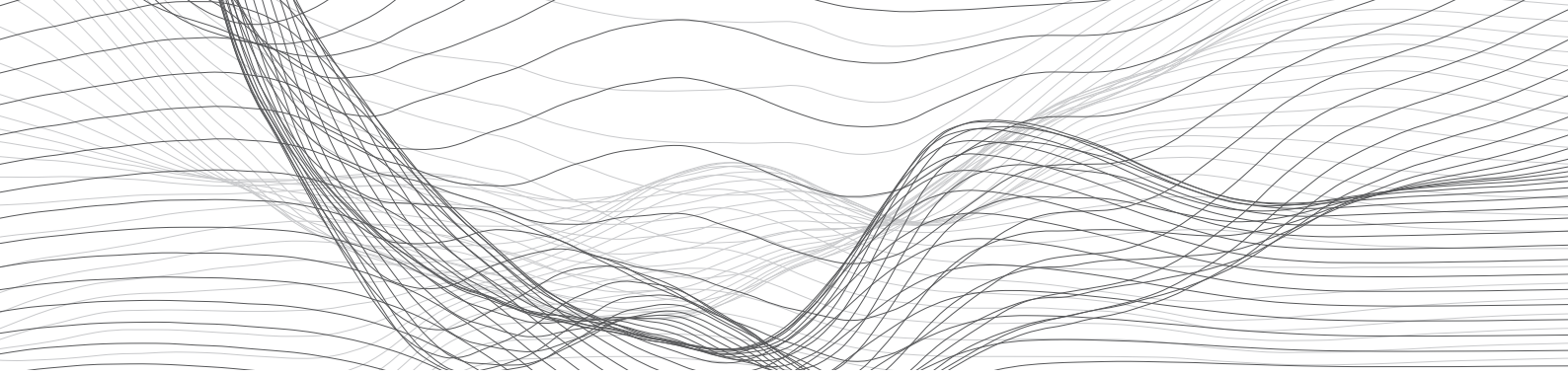

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Do the rich pay their taxes early?

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Abstract

This paper examines the effects of household income on interest credits from early tax payments. The hypothesis that the richest households from high-income municipalities pay their income taxes early is tested in a demand specification for interest credit for early tax payments. The empirical analysis uses regional data from 170 municipalities in the canton of Zurich from 2007 to 2013. A one standard deviation increase in the ratio for household income between the mean and the 75th percentile increases the ratio of interest tax credit to total taxes by 5%. The finding that high-income households pay their taxes early supports the view that institutional arrangements supporting early tax payments make the (effective) tax system more regressive for high-income households.

Keywords: early tax payment, demand for interest credit on early tax payment
JEL Classification Number: D14, D30, E21, E41, H31

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1. Introduction

Tax authorities in several countries offer interest credits on early income tax payments and impose interest penalties on late income tax payments.[1] The rationale for a tax system that offers interest tax credits and debits linked to the timing of a tax payment is to motivate orderly tax compliance by households and to facilitate tax collection by the state. Penalties for late tax payments are designed to achieve compliance. Similarly, early tax payments aid tax authorities in distributing their resources for tax collection more evenly throughout the year. A larger interest rate wedge for early and late payments makes these forces more important. At issue is to determine whether a progressive tax policy that rewards early tax payment favors the rich. If only high-income households benefit from early tax payments, this makes the (effective) tax system more regressive.

This paper is the first to our knowledge to examine the distributional effects of household income at the municipality level on interest credits from early tax payments. The hypothesis that the richest households from high-income municipalities pay their income taxes early is tested using a demand specification for interest credits for early tax payments. At issue is to determine whether a tax system that rewards early tax payments is neutral towards all households.

In the absence of being able to resort to confidential information on the timing of tax payments of individual households, the heterogeneous regional

[1] Many Anglo-Saxon countries offer early payment discounts, including the time-varying rates for the United Kingdom under https://www.gov.uk/government/publications/rates-and-allowances-hmrc-interest-rates-for-late-and-early-payments/rates-and-allowances-hmrc-interest-rates.

distribution of interest credits on early tax payments is an attractive alternative to study issues of income inequality. The empirical sample encompasses 170 municipalities in the canton of Zurich from 2007 to 2013. In this sample, the average share of interest credits on early tax payments over total cantonal taxes is 0.5%. The empirical analysis works with a set of high and low income households within the municipality as opposed to having information at the individual level. The set of richest households at the municipality level is identified by the observation that average household income is larger than household income at the 75th percentile for several high income municipalities. In the extreme case, average household income is larger than household income at the 75th percentile by a multiple of five.

