchet (2014) study tax competition in the setting of tax rates by localities.

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.<sup>6</sup>

**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 (with some variation across cantons). In contrast to other countries, Switzerland has not adopted tax withholding at source under the new system. 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. This pay-as-you-earn system is the standard system used for individual income taxation in virtually all advanced economies at the present time.

## 2.2 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 the Swiss government. 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.<sup>7</sup> However, the cantons were free to adopt the new system whenever they wanted. Two cantons, Zurich and Thurgau decided to switch early in 1999 while most cantons waited till 2001. Three cantons were not yet ready by 2001 and hence postponed the transition to 2003.<sup>8</sup> Importantly, when a canton decided to transition in a given year, the transition applied to all taxes at the federal, cantonal, and municipal levels.<sup>9</sup>

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<sup>6</sup>A few cantons were actually using an annual period of assessment (instead of biennial) for the cantonal and municipal 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. One canton, Basel, 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.

<sup>7</sup>The two laws were the cantonal tax harmonization law (StHG) which was scheduled to become effective on January 1st, 1993 and the new federal tax law (DBG) scheduled to become effective on January 1st, 1995.

<sup>8</sup>Due to the biennial structure of the old system, the change could only take place in an odd year such as 1999, 2001, 2003.

<sup>9</sup>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.

How does the transition generate tax holidays? Suppose a canton wants to transition in 1999. This specific example is illustrated on Figure 3. 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 for the two years before the transition. The initial transitional laws did not specify how the transition should be handled by cantons. A parliamentary initiative that was discussed and voted in 1998 and effective on January 1st, 1999 specified that the transition would indeed create tax holidays and that only extraordinary incomes earned during the holiday would be taxable.<sup>10</sup> 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.<sup>11</sup> In sum, any real labor supply response (and corresponding compensation) was not extraordinary income and hence was fully exempt. Some tax avoidance responses were still possible. For example, tax exempt contributions to pension plans could be postponed during the tax holiday and deferred to after the tax holiday or moved forward to before the tax holiday.

As mentioned above, a few cantons (including Zurich) 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 Zurich which transitioned in 1999. In 1997, local taxes in Zurich are based on 1996 incomes while federal taxes are due 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 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 Zurich 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 for only year 2000 (and 1999-2000 for federal taxes).

Figure 4 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 1997/98 (cantons in blue), 1999/00 (cantons in green), or 2001/02 (cantons in brown).

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<sup>10</sup>Symmetrically, extraordinary deductions made during the holiday period would be deductible against income made outside the tax holiday period, typically in the year just after the holiday.

<sup>11</sup>Bonuses and shared profits were not considered extraordinary profits if they were specified in the contract and had been paid in prior years.



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. One canton (Nidwalden in very dark green) had no local tax holiday at all due to a different form of transition. One canton (Basel in pink) had always had a pay-as-you-earn local tax system and transitioned to the annual pay-as-you-go system for the federal tax in 1995.<sup>12</sup> We will use this color coding in all our subsequent analysis.

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 ordinary income that was tax exempt). As a result, income tax data cannot be used to study the reform. That is why we rely on social security data that provide information on labor earnings (wages and self-employment) for all years and we do not study capital income.

## 2.3 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 very important to provide evidence on how salient the tax holiday was. 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 some cases, such as Zurich, the legislature put the decision to a popular referendum. Typically, the transition was in the public debate for many months before decision time was officially taken. In most cases, the official decision time came about 1.5 years before the beginning of the transition year. Hence, for 2 year long tax holidays, the public was always informed in advance for the *second* year of the tax holiday. The public was typically officially informed in the middle of the first tax holiday year although the public debate often started before the first tax holiday year. In summary, 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 on Figure 4.

**Early transitions.** Two cantons, Zurich and Thurgau transitioned early in 1999. Zurich held a popular referendum on transitioning in 1999 on June 8, 1997, i.e., in the

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<sup>12</sup>For this transition, the federal tax in 1995 was based on the maximum tax liability under the old and the new system so that 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.

middle of the first tax holiday year. As Zurich has a single 1998 tax holiday year for local 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 XX. This means that residents in these two cantons 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 in Thurgau.

**2001 transitions.** Most cantons were expected to transition in 2001. These decisions were typically made during calendar year 1999. This implies that the information was made official during the first tax holiday year of 1999 and before the start of 2000, the second tax holiday year. Hence, we should expect a larger response in the second tax holiday year. As Zurich 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 which transitioned late in 2003 decided to transition at this date typically in 2001. 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. Figure 5 shows the number of press articles mentioning the word “Bemessungslücke” (blank year) which is the expression most commonly used for tax holiday in German by year and most major newspapers. The figure displays four series: (1) the series in blue dashed is for the Zurich based main newspaper (NZZ, Tagesanzeiger), (2) the series in solid green for a Basel and Bern newspaper (BaZ, Der Bund), (3) the series in dotted purple aggregates 5 weekly major newspaper and business magazines, (4) the series in solid black takes the average across all these publications. The tax holiday for Zurich is depicted by the vertical blue shading and the tax holiday for Bern is depicted in the vertical green shading. The figure shows that press interest in the tax holiday peaked during the years when the actual tax holidays happened (i.e., in advance of the transition year which is the year immediately after the tax holidays). 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.

It is important to recognize that 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, recent empirical work has shown that taxpayers often have imperfect information about tax systems even when tax systems have been fairly stable (see e.g., ). However, the most elastic taxpayers are those who have the most to gain from learning about the tax system and hence should have the strongest incentives to get informed. Inelastic taxpayers do not respond to changes in tax rates and hence have no need to learn about the tax system.<sup>13</sup> Hence, if elastic taxpayers are well informed, our estimates still capture most of the “full information” elasticity that would prevail if everybody were perfectly informed. Furthermore, 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.

## 2.4 Expected Behavioral Responses

What behavioral responses should we expect from this tax holiday reform?

**Quasi-pure substitution effects.** The tax holiday generates substitution price effects as income earned during the tax holiday escapes the income tax. On the extensive margin, we have seen that the cut in the average tax rate is around 20 points for a worker earning 100,000 CHF. On the intensive margin, the cut in the marginal tax is even larger, around 30 points for a worker earnings 100,000 CHF. The cut in tax rates is lower for lower income individuals due to the progressivity of the tax system. From a lifetime perspective, this reform is formally a 2 year long income tax cut and hence also creates a wealth effect over the life-time. Under the old system, taxes were due 2 years after death while under the new system, taxation ends at death. In practice, however, the wealth effect is not salient as the savings in taxes after death likely do not loom large when making consumption decisions today. Indeed, the clearest proof of this point is precisely the fact that the government provided a tax holiday when the tax regime switched. Under a pure lifetime perspective, there would be no need to provide relief for taxation during the transition. The fact that it was necessary to provide relief from double taxation during the transition years implies that the annual perspective is much more relevant than the lifetime perspective for most individuals.<sup>14</sup> If individuals are really

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<sup>13</sup>The lack of good information on the tax system could be rationally explained if the earnings decisions of a large fraction of taxpayers are just not elastic with respect to tax rates.

<sup>14</sup>Indeed, in all the transitions from a old system of retrospective taxation to a new system of pay-as-you earn taxation, there are always provisions made for relieving individuals from paying a double tax during the transition.

myopic and make labor supply decisions on a purely annual way as in the standard static labor supply model, then the tax holiday creates a pure substitution effect and no income effect as the burden of taxation remains present in each year. In that case, the response to the tax holiday identifies the compensated labor supply elasticity of the conventional static labor supply model.

Therefore, for practical purposes, the tax holiday can be seen as an almost pure substitution effect with no wealth effect as individuals continue to pay income taxes each year with no interruption. Such a pure substitution effect should induce individuals to respond along both real labor supply and tax avoidance margins.

**Real labor supply responses.** The tax holidays should induce individuals to work more during the tax holiday both at the extensive and intensive margin.

On the extensive margin, individuals might decide to start working who would not have in the presence of taxation. This effect should be strongest for secondary earners as the average tax rate on secondary earners is significant due to joint taxation of married couples. Individuals might also defer retirement to take advantage of the tax holiday. In principle, young workers could decide to start working earlier to tax advantage of the tax holiday.<sup>15</sup>

On the intensive margin, individuals might decide to work more and earn more as the marginal tax rate on extra earnings is zero during the tax holiday. Individuals could work overtime, take an extra job or add work through self-employment, or cut down on unpaid vacation. Self-employed individuals are likely to have more flexibility in adjusting their labor supply and hence we should expect a larger response among the self-employed.

**Tax avoidance responses.** Individuals might also be able to shift income into the tax holiday years (at the expense of surrounding years) through tax avoidance. This could happen for example if workers have flexibility regarding the realization of their labor income. In principle, such shifting is easiest for the self-employed. Alternatively, workers might shift tax exempt contributions to pension plans away from the tax holiday year and into surrounding years. Individuals might also negotiate with their employer a higher pay during the tax holiday (and correspondingly lower pay). For examples bonuses might be retimed into the tax holiday year. Note that some of these tax avoidance strategies might trigger taxation as extraordinary income.

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<sup>15</sup>For young workers, the behavioral response might be smaller for 2 reasons. First, young workers have lower earnings and hence face lower tax rates. Second, under the old system, the first 2 years of work were not taxed until years 3 and 4. As a result, myopic individuals might not have felt the tax burden as much so that the tax relief due to the tax holiday is less salient for new workers.

## 3 Data

We are using several data sources for our empirical analysis.

### 3.1 Matched SSER-Census Data

The main data set used in the empirical analysis tracks the entire labor market history of the population of Switzerland in 2010. To this end, we merge the register-based population census of Switzerland as of December 2010 merged (via a social security number) to 100% of the social security earnings records (SSER) from the Old-Age and Survivors' Insurance (OASI, AHV in German), covering the period 1981–2012.<sup>16</sup> We need to match to census data because the social security data do not contain geographical and marital information which are critical for our empirical design.

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. For example, a person with two different employers and also some self-employment income would generate three records.<sup>17</sup> Finally, the register also contains contributions of non-employed individuals (e.g. students) because contributions to the old-age scheme are mandatory from age 20 onward until reaching the statutory retirement age. The statutory retirement age was 65 for men throughout our sample period. For women, it was increased from 62 to 63 in 2001 and to 64 in 2005 as part of the 10th OASI reform implemented in 1997. Besides the retirement age, the reform increased compulsory coverage of non-employed married and widowed women below retirement age, who had been exempt from annual contributions towards the OASI before.

Because virtually everybody generates a record at some point in their life, our matched data set contains 99% of the permanent population aged 20–64 in 2010. Naturally, as we move back in time, the sample coverage of persons aged 20–64 gets slightly smaller in earlier years because certain individuals that lived in Switzerland in these earlier years died or emigrated and are hence not in the 2010 census. Figure A1 illustrates the sample coverage of our data. It compares the number of individuals aged 20–64 in the matched data set with data on the actual population aged 20–64 in a given year. The latter data are taken from the official population statistics of the Federal Statistical Office. The figure shows that our matched data set contains 91% of all individuals aged 20–64 living

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<sup>16</sup>Unfortunately, the 2000 Census does not have social security numbers and hence cannot be matched to the earnings data.

<sup>17</sup>Moreover, the data contain individual records for unemployment benefits and disability pensions as well as income compensation allowances in the event of military service or maternity.

in Switzerland in 2000.

In Figure A2, we compare the employment rate of 20 to 64 year-old Swiss men and women in our data with the employment rate of these groups according to the SLFS. We observe that the employment rates are slightly higher in our data than they are in the SLFS, which is probably because our data do not contain a small number of individuals that do not participate in the labor market.

While the data hence covers the near universe of the population of Switzerland, the matched data set has some disadvantages, too. First, the earnings records in 1998 are incomplete. The share of wage earners for which records are missing is about 5–6%. It is not entirely clear why these records are missing (see the discussion below). The missing records prevent us from analyzing aggregate outcomes in 1998, as the problem of missing records is not equally distributed across cantons. Second, the register-based census 2010 does not contain information on some variables of interest normally available in census data such as schooling/education, occupation or number of children. Third, we only observe the characteristics of individuals as of 2010. This is a concern for characteristics that can change over time, especially an individual’s place of residence, marital status and immigrant status or citizenship. The census provides information on how these characteristics changed in the past, allowing us to reconstruct the information for years prior to 2010. Nevertheless we have to impute some of the data points making a set of assumptions. We discuss the imputations procedures for the three variables in the following subsections.

### 3.1.1 Missing records in 1998

The earnings records in the year 1998 are incomplete. About 4.5–5.5% of all records are missing. Figure A3 illustrates this. The reasons for the missing observations are not entirely clear. According to statisticians of the compensation office, this is most likely due to IT problems that occurred at one of the IT pools. These IT pools are responsible for delivering the earnings records of several equalization funds (*Ausgleichskassen*). The problem with the missing records remained unnoticed at the time because statistics that are based on the earnings records were only published in odd years. The problem for us is that the missings are unequally distributed across cantons. In some cantons, a sizeable share of records are missing. We discarded observations from 1998 to ensure that our graphical analysis is not affected by this data problem.

A more detailed analysis by the compensation office revealed that it is not just one equalization fund that has missing records in 1998. Rather, we observe a drop in the number of records in 1998 relative to 1997 and 1999 in several equalizations funds. More-

over, these inquiries revealed that it would be impossible to try to recover the missing records as of today. The reason is that many affected workers are retired by now. The equalizations funds discard the data for retired workers. When using aggregate data, it is unavoidable to discard the data from 1998 entirely.

### **3.1.2 Place of residence**

Apart from the place of residence in 2010, the data provide the following information:

- Year a person moved to the municipality
- Municipality of residence 1, 2 and 5 years ago
- Last municipality of residence

Using these information, we can assign a municipality of residence to roughly two thirds of the individuals in the relevant period (i.e. 1997–2003, see Figure A4a). If we are willing to assume that individuals paid taxes for at least 8 years in the municipality they come from—8 years is the median duration of stay in the municipality of residence of 20–64 year olds in the census 2010—we can impute roughly 90% of the places of residence. However, our baseline strategy is to assign all individuals to the last known municipality. Two comments on this assumption are in order. First, the problem of missing information on the place of residence is smaller for older individuals, as individuals usually become more settled, the older they get. Second, the assumption is weaker when it comes to the canton (rather than the municipality) of residence because only 26% of the observed moves in our data occur across cantons.

We can evaluate the accuracy of our imputation when it comes to the canton of residence. The reason is that the data identify cantonal unemployment agencies paying unemployment benefits. Since unemployed are assigned to cantonal agencies based on their canton of residence, we can compare the imputed canton of residence of registered unemployed with the canton of their unemployment agency. Figure A4b provides a summary of the results of this accuracy test. It shows the share of correctly assigned cantons of residence for individuals for which we actually know the canton of residence due to the information in the census and for all individuals, including the imputed places of residence. The figure shows that the share of correctly assigned cantons of residences is more than 90% even in 2000, where the canton of residence is only known for 66% of the sample.

### **3.1.3 Immigrant status**

Information on the residency status of immigrants is important in our analysis because immigrants only pay taxes in Switzerland if they either have a residency permit C or ob-

tained the Swiss citizenship. We impute the missing information on the immigrant status in the years before 2010 using information on when an individual arrived in Switzerland, which is reported in the 2010 census. In particular, we assume that an immigrant has a permit C or gained the Swiss passport—and thus pays taxes in Switzerland—if he or she lived in Switzerland for at least 10 years. Figure A5 provides the motivation for this approach using data from the 2010 census. It shows that ten years after immigration 86% of all foreign born have a C permit or a Swiss passport. Moreover, we know the residence status in 2010. We can thus reassign individuals that are thought to be either Swiss citizen or C permit holders in 2010 which in fact are not.

### 3.1.4 Marital status

Marital status is an important variable as it affects both the potential labor supply response and the tax rate faced by individuals. In addition to the marital status and a variable on whether someone is separated in 2010, the census data provide the following information:

- Year when the marital status changed (if applicable)
- Year of separation (if applicable)

Based on this information, it is possible to reconstruct the history of an individual's marital status up to the last change. Prior to that event, however, we need to make different assumptions to impute the marital status. Note that we need the information on separated but (yet) undivorced individuals because they are taxed as singles. Figure 1 below shows the share of the population aged 35 to 75 in 2010 for which we the civil status is known according to different imputation approaches. The bottom line makes the weakest assumption, assuming only that before divorce or widowhood (marriage) someone was married (single) for at least one year. According to these assumptions, the share of individuals with respect to the total population aged 35 to 75 in 2010 with known civil status lies at 80% in 1995 and increases up to 98% in 2010. In the next line this assumption is extended to having been married for at least 7 years before divorce or widowhood. With the average duration of marriage before divorce being 14 years, this is still not a very strong assumption. In the next scenario (third line from below) we make more sophisticated, gender-specific assumptions on marriage behavior based on age at time of marriage, divorce, and dissolved same-sex partnerships. First, we assume that those who married before the median marriage age (men: 28, women: 26) were single before. Everyone we assume was single for at least one year before getting married. Those who were in their 40s when they got married we assume that they were single for at least two years before getting (re-)married. The reason is that at that age it is



more likely that they have children from an earlier marriage, in which case we assume a divorce to take longer. In case a couple does not reach an amicable agreement on the divorce, 2 years is the time period a couple has to be factually separated before they can get a divorce at a court. Unfortunately, the data does not provide any information on whether someone has children. Those who divorced at the median age of divorce or earlier (m:43, w:40) are assumed to having been married since the gender-specific median age of getting married (m: 28, w:26). Similarly, for widows and widowers we assume that they have been married since the gender-specific median age of getting married. For someone coming out of a same-sex partnership we assume that they were married since 2007, first year in which a legal union between same-sex couples was possible, and that they were single for 7 years prior to getting married. The top line finally is based on an imputation method which assumes that the change in civil status recorded in the data is the only one that ever took place. In this scenario everyone was single before getting married, and every divorce or widowhood was preceded by a marriage which started at the average marriage age (m: 30, w: 29). Before that age, individuals who are divorced in 2010 are assumed to have been single. For dissolved same-sex partnerships we assume that they started no earlier than the average marriage age but always later than 2006, and that before that, the person was always single. These strong assumptions allow to assign a marital status to everyone in the sample, corresponding to 98% of the Swiss population aged 35 to 75 in 2010 throughout the period 1990–2010.

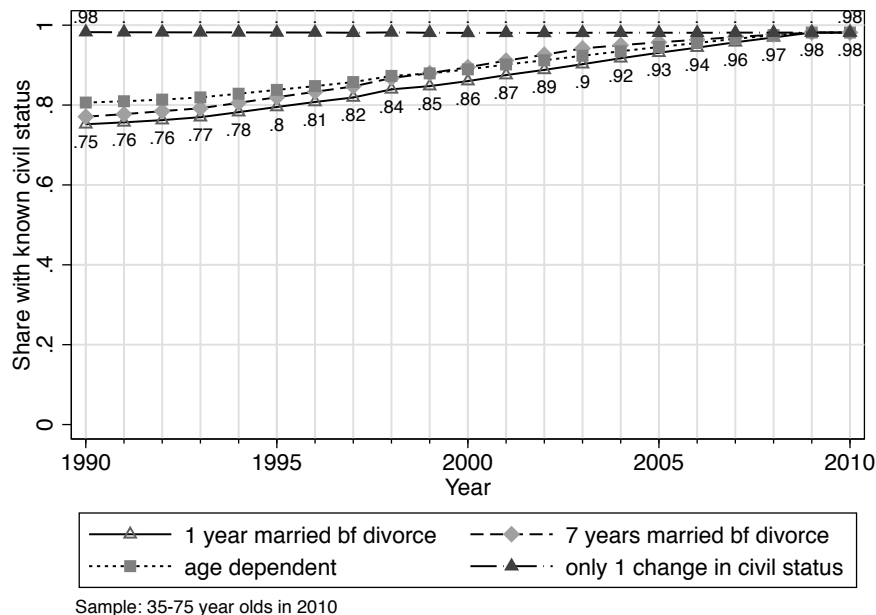


Figure 1: Share of observations with known civil status according to different imputation methods

### 3.2 Labor Force Survey (SAKE)

This labor force survey is the equivalent of the US Current Population Survey.

#### *Sample*

- Swiss nationals and foreign nationals with permit C
- Ages 15–70

#### *Outcomes considered*

- Employment rate: fraction of people employed (SAKE variable used: TBD1) as a share of the permanent population (refers to employment in week before survey)
- Full-time equivalents: average activity level of individuals (TBD1 and TEK2/EK03) as a percentage of a full-time employment (full-time employees: 1=100%), 0 for people who are not employed
- Number of jobs: number of jobs held in week before survey (EX01, LX01 and TBD1), 0 for people who are not employed
- Self-reported earnings: Yearly gross earnings (BWU1)
- Hours worked: Hours effectively worked in week before the survey (EK08, refers to all jobs held), 0 for people who are not employed
- Overtime hours: average hours of overtime work per week in main job in 12 months prior to survey (EK12, note that there is a timing problem, as survey is in Q2!), 0 for people who are not employed
- Stated desired hours of work, part-time workers (EK07). Measurement may be improved.
- Potential further labor supply outcomes:
  - Employed at least once in year before survey: To consider with SESAM, also possible with SAKE

### 3.3 Wage Structure Survey (LSE)

We complement these data sets using data from the Swiss wage structure surveys. The surveys have been conducted every two years by the Swiss Federal Statistical Office (FSO) since 1994. They are a stratified random sample of private and public firms with at least three full-time-equivalent (FTE) workers from the manufacturing and service sectors in Switzerland. They cover between 16.6% (1996) and 50% (2010) of total employment in Switzerland. Participation is mandatory. The surveys contain extensive information on the individual characteristics of workers and provide reliable information on hours worked per worker. Moreover, they provide detailed information on the wage components of each workers, providing, among others, detailed information on overtime pay and bonus

payments per worker.

*Sample*

- Swiss nationals and foreign nationals with permit C
- Ages 15–70
- Years 1996–2010 (the survey in 1994 only covers manufacturing)
- Due to the sampling of the survey:
  - Firms with more than 3 workers in the private and public sector
  - Excluded are (i) public sector employees in municipalities (until 2006), (ii) agriculture, and (iii) apprentices and interns
  - If possible, workers are assigned to cantons over the zipcode and not over the variable *arbkto* which is the canton in which most workers of a firm work. The zipcode variable is likely to serve as an identifier for the establishment/plant.
  - We drop observations with missing information on gender, nationality, and civil status.

*Outcomes considered* (see variable lists “ESS-LSE Codebook 2010 fr” and ”ESS-LSE Questionnaire 2010 fr” for more information)

- Indicators of labor supply
  - Number of workers, measured in October
  - Full-time equivalents (FTE): activity level of employed workers as a percentage of a full-time employment (full-time employees: 1=100%), in October
  - Hours worked: hours worked of employed workers in October (for workers paid a monthly wage: 4 1/3 times effective weekly working time)
- Wage components (see “Erläuterungen” for the wage concept of the survey):
  - Standardized monthly wage: Wage in October including variable wage components except overtime pay, adjusted for working time (see ESS-LSE Description variables fr for details on the computation)
  - Net monthly wage: monthly wage excluding social security contributions and including *all* wage components
  - Gross salary in October including social security contributions
  - Overtime pay in October
  - Extra monthly wage(s): 13th/14th payments of basic wage
  - Bonus: Bonuses, premiums, employee profit sharing and other non-regular wage payments to the worker for the entire year of the survey
  - Other extra pay: extra pay for difficult working conditions (e.g. shift work)

## 4 Empirical Results

In this section, we present our empirical results. We start our empirical analysis by showing results from the matched social security and census data which are the most comprehensive. We divide cantons into 4 groups as depicted in our earlier Figure 4: (0) 2 cantons which transitioned early in 1999 (Zurich and Thurgau) with tax holiday in 1997-98 (and only 1998 for Zurich for local taxes), (1) 16 cantons which transitioned in 2001 with a tax holiday in 1999-00 for both the Federal and local income taxes, (3) 4 cantons which transitioned in 2001 with a tax holiday in for 2000 only for local income taxes (and 1999-00 for the Federal tax), (4) 3 cantons which transitioned in 2003 with tax holiday in 2001-02. We always use the same colors as in Figure 4 to depict each group: (0) blue, (1) light green, (2) dark green, (3) brown.

First, we examine the levels of tax rates to establish the magnitude of the first stage generated by the tax holidays. Second, we analysis aggregate effects on employment, and earnings. Third, we zoom in on specific sub-groups by age and income groups.

### 4.1 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 6 displays the average income tax rate (top panel) and marginal income tax rate (bottom panel) for a single filer with annual gross income of 100,000 CHF by year and groups of cantons from 1990 to 2010. An income of 100,000 CHF corresponds approximately to the 85th percentile of the labor income distribution among all workers in Switzerland. Tax rates include Federal, cantonal, and municipal income taxes. The average tax rate is the total income tax divided by gross income. Averages across municipalities and cantons are population weighted. The cantons are divided in five groups based on when the tax holiday took place. (1a) light blue: tax holiday in 1997-98 (1 canton), (1b) dark blue dashed: tax holiday in 1998 (1 canton), (2a) light green: tax holiday in 1999-2000 (15 cantons), (2b) dark green: tax holiday in 2000 (4 cantons), (3) brown: tax holiday in 2001-02 (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). This graphical representation will be used in all subsequent reduced form graphs. For each of the groups, we represent the corresponding tax holidays 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 1/6 of total income tax revenue. Substantively, two points are worth noting. First, tax rates and especially marginal tax rates are fairly high for the upper middle class workers with earnings of 100,000 CHF. Average tax rates are around 15-20% while marginal tax rates are around 25-30%. Second, the graph shows that, over the period 1990-2010, the variation in tax rates (either average or marginal) due to the tax holidays dwarves other forms variations due to tax reforms. Hence, there is no doubt that the tax holiday reform creates very large variation in tax rates and hence is a very good natural experiment to identify the Frisch elasticity.

## 4.2 Effects on Employment and Earnings

We start by plotting with simple employment and earnings statistics by year and by groups of cantons focusing on the sample of individuals aged 20-64 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. Light green for group (2), dark green for group (3), and brown for group (4). In our main graphs, we exclude group (0) which had its tax holiday in 1997-8. We exclude this group in our benchmark results for three reasons: First, we unfortunately do not have complete data for 1998. Second, it was not fully clear until June 1997 that 1997 would be a tax holiday so that the response in 1997 might have been muted. Third, for Zurich, the largest of the two early cantons in group 1, 1997 was a tax holiday only for the Federal tax (and not local income taxes).