The empirical findings suggest that financial incentives designed to facilitate tax collection make the tax system regressive for high-income households.[2] The analysis finds that the richest households from high-income municipalities benefit the most from interest credits from early tax payments. The main finding is that a one standard deviation increase in average household income over the 75th percentile of household income increases the ratio of interest tax credit to total taxes by 5%.

The empirical findings on the distributional effects from early tax payments add to the literature on the relationship between tax reductions and income inequality. Studies by Brewer et al. (2010), Duncan and Sabirianova Peter (2016), Piketty et al. (2014), and Slemrod (1996) have examined cross-country evidence or within-country variations of progressive taxes and income

[2]There is no evidence that cantonal taxes became more progressive after the introduction of early payments. Such an action would offset the regressive outcome arising from early tax payments.

inequality. However, the relationship between income taxation and income inequality remains unclear. We add to this debate and show that reductions in progressive taxes may need not only occur through legislative tax reform but can also arise due to government incentives that reward early tax payments.

The paper is organized as follows. Section 2 documents features of early and late tax payments in several countries. The same section also discusses institutional features for the canton of Zurich that are used in the empirical analysis. Section 3 presents the empirical framework and discusses the data. Section 4 presents the empirical findings. Section 5 provides final remarks.

2. Early and late tax payment

This section discusses international and local features of early and late tax payments. The next subsection documents the international phenomena of interest tax credits and interest penalties of early and late tax payments. This is done to show that the Swiss case is not unique and that the interest rate wedge between early and late tax payments in Switzerland is smaller than in many other countries. These observations suggest that our empirical findings are relevant for other countries. Thereafter, the next subsection reviews the main institutional procedures for early and late tax payments in the canton of Zurich. These local features are used in the empirical analysis presented in Section 4.

2.1 International comparison of early and late tax payments

Numerous countries reward early tax payments.[3] Early tax payments aid

[3]Examples of countries that reward early tax payments at the national or federal level

tax authorities in distributing their resources for tax collection more evenly throughout the year. Similarly, taxpayers seeking interest tax credits are motivated to be compliant and transparent with their tax declarations. Such behavior reduces resources devoted to controlling and monitoring tax declarations by the authorities.

Figure 1 plots credit and debit interest rates on early and late tax payment for several countries. Three observations can be taken from these plots. First, debit interest rates for late tax payments tend to be higher than credit interest rates for early payments. The interest rate gap in the two rates varies over time and over countries. Second, the two interest rates have fallen across countries since the 2007 to 2009 Global Financial Crisis. This development reflects the international movement of short-term interest rates and the expansionary monetary policies in response to the financial crisis. Third, the tax wedge between early and late tax payments (i.e., the sum of the two rates) has fallen sharply over the last ten years. In many countries, expansionary monetary policies have reduced the tax wedge by one-half. In the international comparison, the Swiss wedge in 2016 is the second smallest after Sweden.

2.2 Early and late tax payment in the canton of Zurich

Cantonal tax authorities levy three types of interest rates on early or late tax payments. For early tax payments, taxpayers receive interest tax credits on the early payment amount and on the overpaid portion.[4] In the canton of

include Australia, Canada, New Zealand, Sweden, and the United Kingdom. Other countries such as Italy or Germany do not recognize early tax payments.

[4]Appendix A1 illustrates two examples of interest tax credit and debit payments and shows their impact on the effective tax rates.

Zurich, there is no legal restriction on the size of the (over)payment. Consequently, the tax authority behaves similar to a bank (on the liability side of the balance sheet). Tax declarations for income earned in year t need to be sent to the Municipal Tax Authorities by March 31 in the following year $t+1$.[5] Taxpayers have the option to fully pay in advance their (provisional) income taxes before September 30 of the tax year t and receive an interest tax credit or to pay their taxes in three installments by the end of June, September, and December and receive on balance no (net) interest tax credit. In most cases, the tax window for early tax payment is three months.[6] The interest rate for early tax payments (i.e., Verguetungszins) in the canton of Zurich was constant at (annualized) 2% between 1999 and 2011.[7] Thereafter, it was 1.5% until 2015 and 0.5% in 2016.

The interest tax credits for early tax payments for cantonal taxes in Zurich consists of two parts for tax payers. The first part pays interest on the portion of early payment prior to the 30th of September. A second part also pays interest on the overpaid portion after the 30th of September until the final tax bill has been settled (generally after two years):[8]

$$credit_t = P_t \cdot cir_t \cdot (dc/360) + A_t \cdot cir_t \cdot (dc'/360), \tag{1}$$

where $credit_t$ denotes the volume of interest tax credits (hereafter, interest tax credits) for tax year t received by the household taxpayer, $P_t > 0$ is the

[5]Extensions are possible, but they need to be requested.

[6]The window can be theoretically larger in that, as it is possible for households in the canton of Zurich to make early tax payments starting in January 2.

[7]Each Swiss canton sets their own credit interest rates for early or late tax payments.

[8]This formula is a simplification but representative for interest tax credit calculations.

payment by the household towards the tax bill for year t, cir_t is the interest rate applied for early tax payments (hereafter, credit interest rate) for year t, and dc is the size of the early payment window measured in days. Next, $A_t > 0$ is the difference between the tax payment and the tax bill and dc' is the overpayment window from 30th of September to the date of the final tax bill.

A second interest rate applies to the outstanding difference between the provisional and the final tax declaration. This difference results in an interest tax debit for the taxpayer when $A_t < 0$. The interest rate on the outstanding amount to be paid (i.e., Ausgleichszins, dir) is the same as the rate for early payments (cir) in the canton of Zurich. Interest tax debit is:

$$debit_t = A_t \cdot dir_t \cdot (dd'/360), \tag{2}$$

where $A_t < 0$ is the outstanding difference between the tax payment and tax bill and dd' the underpayment window (date of the tax bill - mean maturity date).

A third interest rate (i.e., Verzugszins) applies to tax bill payments in arrears after the date of the final tax bill.[9] This rate was 2% from 1999 to 2007 and thereafter has been constant at 4.5%.

Figure 2A plots the 3M Libor and the credit interest rate (and the equivalent debit interest rate) for our sample from 2007 until 2013. The 3M Libor declined sharply between 2008 and 2009. During this time, the credit interest rate hardly moved. The credit interest rate was lowered by 0.5% only

[9]The application date for tax payments in arrears depends on the finalization of the tax account, which is often after two years.

after three years. Figure 2B shows the volume of interest tax credits and interest tax debits at the cantonal level. Interest tax debits exceeded interest tax credits before 2009. This may be interpreted as suggestive evidence that households favored late payments or underpayments of taxes. After 2009, the payment habits switched in that interest tax credits dominated the interest tax debits. This suggests that early payments and overpayments of taxes became more pronounced after the financial crisis.

3. Empirical framework and data

This section has two parts. The empirical model to test the hypothesis that the richest households within municipalities pay their income taxes early is presented in the first subsection. The data are discussed in the second subsection.

3.1 Empirical framework

The underlying mechanism that we seek to capture is the following. A household owes taxes to the state according to his annual earnings and wealth. At the beginning of the tax period the annual income is not always predetermined and therefore the tax debt that is due at the end of the period maybe unknown. At the beginning of the period, the household can immediately consume from his current income and past savings. The remaining cash may be deposited in a savings account (conventional savings) or used to prepay the expected tax debt (unconventional savings). The use of tax prepayments as a savings channel depends on (i) relative returns (i.e., the difference in the credit interest rate and interest rates on savings account), (ii) the liquidity demand throughout the tax period (early tax payments are irreversible) and

(iii) the ability to pay a large portion at the beginning of the year.