**Employment Effects.** Figure 7 displays the employment rates for men (top panel) and for women (bottom panel) from 1990 to 2010 in the three groups of cantons: (1), (2), (3). The sample in each year is defined at all individuals aged 20-69 in the year (and who are still alive and Swiss residents in 2010, when we match to Census). The employment rate is computed as the fraction of individuals in the sample with positive earnings (either from wages or self-employment) during the year. Two findings are worth noting. First, all three groups of cantons follow remarkably parallel trends over the full period, and particularly so for men. This implies that for each group of cantons, the two other groups constitute good control groups. Second, there is no evidence of any relative increase in employment rates during the tax holidays. This implies that a temporary tax holiday does not affect labor supply along the extensive margin at least in the aggregate.

Figure 8 zooms in on the employment rate of older workers aged 55-69. In principle, this group should be more elastic along the extensive margin as older workers can decide to retire. Yet, the figure shows no effects for this group either confirming our finding that

the tax holiday did not create responses along the extensive margin.

**Earnings Effects.** Figure 9 displays the average earnings (including non-workers) for men (top panel) and for women (bottom panel) from 1990 to 2010 in the three groups of cantons: (1), (2), (3). The sample in each year is again defined at all individuals aged 20-69 in the year (and who are still alive and Swiss residents in 2010, when we match to Census). Hence, people with zero earnings are also included in the averages. Earnings are defined as the sum of wage earnings and self-employment earnings. Three points are worth noting. First, overall, the trends are close to parallel in all three groups especially for women. Second, for men, there are clear spikes in earnings in 2000 for cantons with tax holidays in 1999-2000 or 2000 (green series) and in 2001-02 for cantons with tax holidays in 2001-02 (brown series). These spikes are consistent with a behavioral response to the tax change. However, the magnitude of the spikes are fairly modest, in the order of 5% of average earnings. Third, for women, the spikes are largely absent suggesting a much smaller response in this group. Note that the parallel trend assumption between the light green and brown groups is excellent both pre- and post-reform and displays a very small positive earnings effect for women for the cantons which transitioned last (in brown).

Next on Figure 10, we disaggregate earnings between wage earnings vs. self-employment earnings. Figure 10 displays average wage earnings (top) and average self-employment earnings (bottom) by year and groups of cantons from 1990 to 2010. The sample in a given year  $t$  is all individuals aged 20-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census). For the top panel on wage earnings, the sample in year  $t$  includes only individual with positive wage earnings in year  $t$ . For the bottom panel on self-employment earnings, the sample in year  $t$  includes only individual with positive self-employment earnings in year  $t$ . For wage earnings, we observe a very small response to the tax holiday but precisely estimated as the parallel trend assumption pre- and post-reform holds very well. For self-employment income, we see a much larger response for late transitioning cantons (in brown) with about 10% excess self-employment earnings during the tax holiday years although the effect is not quite as precisely estimated due to overall noise in the series.

Next on Figure 11, we repeat Figure 10 but zooming in on high income earners. This figure displays average wage earnings (top) and average self-employment earnings (bottom) by year and groups of cantons from 1990 to 2010. The sample in a given year  $t$  is all individuals aged 20-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census) and had average annual labor earnings (wages plus self-employment) above 200,000 CHF in 1994-1996. Earnings are expressed in 1000s of

2010 CH francs (adjusted for inflation). The top panel on wage earnings show a clear and significantly larger response of wage earnings for this high income group (relative to the full population), of around 7% excess earnings during the tax holidays. The bottom panel also shows large spike in self-employment income for the 2001-2 tax holiday, again of about 10% excess self-employment in these years.

Figure 12 zooms in on married women whose labor supply decisions are likely to be most elastic. This figure displays the employment rate and average earnings (including non-workers) for married women by year and groups of cantons from 1990 to 2010. The sample in a given year  $t$  is all female individuals aged 20-69 in year  $t$  and married in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census). Married women are expected to be particularly responsive to taxes, yet, the figure does not show effects on employment or average earnings.

**Early transition cantons.** Finally, we examine the effect of the early tax holiday in the cantons of Zurich and Thurgau. Figure 13 displays the employment rate by year and groups of cantons from 1990 to 2010. The top panel is for men and the bottom panel for women. The sample in a given year  $t$  is all individuals aged 20-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census). The employment rate is computed as the fraction of individuals in the sample with positive earnings (either from wages or self-employment) during the year. The two groups of cantons are: (1) 2 cantons which transitioned in 1999 with a tax holiday in 1999 for local taxes and 1999-00 for the Federal tax (in blue), (2) 4 cantons which transitioned in 2001 with a tax holiday for 2000 only for local income taxes and 1999-00 for the Federal tax (in darker green). There is no visible effect on employment rates for the early transition counties.

This figure 14 displays average wage earnings (top) and average self-employment earnings (bottom) by year and groups of cantons from 1990 to 2010. The sample in a given year  $t$  is all individuals aged 20-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census) and had average annual labor earnings (wages plus self-employment) above 200,000 CHF in 1994-1996. Earnings are expressed in 1000s of 2010 CH francs (adjusted for inflation). The two groups of cantons are: (1) 2 cantons which transitioned in 1999 with a tax holiday in 1999 for local taxes and 1999-00 for the Federal tax (in blue), (2) 4 cantons which transitioned in 2001 with a tax holiday for 2000 only for local income taxes and 1999-00 for the Federal tax (in darker green).

**Heterogeneity by local tax levels.** Last, we examine heterogeneity in tax holiday effects by the size of local taxes, exploiting the rich variation in tax rates that we documented in Figure 3. This figure displays average wage earnings (top) and average

self-employment earnings (bottom) by year and groups of cantons from 1995 to 2005. The sample in a given year  $t$  is all individuals aged 20-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census) and had average annual labor earnings (wages plus self-employment) above 250,000 CHF in 1994-1996. Earnings are expressed in 1000s of 2010 CH francs (adjusted for inflation). We consider two groups of cantons: (a) 4 cantons which transitioned in 2001 with a tax holiday for 2000 only for local income taxes and 1999-00 for the Federal tax (in darker green), (b) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). Group (b) is further split into three subgroups of municipalities based on the level of taxes in each area: (1) low taxes (squares, solid line), (2) medium taxes (triangles, dotted line), (3) high taxes (circles, dashed line). 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 two groups, we represent the corresponding tax holidays periods using the vertical shading and the same color code. The figures show somewhat larger effects of the tax holiday in high tax areas, particularly for self-employment.

**Summary.** Hence, from these graphs we can draw the following conclusions. First, there is no evidence at all of responses along the extensive margins, even for sub-groups likely to be more elastic such as married women or older workers. Second, there is a small aggregate response of wage earnings which is concentrated at the top of the earnings distribution for individuals with earnings above 100,000 CHF (top 5%) and no visible response below. Third, there is a larger response of self-employment earnings that is present at all earnings level (and not just the top). Fourth, most of these responses are visible for the last wave of transitioning cantons with tax holidays in 2001-2. Responses for earlier transitions such as 1997-8 or 1999-2000 appear to be much 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.

### 4.3 Labor Force Survey (SAKE)

So far, the graphs computed using the labor force survey provide limited evidence that there were actual labor supply responses to the blank years. The limited evidence for labor supply effects of the reform may be due to sampling error: some outcomes display substantial year-to-year movements (despite the fact that we already pool two consecutive years). This is particularly true for the years prior to 2002 (which is the year in which the sample size of the survey was tripled) and it is, evidently, particularly true for small subgroups of the population. The most smooth pre- and post-trends are observed for



the employment rates, the number of jobs as well as for (self-reported) gross earnings. Other outcomes (especially those based on hours worked) may have to be trimmed or winsorized to reduce the impact of outliers. The SAKE also contains a variable revealing working hours that employees would like to work. This variable could be helpful to see whether workers would like but cannot, e.g. due to indivisible labor. There is, so far, also limited evidence that the household income plays a significant role in affecting the labor supply decisions. The only group which potentially displays a response to the reform is married women with children in high-income households (e.g., in terms of hours worked per week, earnings or relative earnings), especially if the sampling weights were not used.

Figure 18 displays the employment rate (top) and hours of work per week (bottom) using the Labor Force Survey (SAKE). The sample in a given year  $t$  includes all individuals aged 20-69. For hours of work, we restrict the sample to employees. We consider 3 groups of cantons. (1) 2 cantons which transitioned in 1999 with a tax holiday in 1998 or 1998-98 (in blue), (2) 20 cantons which transitioned in 2001 with a tax holiday in 1999-00 or 2000 (in green), (3) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). 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 figure does not display any tax holiday effects on the employment rate (consistent with our results using Social Security data) or on hours of work per week among workers.

## 4.4 Wage Structure Survey (LSE)

The wage structure survey provides information on hours of work as well as bonuses. Hence, it can be used to analyze these specific components.

Figure 16 displays average hours of work per month for female employees (married in the top panel and single in the bottom panel) by year and groups of cantons from 1996 to 2010 using the wage structure survey (LSE) carried out bi-annually. The sample in a given year  $t$  includes all female employees in the dataset weighted to represent population averages. We consider two groups of cantons: (a) cantons which transitioned in 2001 with a tax holiday for 2000 or 1999-2000 (in darker green), (b) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). Geographical information in the data is based on place of work while tax treatment is based on residence. Hence, to reduce the number of cases where a person works in one group of cantons but resides in another one, we have excluded small cantons geographically close to cantons from other groups where such commuting is common. Single women display no evidence of response around the tax holiday. In contrast, there is some evidence of responses for married women, particularly for late transitioning cantons.

Using the same Figure 17 displays the fraction of employees with bonuses above 20,000 CHF (among all employees including those with no bonus) by year and groups of cantons from 1996 to 2010 using the wage structure survey (LSE) carried out bi-annually. The sample in a given year  $t$  includes all employees in the dataset weighted to represent population averages. The top panel is for all employees while the bottom panel is for employees in the insurance industry sector only. There is no evidence of bonus responses for all employees in the top panel but a very strong response in the specific insurance industry.

## 5 Conclusion

Our paper has estimated the intertemporal labor supply (Frisch) elasticity of substitution exploiting an unusual tax policy change in Switzerland. In the late 1990s, 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 go system. This transition created a two-year long, salient, and well advertised tax holiday. This change occurred both for the Federal and local income taxes. Swiss cantons switched to the new regime at different points in time during the 1995–2003 period and 2/3 of income taxes are raised by local government with large heterogeneity in local tax levels across places. Exploiting such rich local variation, and using population wide administrative social security earnings data matched with census data, we identify the Frisch elasticity. We find significant but quantitatively small responses of earnings consistent with a Frisch elasticity around .2. Some groups, such as the self-employed, high income earners, and older workers display larger responses. Part of the response is likely due to tax avoidance rather than actual labor supply change. Hence, our findings definitely rule out large Frisch elasticities that are conventionally used to calibrate business cycle macro models.

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Average Tax on CHF 100,000 Gross Income

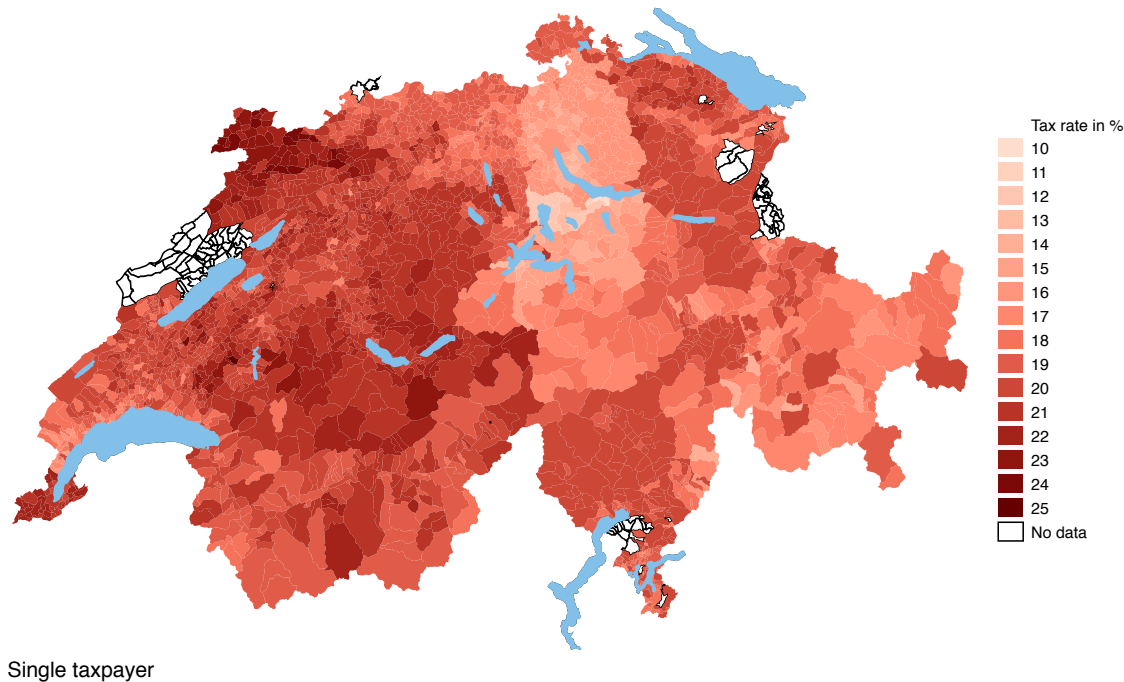


Figure 2: Average Tax Rates Across Swiss Cantons

Notes: This figure depicts the average income tax rate in 1999 across Swiss municipalities. The tax rate combines income taxes at the Federal, cantonal, and municipal levels and is computed for a single taxfiler with gross income of 100,000 CHF, approximately the 90th percentile of labor earnings across all Swiss workers. The average tax rate is defined as taxes owed divided by gross income. The graph shows substantial variation in tax burdens across areas with tax rates at low at 10% and tax rates as high as 25%.