The demand specification for interest tax credit is the aggregate of the individual tax relations at the municipal level defined by equation (1). By replacing $P = s \cdot T$ (i.e., the share of the tax bill paid early) and dividing both sides by T, the relation $C/T = s \cdot cir \cdot dc/360$ is obtained.[10] The demand for interest tax credit depends on the share of the tax bill paid early, s, and the own rate, $cir \cdot dc/360$. These two variables in turn are similar to those that enter a regional demand function for cash, which include income, wealth, measures of opportunity costs, and regional controls (Fischer (2014)).[11] The demand specification for interest credit for early tax payments is the following:

$$c_{it} = \beta y_{it} + \gamma x_{it} + \lambda t + \rho i + \varepsilon_{it}, \tag{3}$$

where c_{it} denotes the *interest tax credit* scaled by *tax bill* at the municipality level for municipality i and year t. Next, the variable y_{it}, denotes income percentile ratios measured at the municipality level. This variable should be positively correlated with c_{it}. Regional control variables are denoted by x_{it}. These include population and demographic variables, employment levels, tax rates, and home ownership rates at the municipality level. Annual time effects (capturing the opportunity costs linked to cir and other short-term rates) and municipal fixed effects are captured by t and i and the residuals by ε_{it}.

[10] We abstract from the second (overpayment) part for simplification. Even with the overpayment part, the interest tax credit to tax bill ratio is equivalently dependent on s and $cir \cdot dc/360$.

[11] Other regional money demand studies include Lippi and Secchi (2009), Mulligan and Sala-i-Martin (1992), Fischer (2007), Jankowski et al. (2007), and Fujiki (2002).

Percentile ratios for household income at the municipality level are used, because we want to identify low and high income households in municipalities with low or high average household income. Four within-municipality inequality ratios for household income are considered (due to data availability, discussed in the next subsection): (1) median to 25th percentile, (2) 75th percentile to median, (3) mean to median and (4) mean to 75th percentile. The first two ratios control whether lower and middle income households in possibly high average income municipalities are driving our results. The latter two ratios capture the right-skewness of the within-municipality income distribution. The motivation is to identify a set of extremely rich households (through an exceptionally high mean) within a municipality.

The variable of interest is the coefficient for y_{it}, β, in regressions with different percentile ratios for household income at the municipality level. The coefficient can be interpreted as a one standard deviation increase in the ratio for household income between the Xth percentile and the Yth percentile increases the ratio of interest tax credit to total taxes by $\beta \cdot$ sample standard deviation of the income ratio between X and Y multiplied by 100. The hypothesis that the rich pay their taxes early is supported if the following condition holds. The coefficient, β^h, for municipalities with high income inequality (i.e., the municipalities in which average household income is greater than the 75th percentile) should be greater than β^l for municipalities with lower income inequality.

3.2 Data

The sample frequency is annual from 2007 to 2013 for the 170 municipalities

in the canton of Zurich, yielding 1190 observations.[12] Interest tax credits for early income tax payments are for households residing in the canton of Zurich aggregated at the municipal level. Swiss residents pay municipal, cantonal, and federal taxes on their income and wealth. We use cantonal interest tax credits, which apply only to cantonal taxes that have a uniform tax rate. The data source is the Department of Finance of the canton of Zurich.

The canton of Zurich does not separately distinguish between households and firms in interest tax credits at the municipal level. We overcome this limitation in that interest tax credits for a particular tax year do not track the full historical payments records of 15 years.[13] We truncate the interest tax credit and debit variables after two years, because household taxes are generally settled after two years.[14] Interest tax credits for tax year t are thus the sum of interest tax credits paid out in years t, $t+1$, and $t+2$. In truncating the municipal interest tax credits after two years, we seek to diminish the influence of firm behavior at the regional level.[15]

The interest debit payments from households are comprised of early under payments and tax bill payments in arrears. This means the volume for debits has two separate (penalty) interest rates. The opportunity cost measure for interest tax debits is thus less precise in the estimation than in the case

[12]There are 171 municipalities in the canton of Zurich as of December 31, 2013. We exclude one municipality from the analysis because there is no information for average household income.

[13]Tax claims expire after 15 years.

[14]Discussions with the Cantonal Tax Office revealed that only in exceptional cases are household taxes not finalized after two years. Instead, it is common for firms to take longer to arrive at final tax settlements.

[15]Figure A2 in Appendix A2 shows that the bulk of the transfers for a particular year occur within the first two years. Regressions in the next section and in Appendix 2 document that the statistically significant effects from early and late tax payments pertain to household income and wealth and not to firm profits and equity.

of interest tax credits, because the weighting of the two interest rates is unknown.[16]

Information on household income and other control variables are from different sources. Regional information on municipal tax rates, household income, household wealth, firm profits, firm equity, the number of unemployed, residential population, and the number of taxable households and firms in a municipality are from the Statistical Office of the canton of Zurich. Information on interest rates for early and late tax payments are from the Department of Finance of the canton of Zurich. The source for interest rates used to calculate alternative measures of opportunity costs is Datastream and the Swiss National Bank.

Figure 3 shows the ratio of interest tax credits on early tax payments to total cantonal taxes. The ratio jumps from 0.45% in 2007 to just under 0.6% in 2009. Thereafter, the ratio falls back to 0.45%. The average interest tax credit is CHF 149,900 for 170 municipalities in the canton of Zurich. This variable exhibits considerable variation across municipalities. The standard deviation is almost five times as large as the average. The minimum interest tax credit for a municipality for a given year is 0 and the maximum is CHF 10,7 million. The average interest tax credit per household at the municipality level is CHF 22.40 with a range minimum 0 and maximum CHF 351.0. Interest tax debits exhibit a similar average as interest tax credits but its maximums are more extreme.

Figure 4 shows a high level of heterogeneity across municipalities for av-

[16]The average interest rate wedge for interest tax credits and late tax payments after the tax bill is settled is 6% for our sample. Instead, the average interest rate wedge for interest tax credits and under tax payments is 3.7%.

erage household income in panel A and interest tax credits (per household) for early tax payments in panel B. The figure shows that municipalities surrounding the lake of Zurich have the highest levels of interest tax credits and household income. The cross regional correlation between the (average) household incomes and interest tax credits for the lakeside municipalities is 0.94.

Lorenz curves are a simple indicator of regional inequality. Figure 5 shows the Lorenz curves for household income, tax payments, and interest tax credits. These are measured at the municipality level. The figure shows that the level of municipal inequality for household income and household taxes paid are considerably lower than for interest tax credits. The Gini ratios for interest tax credits yield 2.5 more dispersion than household income and 1.65 more than household taxes paid.

Statistical information of the main regression variables is provided in Table 1. The average interest tax credit to tax bill ratio (multiplied by 1,000) at the municipal level is 4.20 with a minimum - maximum range between 0 and 9.02. Similarly, the average interest tax debit to tax bill at the municipal level is 4.71, however its minimum - maximum range is considerably larger and lies between 0 and 329.98. The average household income is CHF 65,600 and their minimum and maximum ranges between CHF 41,600 and CHF 581,500. Household wealth and municipal tax rates also show considerable heterogeneity. Table 1 also records statistics on percentile ratios for household income and household wealth within the 170 municipalities. The mean to 75th percentile ratio is an extreme measure of within municipality income inequality. Table 1 shows than on average the mean is below 75th percentile

of household income at the municipality level. However, the maximum shows there are municipalities where average household income at the municipality level is almost five times larger than the 75th percentile of household income at the municipality level. There are 8 municipalities where the average household income is larger than the 75th percentile. This set of high income households in high income municipalities, i.e., where mean household income is greater than the 75th percentile, defines our rich households.

4. Estimation results

This section presents regression results based on equation (3). The empirical evidence, documented in Tables 2 to 6 below, indicates that rich households, defined by the sets of percentile ratios for household income at the municipality level, pay their taxes early. The main finding is that a one standard deviation increase in the ratio for household income between the mean and the 75th percentile increases the ratio of interest tax credit to total taxes by 5%. This suggests that the main beneficiaries of a tax system which encourages early tax payment are the highest income households. Such a tax policy makes the tax system regressive for high-income households.

The evidence also shows that the rich pay less interest tax debit. The empirical findings indicate that interest tax debits for late payment and taxes in arrears are considerably more sensitive to changes in income than are early payments. A one standard deviation increase in the ratio for household income between the mean and the 75th percentile decreases the ratio of interest tax debit to total taxes by 41.3%.

The analysis also shows that wealth inequality at the municipality level

does not explain the demand for interest tax credit and interest tax debit. The non significance of percentile ratios for household wealth may be explained by the fact that a large share of household wealth is in housing. This means that household wealth is unlikely to be liquid enough to serve for early tax payment purposes.