Year X	1993	1994	1995	1996	1997	1998	1999	2000
Tax base for assessment period X	Incomes realized in 1991 + 1992		Incomes realized in 1993 + 1994		Incomes realized in 1995 + 1996		Income realized in 1999	Income realized in 2000
Payment of tax liability owed for year X	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

Figure 3: Transition from Old to New System

Notes: This figure depicts an example of a transition from the old system of biennial retrospective taxation to the new system of annual pay-as-you-go taxation in 1999. 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.



Figure 4: Tax Transition Across Swiss Cantons

Notes: This figure depicts timing of the transition across the 26 Swiss cantons. For the Federal income tax, the tax holiday was either 1997/98 (cantons in blue), 1999/00 (cantons in green), or 2001/02 (cantons in brown). 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. One canton (Nidwalden in very dark green) had no local tax holiday at all because it chose a different transition tax. One canton (Basel in white) transitioned earlier and hence had no tax holiday.



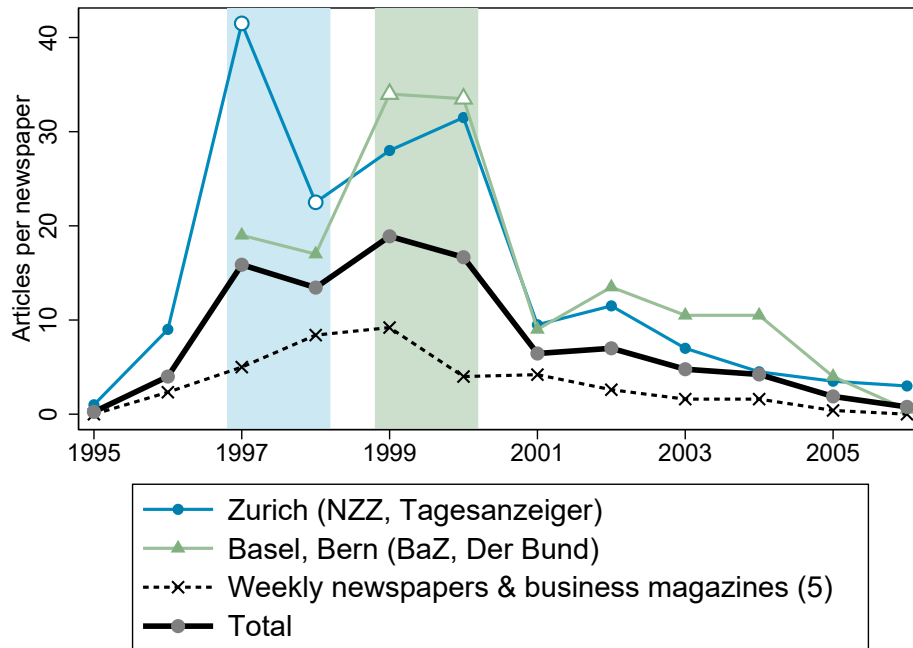


Figure 5: Press articles referring to the Tax Holiday

Notes: This figure shows the number of press articles mentioning the word “Bemessungslücke” (blank year) which is the expression most commonly used for tax holiday in German by year and most major newspapers. The figure displays four series: (1) the series in blue dashed is for a Zurich based newspaper (NZZ, Tagesanzeiger), (2) the series in solid green for a Basel and Bern newspaper (BaZ, Der Bund), (3) the series in dotted purple aggregates 5 weekly major newspaper and business magazines, (4) the series in solid black takes the average across all these publications. The tax holiday for Zurich is depicted in blue and the tax holiday for Bern is depicted in green. The figure shows that press interest in the tax holiday peaked during the years when the actual tax holidays happened.

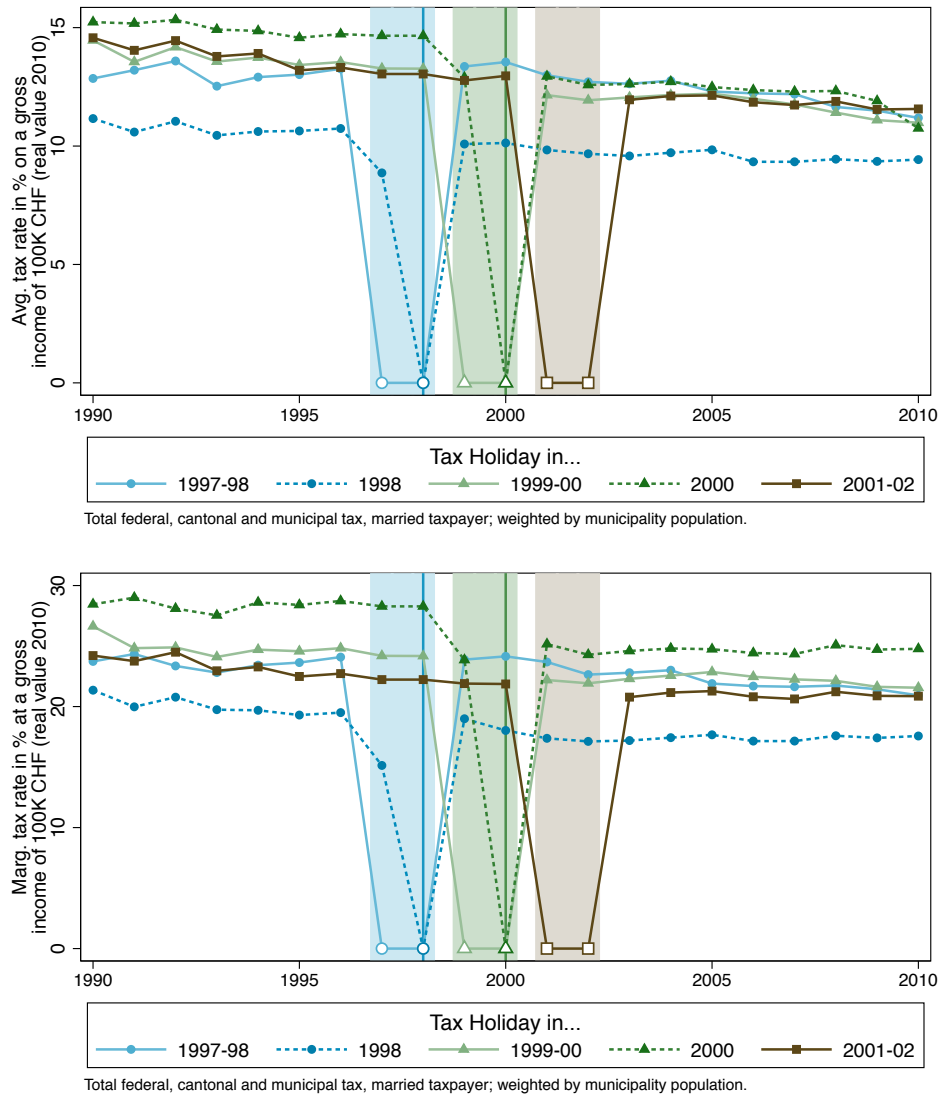


Figure 6: Effect of Tax Reform on Average and Marginal Tax Rates

Notes: This figure displays the average income tax rate (top panel) and marginal income tax rate (bottom panel) for a married filer (and no dependent children) with annual gross income of 100,000 CHF by year and groups of cantons from 1990 to 2010. An income of 100,000 CHF corresponds approximately to the 85th percentile of the labor income distribution among all workers in Switzerland. Tax rates include Federal, cantonal, and municipal income taxes. The average tax rate is the total income tax divided by gross income. Averages across municipalities and cantons are population weighted. The cantons are divided in five groups based on when the tax holiday took place. (1a) light blue: tax holiday in 1997-98 (1 canton), (1b) dark blue dashed: tax holiday in 1998 (1 canton), (2a) light green: tax holiday in 1999-2000 (15 cantons), (2b) dark green: tax holiday in 2000 (4 cantons), (3) brown: tax holiday in 2001-02 (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). 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 1/6 of total income tax revenue. This graphical representation will be used in all subsequent reduced form graphs. For each of the groups, we represent the corresponding tax holidays periods using the vertical shading and the same color code.

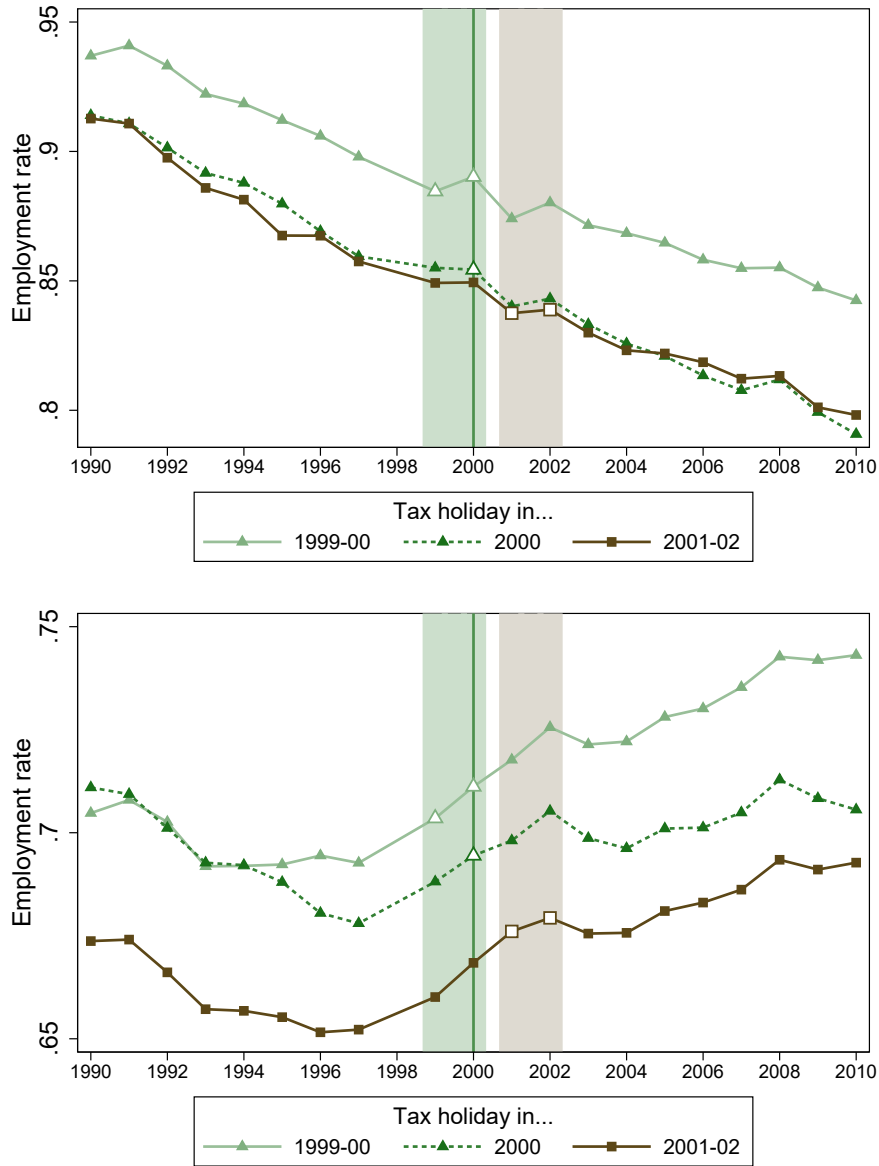


Figure 7: Effects of Tax Holiday on Employment: Males (top), Females (bottom)

Notes: This figure displays the employment rate by year and groups of cantons from 1990 to 2010. The top panel is for men and the bottom panel for women. The sample in a given year  $t$  is all individuals aged 20-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census). The employment rate is computed as the fraction of individuals in the sample with positive earnings (either from wages or self-employment) during the year. The three groups of cantons are: (1) 16 cantons which transitioned in 2001 with a tax holiday in 1999-00 for both the Federal and local income taxes (in light green), (3) 4 cantons which transitioned in 2001 with a tax holiday for 2000 only for local income taxes and 1999-00 for the Federal tax (in darker green), (4) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). For each of the three groups, we represent the corresponding tax holidays 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). The figure shows no evidence of employment effects.

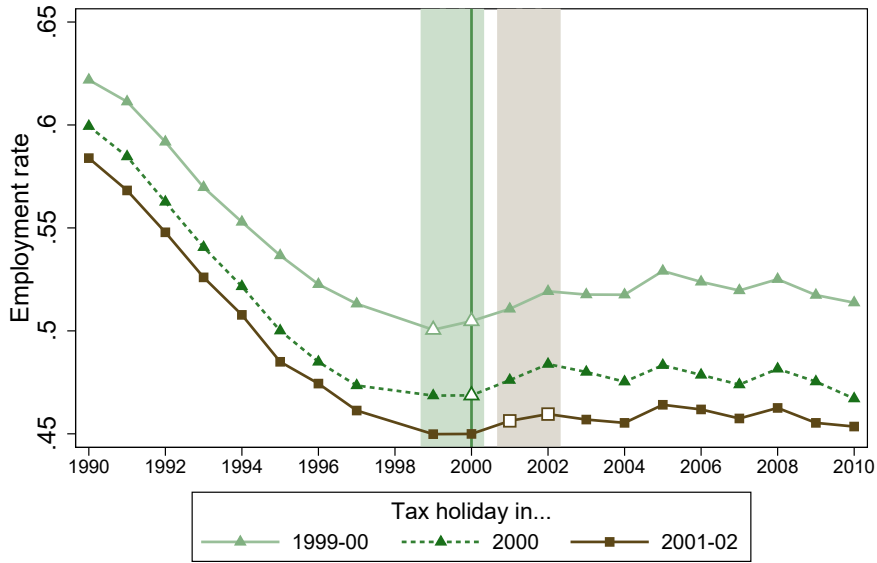


Figure 8: Effects of Tax Holiday on Employment of Older Workers (age 55-69)

Notes: This figure displays the employment rate for older workers aged 55-69 by year and groups of cantons from 1990 to 2010. The sample in a given year  $t$  is all individuals aged 55-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census). The employment rate is computed as the fraction of individuals in the sample with positive earnings (either from wages or self-employment) during the year. The three groups of cantons are: (1) 16 cantons which transitioned in 2001 with a tax holiday in 1999-00 for both the Federal and local income taxes (in light green), (3) 4 cantons which transitioned in 2001 with a tax holiday for 2000 only for local income taxes and 1999-00 for the Federal tax (in darker green), (4) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). For each of the three groups, we represent the corresponding tax holidays 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). The figure shows no evidence of employment effects even for older workers who tend to be more elastic.