The main empirical findings for early tax payment are presented in Table 2. The table summarizes empirical results for the effect of four percentile ratios for household income (i.e., 50th to 25th percentile, 75th to 50th, mean to 50th, and mean to 75th) on the dependent variable, interest tax credit to tax bill ratio. All regressions cover the full sample, include municipality fixed effects, year effects, and standard errors are clustered at the municipality level. Column 1 shows that 50th to 25th percentile ratio for household income at the municipal level has a positive coefficient of 0.33 is consistent with the view that higher income leads to greater use of early tax payment. This coefficient says that a one standard deviation increase in the ratio for household income between the 50th and the 25th percentile increases the ratio of interest tax credit to total taxes by 6%. However, this empirical result is not statistically significant.

The regression in Column 2 repeats the same regression as in Column 1 however with a set of control variables capturing municipal factors. These municipal controls are the municipal tax rate, the number of unemployed residing in the municipality over the municipality's population of 15 to 65 year olds, and the number of foreign citizens over the municipal population. Although low tax regions have a positive and weakly statistically significant effect on the interest tax credit to tax ratio, this does not change the result

in Column 1 that lower income households do not make use of early tax payment.

Columns 3 and 4 repeat the regressions from Columns 1 and 2 but consider now the effect capturing the income group between the 75th and 50th percentile. As for the lower income group defined by the household income ratio between the 50th and 25th percentile, the coefficient for the income ratio between the 75 and the 50th percentile is negative and statistically insignificant both in the regression with and without the control variables. We interpret the regression results in Columns 1 to 4 to be consistent with the view that lower and middle income households do not make strong use of early tax payment.

Next, Columns 5 and 6 repeat the same exercise as in the previous regressions in Columns 1 to 4 but replaces the income ratio between the mean and the 50th percentile. In regressions with and without the controls the coefficient is 0.2 and statistically significant. This says a one standard deviation increase in the ratio for household income between the mean and the 50th percentile increases the ratio of interest tax credit to total taxes by 6.3%. The same exercise is performed for the more restrictive income ratio between the mean and the 75th percentile. The results, presented in Columns 7 and 8, find that a one standard deviation increase in the ratio for household income between the mean and the 75th percentile increases the ratio of interest tax credit to total taxes by 5.4%.

Table 3 presents regressions from Table 2 with the interest rate differential between the interest rate for early tax payment and the 3-month Libor. In these regressions, year effects are replaced by the interest rate differentials.

The interest rate channel is an integral component of early tax payment. The positive and statistically significant coefficient says that households make greater use of early tax payment with an increase in the interest rate spread. The coefficients for the income ratios are unaffected by the introduction of the interest rate differential.

Table 4 presents further information on the household income ratios when average household income is greater than the 50th and 75th percentiles. The regressions show that the early payment results in Table 2 are driven by household incomes above the 50th and 75th percentile. Columns 1 and 2 repeat the same regressions as in Columns 5 and 6 of Table 2 but now drops 7 observations in which average household income is below the median. The regressions are nearly identical to those in Columns 5 and 6 in Table 2. Next, Columns 3 and 4 present regressions for 25 observations when average household income is above the 75th percentile. These results yield positive and statistically significant coefficients of 0.2. These coefficients are slightly lower compared to the coefficient of 0.4 presented in Table 2 for the full sample. Columns 5 and 6 present the same regression as in Columns 3 and 4 but for the case when average household income is below the 75th percentile. In both regressions the coefficients on the income ratios are negative and statistically insignificant. We interpret the evidence in Tables 2 and 4 to suggest that households with income above the 75th percentile in high income municipalities are the main beneficiaries of early tax credit.

Table 5 presents regressions that replace the household income ratio with household wealth ratios. The results show that there is no clear evidence that different levels of household wealth explain interest tax credit. In each

regression, the household wealth ratios are statistically insignificant. Further, the coefficient estimates tend to be smaller than in the case for household income and are in most cases negative. Based on this evidence, we conclude that wealth inequality captured by household wealth ratio has no effect on interest tax credit.

Table 6 presents regressions of interest tax debits on the four household income ratios at the municipality level. The results are similar to interest tax credits in that the household income ratios for lower to medium households, as measured by the 50th to 25th percentile and the 75th to 50th percentile ratios, to do not appear to make use of early tax payment nor are they subject to late payment charges. The income ratios for both coefficients are negative consistent with the theory but are statistically insignificant. The more interesting cases are for the household income ratios average to 50th percentile and average to 75th percentile presented in Columns 5 to 8. The coefficients for the household income ratios range between -1.5 and -3.3 and are statistically significant. The latter coefficient for the regression presented in Column 8 says that a one standard deviation increase in the ratio for household income between the mean and the 75th percentile decreases the ratio of interest tax debit to total taxes by 45.7%.

5. Conclusions

The empirical findings show that tax policy intended to facilitate tax collection through interest tax credits for early tax payments makes the tax system regressive for high-income households. High-income households are the main beneficiaries of tax systems that offer interest tax credits on early tax pay-

ments. A one standard deviation increase in the ratio for household income between the mean and the 75th percentile increases the ratio of interest tax credit to total taxes by 5%. Because the Swiss tax wedge for early and late payments is small by international comparisons, the empirical findings are relevant for other countries.

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Appendix

A1. Interest tax credits and debits: Timeline

This Appendix provides two illustrative examples of interest tax credit and interest tax debit payments in the canton of Zurich. Assume that the credit and debit interest rate is 2% for tax year t. Consider the case of overpayment of household A in Figure A1. Household A is a high-income household with a taxable income of 120,000 CHF, and household B has a taxable income of 80,000 CHF. They both pay taxes in the same municipality and have the same civil status. Household A pays CHF 10,000 early on May 2nd in year t for tax period t. On November 12th in $t+2$, the tax authority closes the tax account by making the following calculations: $10,000 \times 0.02 \times (151/360) = 83,8$ CHF interest tax credit is paid to household A as well as $3,514 \times 0.02 \times (773/360)$ = 150,9 CHF for overpaying the final tax bill. Household A also gets back his A_t = 3,514 so that his tax account for tax year t is closed. The early payment time window, dc, is from May 2nd to September 30th = 151 days and the overpayment window, dc', is between November 12th in $t+2$ to September 30th in t = 773 days.

Next, consider the case of underpayment. Household B does not pay early. However, because household B underpaid the final tax bill by his full tax debt, $-3,406 \times 0.02 \times (602/360)$ = -113,9 CHF of interest tax debit as well as 3,406 CHF of outstanding tax claims need to be paid to the canton of Zurich. If household B fails to meet this tax obligation, the tax authority will charge an interest rate of 4.5% for tax payments in arrears after 30 days.

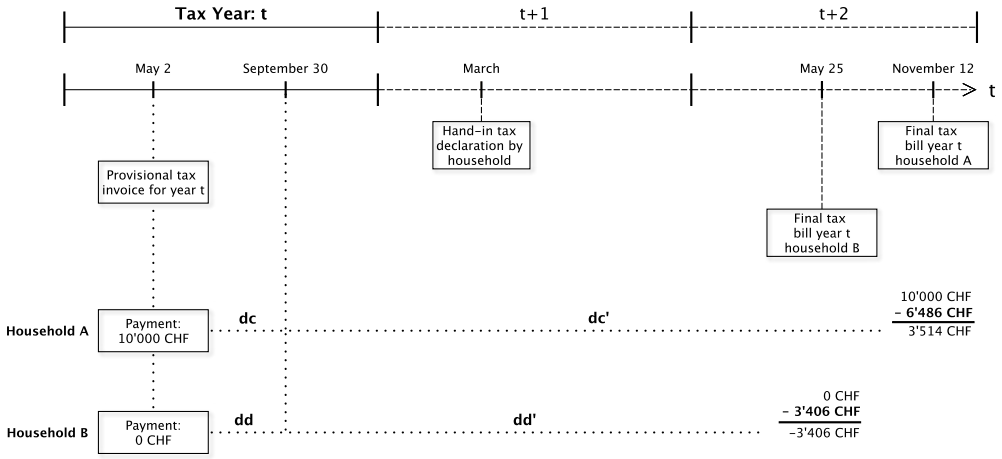


Figure A1: Timeline

Table A1 illustrates the impact of early payments and overpayments on the

effective tax rate. Since household A earned 234,7 CHF from paying early and overpaying his final tax bill, his effective tax bill is reduced from 6,486 CHF to 6,251 CHF. This results in a reduction of his effective tax rate by 3.6%. Household B's effective tax rate is 3.3% larger since his effective tax bill increased by 113,9 CHF. Therefore, households who are the main beneficiaries of interest tax credits are able to reduce their effective tax rate.