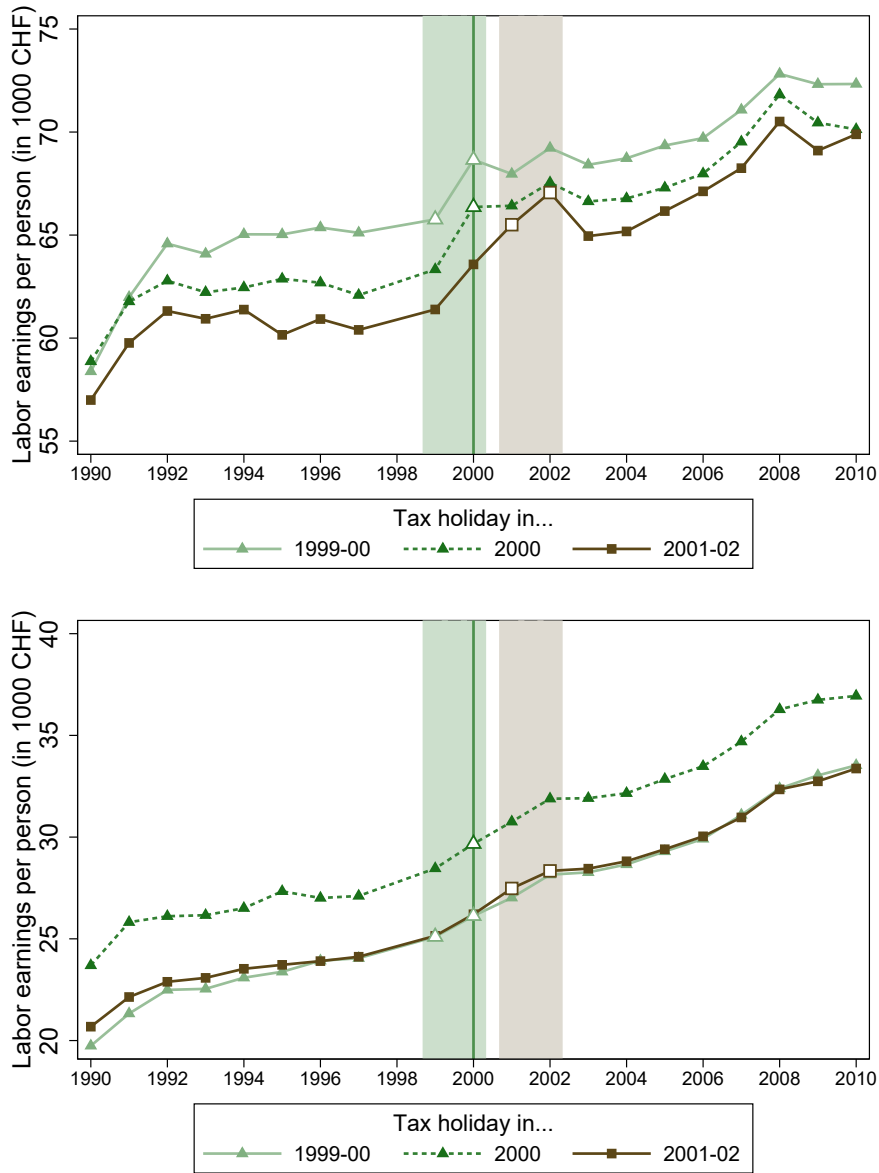


Figure 9: Effects of Tax Holiday on Earnings: Males (top), Females (bottom)

Notes: This figure displays average earnings (including non-workers) by year and groups of cantons from 1990 to 2010. The top panel is for men and the bottom panel for women. The sample in a given year  $t$  is all individuals aged 20-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census). Earnings include both wage earnings and self-employment earnings and are expressed in 1000s of 2010 CH francs (adjusted for inflation). The three groups of cantons are: (1) 16 cantons which transitioned in 2001 with a tax holiday in 1999-00 for both the Federal and local income taxes (in light green), (3) 4 cantons which transitioned in 2001 with a tax holiday for 2000 only for local income taxes and 1999-00 for the Federal tax (in darker green), (4) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). For each of the three groups, we represent the corresponding tax holidays periods using the vertical shading and the same color code. Both figures show no effect of the tax holiday on employment levels. 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).

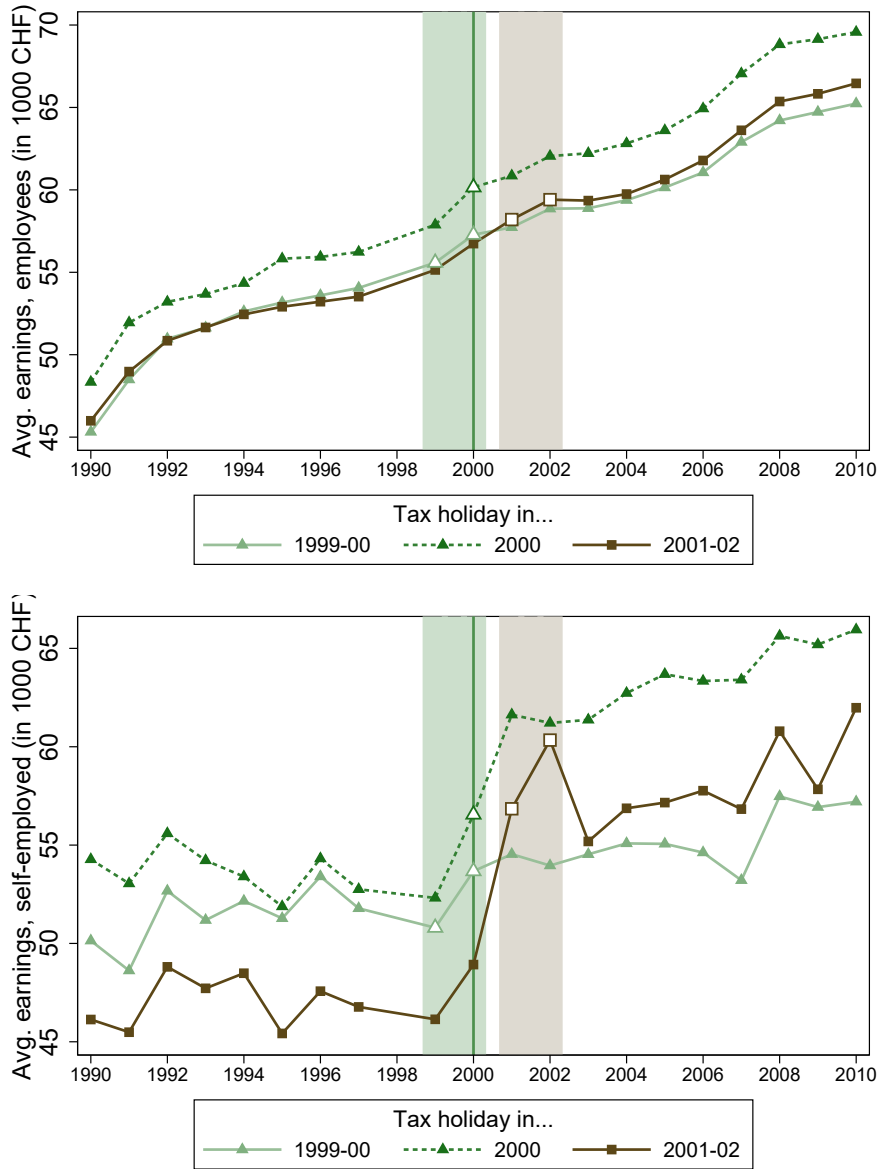


Figure 10: Effects of Tax Holiday on Wages (top) vs. Self-Employment (bottom)

Notes: This figure displays average wage earnings (top) and average self-employment earnings (bottom) by year and groups of cantons from 1990 to 2010. The sample in a given year  $t$  is all individuals aged 20-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census). For the top panel on wage earnings, the sample in year  $t$  includes only individual with positive wage earnings in year  $t$ . For the bottom panel on self-employment earnings, the sample in year  $t$  includes only individual with positive self-employment earnings in year  $t$ . Earnings are expressed in 1000s of 2010 CH francs (adjusted for inflation). The three groups of cantons are: (1) 16 cantons which transitioned in 2001 with a tax holiday in 1999-00 for both the Federal and local income taxes (in light green), (3) 4 cantons which transitioned in 2001 with a tax holiday for 2000 only for local income taxes and 1999-00 for the Federal tax (in darker green), (4) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). 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 three groups, we represent the corresponding tax holidays periods using the vertical shading and the same color code.

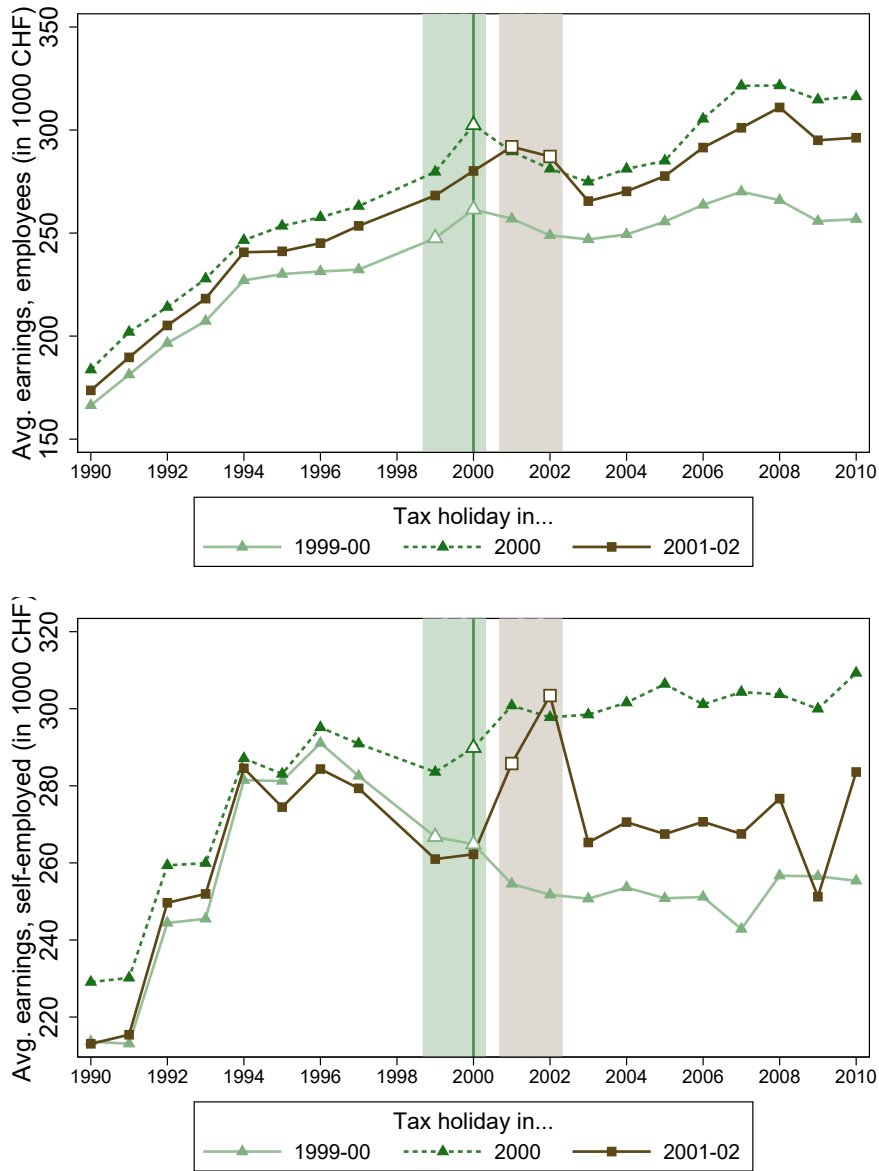


Figure 11: Effects on High Earners: Wages (top) and Self-Employment (bottom)

Notes: This figure displays average wage earnings (top) and average self-employment earnings (bottom) by year and groups of cantons from 1990 to 2010. The sample in a given year  $t$  is all individuals aged 20-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census) and had average annual labor earnings (wages plus self-employment) above 200,000 CHF in 1994-1996. Earnings are expressed in 1000s of 2010 CH francs (adjusted for inflation). The three groups of cantons are: (1) 16 cantons which transitioned in 2001 with a tax holiday in 1999-00 for both the Federal and local income taxes (in light green), (3) 4 cantons which transitioned in 2001 with a tax holiday for 2000 only for local income taxes and 1999-00 for the Federal tax (in darker green), (4) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). 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 three groups, we represent the corresponding tax holidays periods using the vertical shading and the same color code.

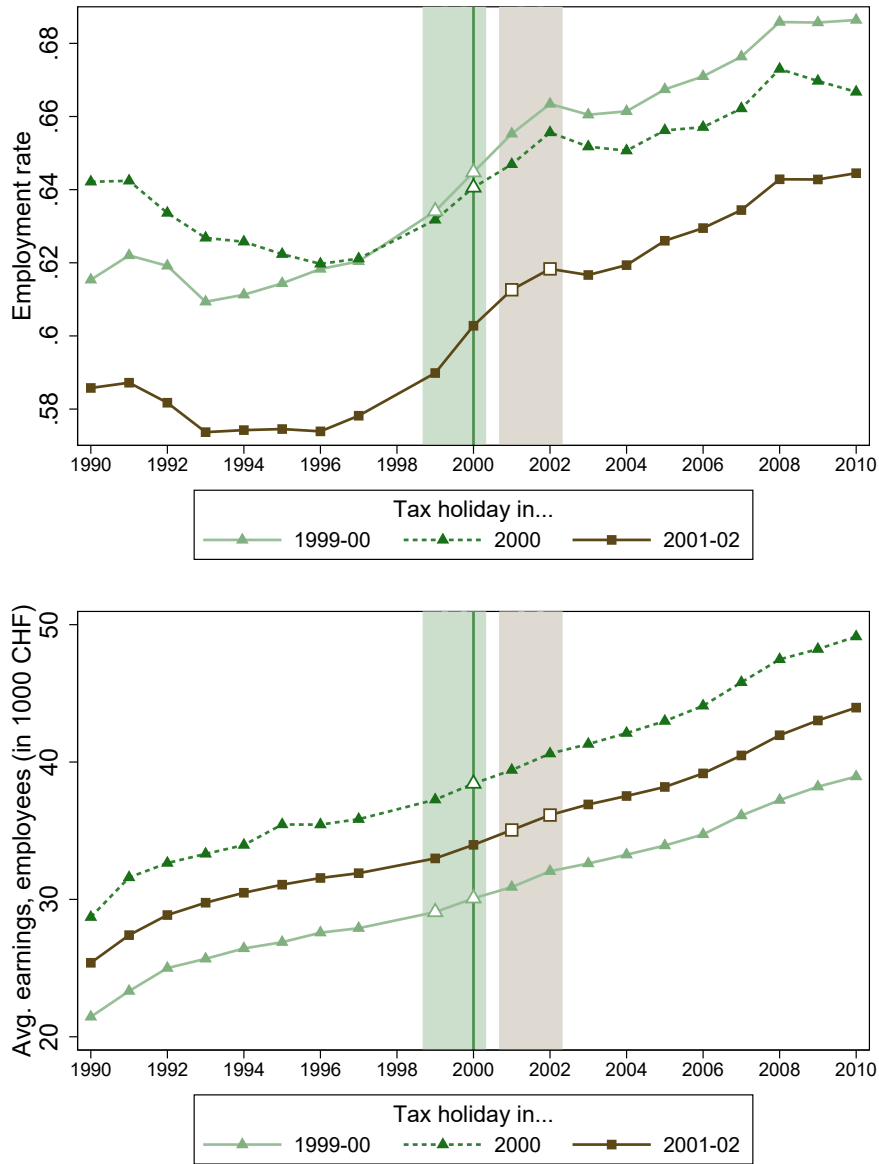


Figure 12: Effects on Married Women: Employment (top) and Earnings (bottom)

Notes: This figure displays the employment rate and average earnings (including non-workers) for married women by year and groups of cantons from 1990 to 2010. The sample in a given year  $t$  is all female individuals aged 20-69 in year  $t$  and married in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census). Earnings include both wage earnings and self-employment earnings and are expressed in 1000s of 2010 CH francs (adjusted for inflation). The three groups of cantons are: (1) 16 cantons which transitioned in 2001 with a tax holiday in 1999-00 for both the Federal and local income taxes (in light green), (3) 4 cantons which transitioned in 2001 with a tax holiday for 2000 only for local income taxes and 1999-00 for the Federal tax (in darker green), (4) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). For each of the three groups, we represent the corresponding tax holidays periods using the vertical shading and the same color code. Both figures show no effect of the tax holiday on employment levels. 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). Married women are expected to be particularly responsive to taxes, yet, the figure does not show effects on employment or average earnings.



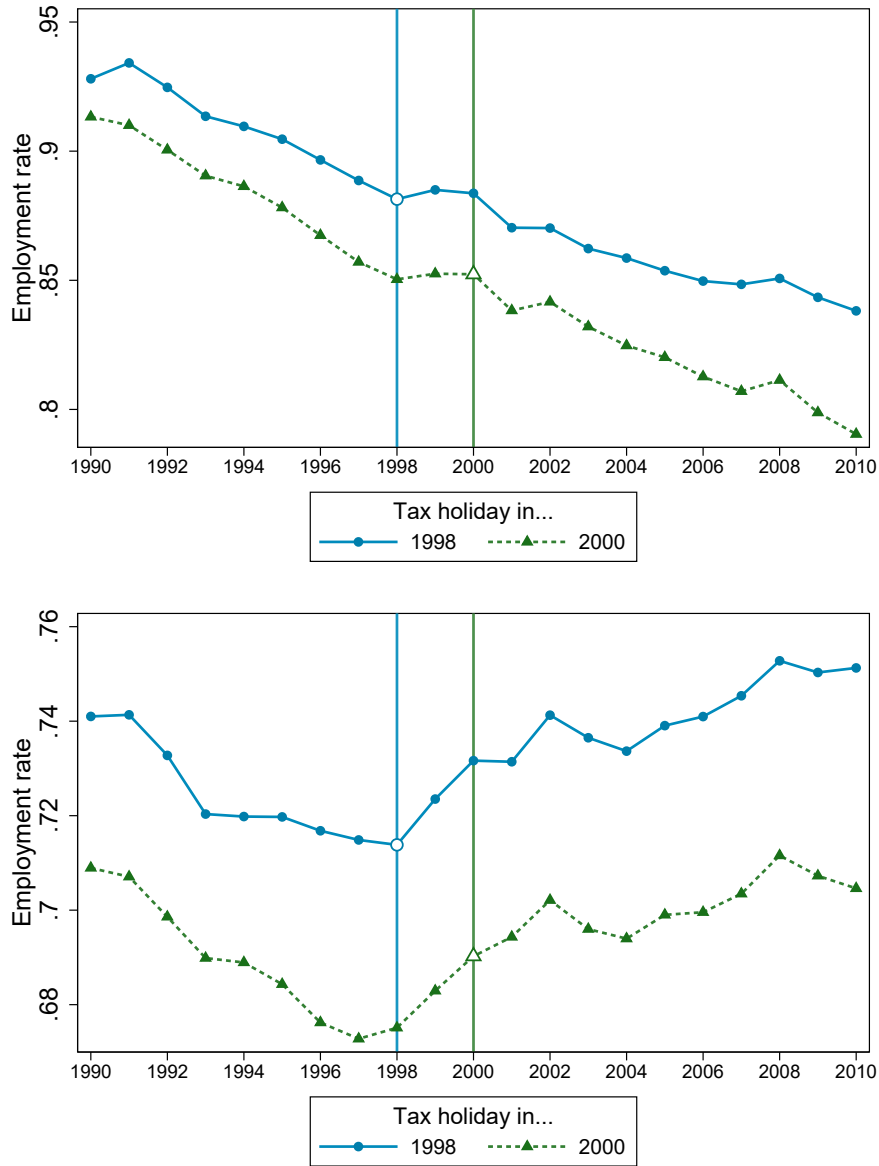


Figure 13: Effects of Early Tax Holiday on Employment: Males (top), Females (bottom)

Notes: This figure displays the employment rate by year and groups of cantons from 1990 to 2010. The top panel is for men and the bottom panel for women. The sample in a given year  $t$  is all individuals aged 20-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census). The employment rate is computed as the fraction of individuals in the sample with positive earnings (either from wages or self-employment) during the year. The two groups of cantons are: (1) 2 cantons which transitioned in 1999 with a tax holiday in 1999 for local taxes and 1999-00 for the Federal tax (in blue), (2) 4 cantons which transitioned in 2001 with a tax holiday for 2000 only for local income taxes and 1999-00 for the Federal tax (in darker green). For each of the two groups, we represent the corresponding tax holidays 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).

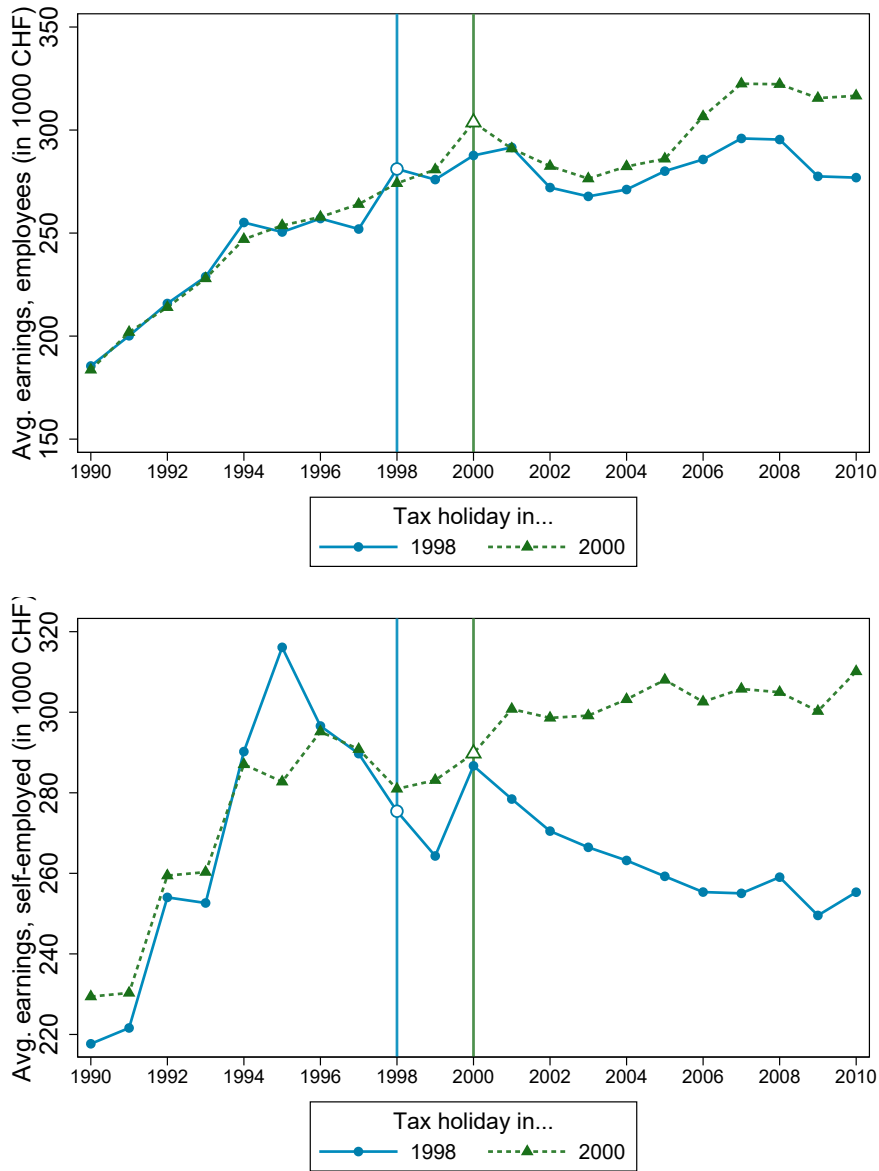


Figure 14: Effects on Early Tax Holiday on High Earners:  
Wages (top) and Self-Employment (bottom)

Notes: This figure displays average wage earnings (top) and average self-employment earnings (bottom) by year and groups of cantons from 1990 to 2010 for high income earners. The sample in a given year  $t$  is all individuals aged 20-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census) and had average annual labor earnings (wages plus self-employment) above 200,000 CHF in 1994-1996. Earnings are expressed in 1000s of 2010 CH francs (adjusted for inflation). The two groups of cantons are: (1) 2 cantons which transitioned in 1999 with a tax holiday in 1999 for local taxes and 1999-00 for the Federal tax (in blue), (2) 4 cantons which transitioned in 2001 with a tax holiday for 2000 only for local income taxes and 1999-00 for the Federal tax (in darker green). For each of the two groups, we represent the corresponding tax holidays 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).

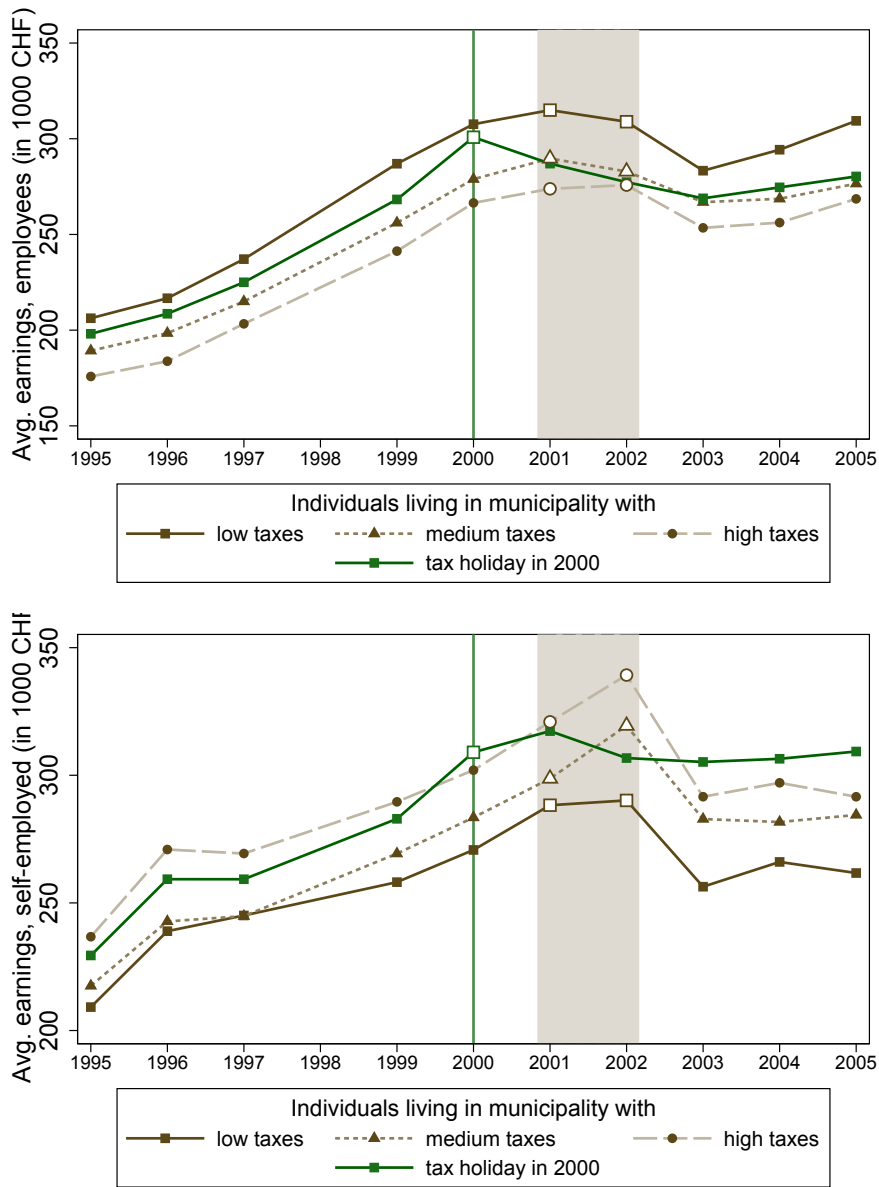


Figure 15: Effects on High Earners in Low vs. High Tax Areas:  
Wages (top) and Self-employment (bottom)

Notes: This figure displays average wage earnings (top) and average self-employment earnings (bottom) by year and groups of cantons from 1995 to 2005. The sample in a given year  $t$  is all individuals aged 20-69 in year  $t$  who are still alive and Swiss residents by 2010 (i.e., present in the 2010 Census) and had average annual labor earnings (wages plus self-employment) above 200,000 CHF in 1994-1996. Earnings are expressed in 1000s of 2010 CH francs (adjusted for inflation). We consider two groups of cantons: (a) 4 cantons which transitioned in 2001 with a tax holiday for 2000 only for local income taxes and 1999-00 for the Federal tax (in darker green), (b) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). Group (b) is further split into three subgroups of municipalities based on the level of taxes in each area: (1) low taxes (squares, solid line), (2) medium taxes (triangles, dotted line), (3) high taxes (circles, dashed line). 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 two groups, we represent the corresponding tax holidays periods using the vertical shading and the same color code. The figures show somewhat larger effects of the tax holiday in high tax areas, particularly for self-employment.

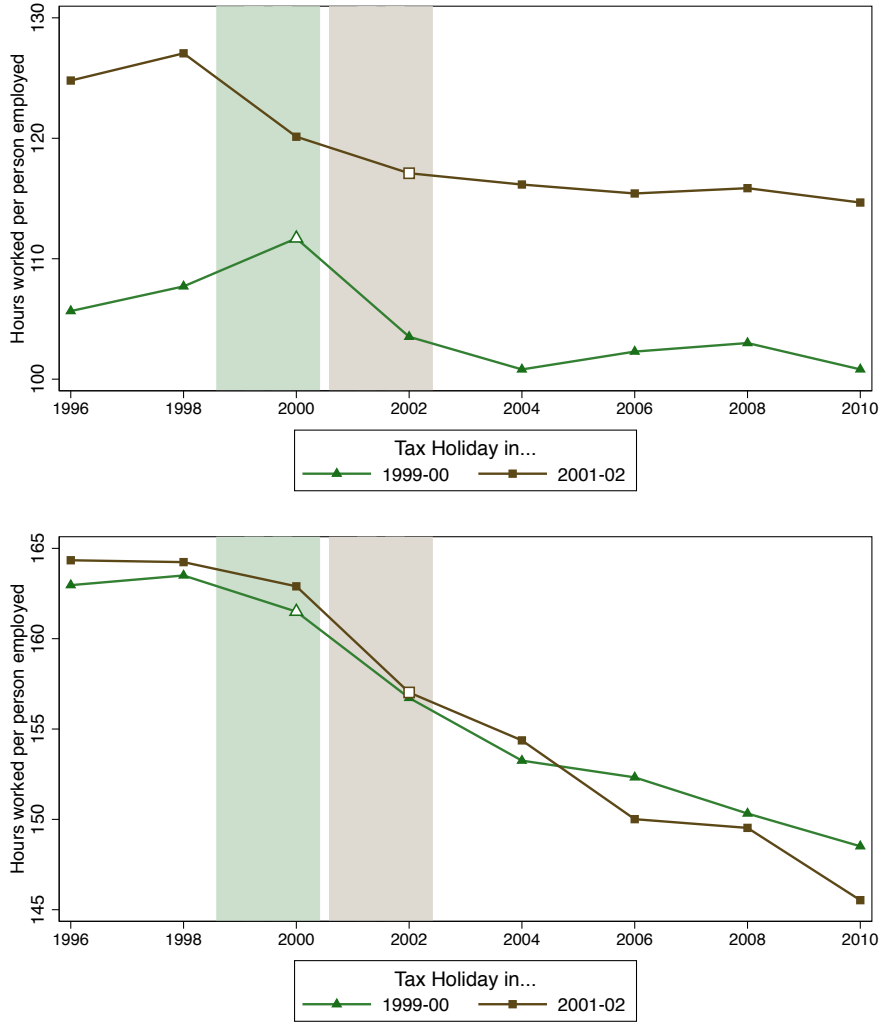


Figure 16: Hours Effects on Married (top) vs. Single (bottom) Women

Notes: This figure displays average hours of work per month for female employees (married in the top panel and single in the bottom panel) by year and groups of cantons from 1996 to 2010 using the wage structure survey (LSE) carried out bi-annually. The sample in a given year  $t$  includes all female employees in the dataset weighted to represent population averages. We consider two groups of cantons: (a) cantons which transitioned in 2001 with a tax holiday for 2000 or 1999-2000 (in darker green), (b) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). Geographical information in the data is based on place of work while tax treatment is based on residence. Hence, to reduce the number of cases where a person works in one group of cantons but resides in another one, we have excluded small cantons geographically close to cantons from other groups where such commuting is common. 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).

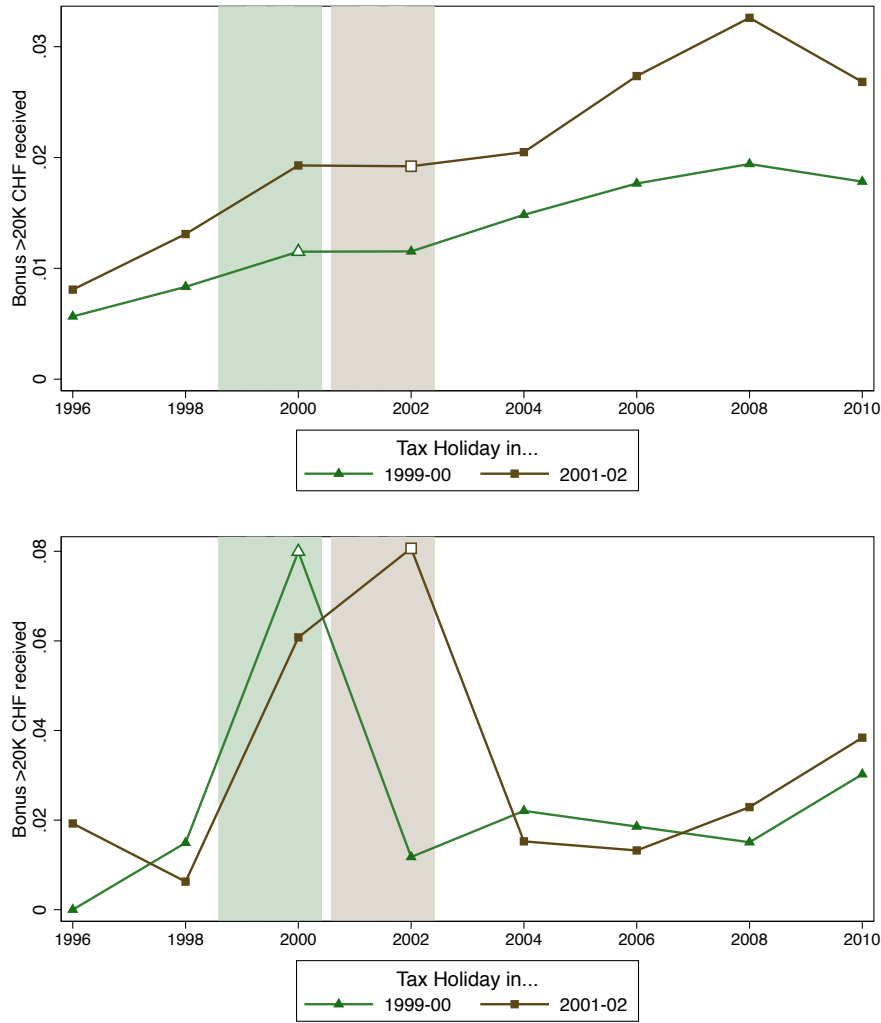


Figure 17: Effects on Bonuses among all Employees (top) and Insurance Sector (Bottom)

Notes: This figure displays the fraction employees with bonuses above 20,000 CHF by year and groups of cantons from 1996 to 2010 using the wage structure survey (LSE) carried out bi-annually. The sample in a given year  $t$  includes all employees in the dataset weighted to represent population averages. The top panel is for all employees while the bottom panel is for employees in the insurance industry sector only. We consider two groups of cantons: (a) cantons which transitioned in 2001 with a tax holiday for 2000 or 1999-2000 (in darker green), (b) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). Geographical information in the data is based on place of work while tax treatment is based on residence. Hence, to reduce the number of cases where a person works in one group of cantons but resides in another one, we have excluded small cantons geographically close to cantons from other groups where such commuting is common. 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).

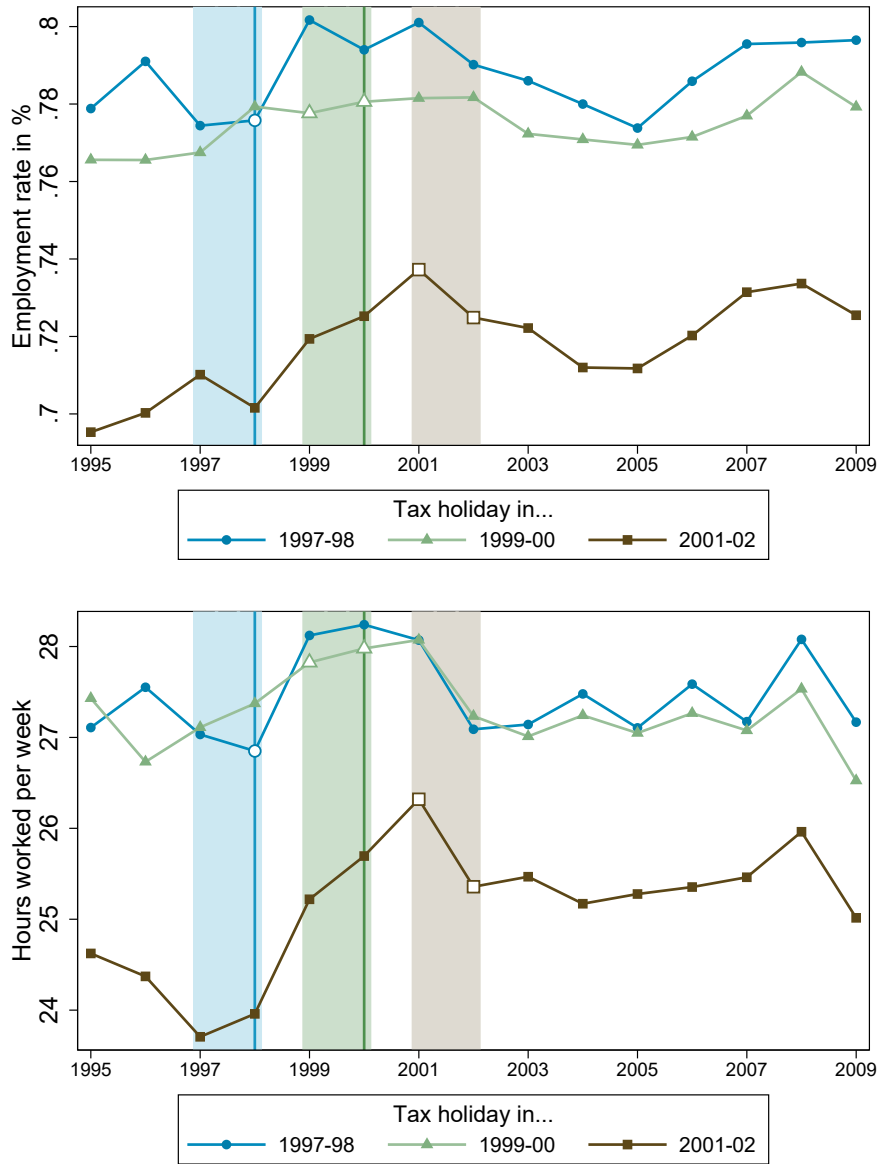


Figure 18: Effects on Employment Rate (top) and Hours (bottom) from the Labor Force Survey

Notes: This figure displays the employment rate (top) and hours of work per week (bottom) using the Labor Force Survey (SAKE). The sample in a given year  $t$  includes all individuals aged 20-69. For hours of work, we restrict the sample to employees. We consider 3 groups of cantons. (1) 2 cantons which transitioned in 1999 with a tax holiday in 1998 or 1998-98 (in blue), (2) 20 cantons which transitioned in 2001 with a tax holiday in 1999-00 or 2000 (in green), (3) 3 cantons which transitioned in 2003 with tax holiday in 2001-02 (in brown). 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 figure does not display any tax holiday effects on the employment rate (consistent with our results using Social Security data) or on hours of work per week among workers.

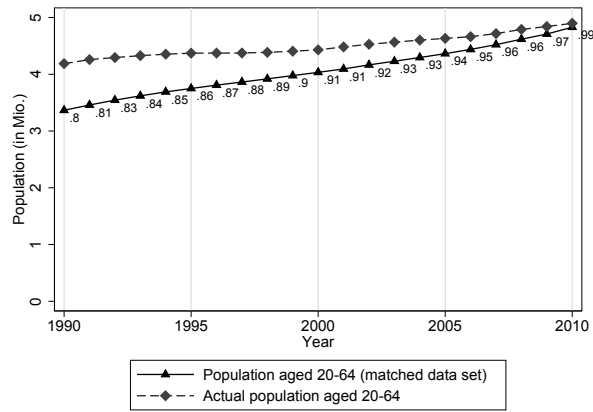


Figure A1: Sample coverage

Notes: This figure displays the total resident population of Switzerland aged 20-64 and the total population captured by our sample aged 20-64 (which are all individuals with a social security record in any year 1990-2010 and resident in Switzerland in 2010 so that they can be matched to the Census 2010). The numbers show the fraction of individuals in our sample vs. the full population. Coverage is closer to one in recent years (due to deaths and migration).

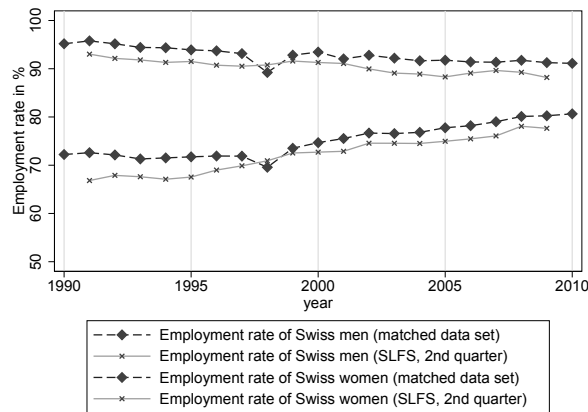


Figure A2: Accuracy of employment rate

Notes: This figure displays the employment rates of men and women separately in our sample vs. official statistics derived from the Swiss Labor Force Survey (SLFS).

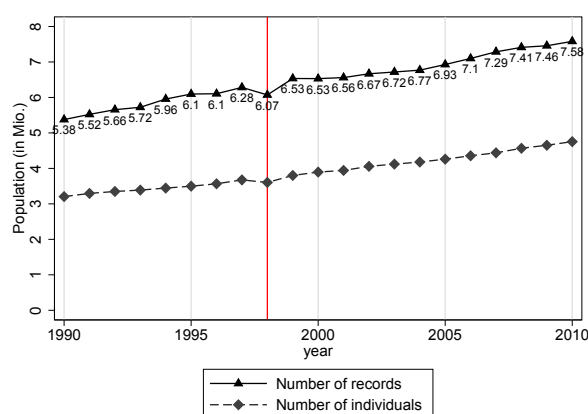
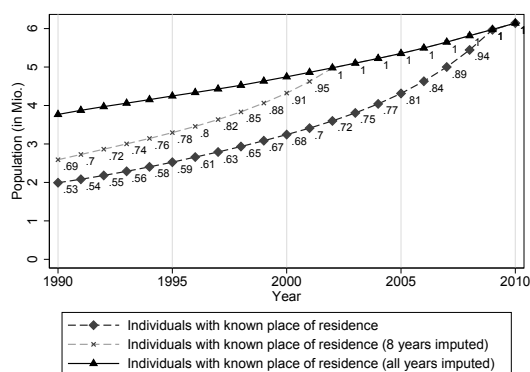


Figure A3: Missing records in 1998

Notes: This figure displays the number of records and individuals in our data by year and illustrates the issue of missing records in 1998 due to missing social security data for that year.

(a) Share with known place of residence



(b) Accuracy of imputed canton of residence

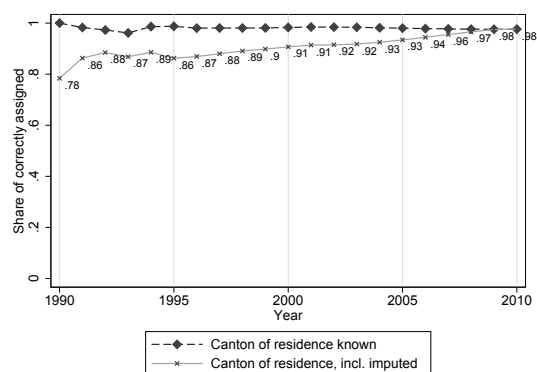


Figure A4: Imputation of municipality of residence

Notes: The figure displays statistics of the imputation of municipality of residence.



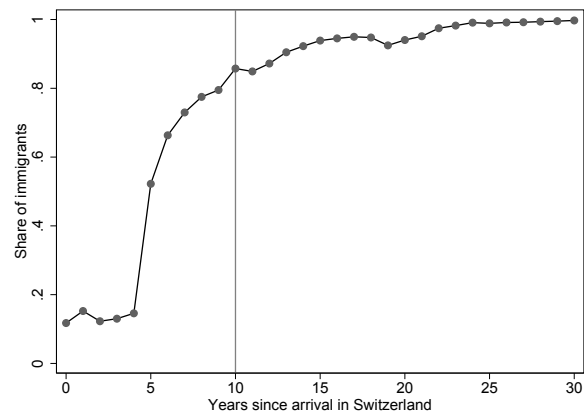


Figure A5: Share of immigrants with C permit or a Swiss passport, by duration of stay  
Notes: The figure displays the share of immigrants with C permit or a Swiss passport, by duration of stay.

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

	(1) Employment rate	(2) Earnings per person	(3) Wage per worker	(4) Labor income self employed
<b>Panel A: Total Sample</b>				
First federal blank year	0.001 (0.004)	0.391 (0.283)	0.249 (0.395)	2.084 (1.779)
Second federal blank year	-0.000 (0.004)	0.622** (0.283)	0.465 (0.395)	4.472** (1.779)
Sum of effect	0.001	1.013**	0.715	6.556**
Implied increase in income	0.001	0.022**	0.012	0.118**
<b>Panel B: Men</b>				
Sum of effect	0.001	2.040***	1.347*	8.391***
Implied increase in income	0.001	0.031***	0.018*	0.128***
<b>Panel C: Women</b>				
Sum of effect	0.001	0.117	0.089	1.737
Implied increase in income	0.002	0.004	0.002	0.056
<b>Panel D: Married Women</b>				
Sum of effect	0.002	0.129	0.084	2.390*
Implied increase in income	0.003	0.006	0.002	0.080*
<b>Panel E: By labor income in 94/96</b>				
<b><i>1–25000 CHF</i></b>				
Sum of effect	0.001	0.258	0.122	2.681**
Implied increase in income	0.001	0.010	0.004	0.106**
<b><i>25k–50k CHF</i></b>				
Sum of effect	-0.002	0.585	0.274	3.971**
Implied increase in income	-0.002	0.014	0.006	0.100**
<b><i>50k–100k CHF</i></b>				
Sum of effect	-0.003	0.958**	0.606	7.135**
Implied increase in income	-0.003	0.014**	0.008	0.125**
<b><i>100k–200k CHF</i></b>				
Sum of effect	0.005	5.734***	4.110*	15.296**
Implied increase in income	0.006	0.048***	0.031*	0.129**
<b><i>More than 200k CHF</i></b>				
Sum of effect	-0.008	20.429***	18.987**	32.986**
Implied increase in income	-0.009	0.077***	0.072**	0.120**

Notes: TBA

Table 3: Regression Analysis of Tax Holidays: Residualized Outcomes

	(1) Employment rate	(2) Earnings per person	(3) Wage per worker	(4) Labor income self employed
<b>Panel A: Total Sample</b>				
First federal blank year	0.000 (0.001)	0.351 (0.263)	0.256 (0.365)	1.255 (1.219)
Second federal blank year	0.000 (0.001)	0.652** (0.263)	0.447 (0.365)	3.486*** (1.219)
Sum of effect	0.001	1.002**	0.703	4.741***
Implied increase in income	0.001	0.022***	0.012	0.085***
<b>Panel B: Men</b>				
Sum of effect	0.001	2.079***	1.323	6.571***
Implied increase in income	0.001	0.032***	0.018	0.100**
<b>Panel C: Women</b>				
Sum of effect	0.002	0.240	0.166	1.101
Implied increase in income	0.003	0.008	0.004	0.036
<b>Panel D: Married Women</b>				
Sum of effect	0.001	0.084	0.056	1.878**
Implied increase in income	0.001	0.004	0.002	0.063**
<b>Panel E: By labor income in 94/96</b>				
<b><i>1–25000 CHF</i></b>				
Sum of effect	0.000	0.272	0.108	2.016***
Implied increase in income	0.000	0.011	0.003	0.080***
<b><i>25k–50k CHF</i></b>				
Sum of effect	-0.002	0.708	0.381	3.733**
Implied increase in income	-0.002	0.017	0.008	0.094**
<b><i>50k–100k CHF</i></b>				
Sum of effect	-0.002	1.089*	0.638	5.168**
Implied increase in income	-0.002	0.016*	0.009	0.090**
<b><i>100k–200k CHF</i></b>				
Sum of effect	0.004	5.601***	3.854***	11.069**
Implied increase in income	0.004	0.046***	0.029***	0.093**
<b><i>More than 200k CHF</i></b>				
Sum of effect	-0.007	21.044***	18.622**	31.356***
Implied increase in income	-0.008	0.079***	0.070**	0.114***

Notes: TBA

Table A1: Biennial income growth rates (in percent)

Blank years:	full sample		female		self-employed		high-income		age 56-69	
	99-00	01-02	99-00	01-02	99-00	01-02	99-00	01-02	99-00	01-02
Total labor income										
1994-95	12.96	12.18	13.92	12.87	8.76	8.79	21.01	20.52	4.40	3.50
1996-97	9.99	9.43	10.89	9.85	9.05	8.61	7.01	7.39	2.17	1.67
1999-00	<b>14.27</b>	14.33	<b>14.61</b>	14.23	<b>9.12</b>	10.33	<b>6.91</b>	7.54	<b>2.78</b>	2.93
2001-02	13.44	<b>14.82</b>	14.47	<b>14.38</b>	12.48	<b>18.05</b>	1.24	<b>10.14</b>	3.79	<b>5.64</b>
2003-04	9.29	9.01	10.32	10.20	8.61	6.05	0.18	-4.24	1.65	1.18
2005-06	10.84	10.57	11.08	10.39	9.33	9.75	4.26	6.73	2.97	3.23
Income from self-employment										
1994-95	10.40	7.75	14.68	12.22	21.01	21.68	26.16	24.57	0.12	-0.64
1996-97	13.05	13.01	14.14	12.02	24.47	26.47	9.45	6.57	5.92	6.82
1999-00	<b>7.62</b>	9.89	<b>7.29</b>	9.36	<b>25.35</b>	27.98	<b>-3.89</b>	-2.70	<b>-0.76</b>	4.51
2001-02	13.50	<b>18.10</b>	18.69	<b>18.41</b>	28.31	<b>37.20</b>	0.65	<b>17.02</b>	2.02	<b>8.23</b>
2003-04	8.54	4.39	8.94	7.56	21.08	18.88	4.02	-2.00	3.10	0.42
2005-06	7.89	8.39	7.73	9.16	20.23	22.26	2.06	5.21	3.13	5.20

Notes: This table displays the average biennial income growth rate of total labor income (top panel) and of income from self-employment (bottom panel). Note that the year 1998 is skipped due to missing data in that year. The full sample in a given two-year period includes all individuals aged 20-69 with total annual labor income > 10,000 CHF and present in both years of a biennial period. We subsequently restrict the sample to women, the self-employed, those with average incomes > 200,000 over the years 1994-1996, and those aged 56-69, respectively. We further split each sample into two groups of cantons: (1) 20 cantons which transitioned in 2001, with a tax holiday in 1999-00 for both the Federal and local income taxes (except for 4 cantons which had only a one-year holiday at the cantonal level in 2000), (2) 3 cantons which transitioned in 2003 with tax holiday in 2001-02. Numbers in bold italic font indicate a blank year period. Growth rates are in real terms. To reduce the impact of outliers, we winsorized the top 5% of the growth rates. Differences in means are all statistically highly significant and hence omitted in the table. The table indicates that responses were strongest in the last group of cantons changing system in 2001-02, and that responses are concentrated among most responsive subgroups, namely self-employed, high-income earners, and older workers.