Set-up

Household	Taxable income	Municipality	Civil status	Tax rate	Tax bill
A	120,000	City of Zurich	married	5.405%	6,486
B	80,000	City of Zurich	married	4.258%	3,406

Early payment

Household	P_t	Date payment	Mean maturity date	dc	Interest credit
A	10,000	02.05.2013	30.09.2013	151	83.8
B	0	02.05.2013	30.09.2013	151	0

Over-/underpayment

Household	A_t	Mean maturity date	Date tax bill	dc'/dd'	Interest credit/debit
A	3,514	30.09.2013	12.11.2015	773	150.9
B	-3,406	30.09.2013	25.05.2015	602	-113.9

Tax rate calculation

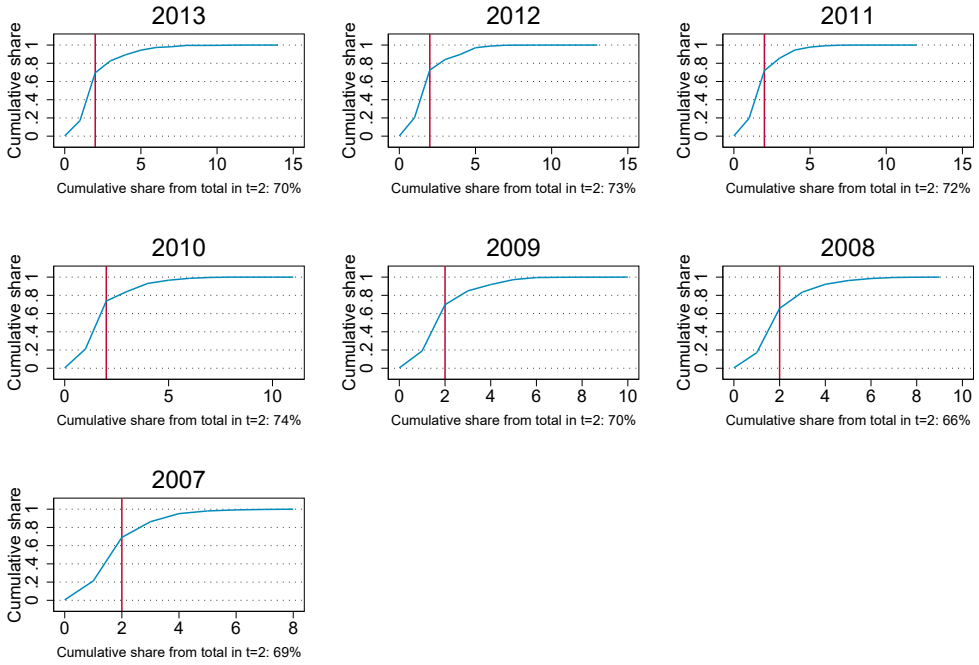
Household	Tax bill	Effective tax bill	Tax rate	Effective tax rate	Reduction
A	6,486	6,251	5.405%	5.209%	3.6%
B	3,406	3,519	4.258%	4.400%	-3.3%

Table A1: Effective tax rate calculation

A2. Data transformation: Interest tax credits

Under the Swiss tax code, interest tax credits for early tax payments arise through two channels. The first channel is through early payments for taxes declared in year $t+1$ for income earned in year t. The second channel is for early tax payments on provisional tax declarations that are higher than the definite tax declarations. Differences in tax declarations may take up to 15 years to resolve in Switzerland. It is generally the case that these differences are resolved after two years for households, while it may take longer for firms.

Data on interest tax credits for early tax payments for municipalities in the canton of Zurich have the limitation that there are no separate records for payments by firms and households. To filter out the longer-term effects arising from firms, the empirical analysis works with interest tax credits that are truncated after two years (i.e., interest tax credits for tax year t made in years t, $t+1$, and $t+2$). The same data transformation is also made for interest penalties for late tax payments. Figure A2 shows the cumulated share from total interest tax credits for early tax payments in the canton of Zurich for 2007 to 2013 accumulated across 171 municipalities for individual years.



Note: The x-axis reports the number of years past tax-period, the y-axis the cumulative share from total interest credit at the cantonal level.

Figure A2: Total interest tax credit

A3. No spatial effects between interest tax credit and firms

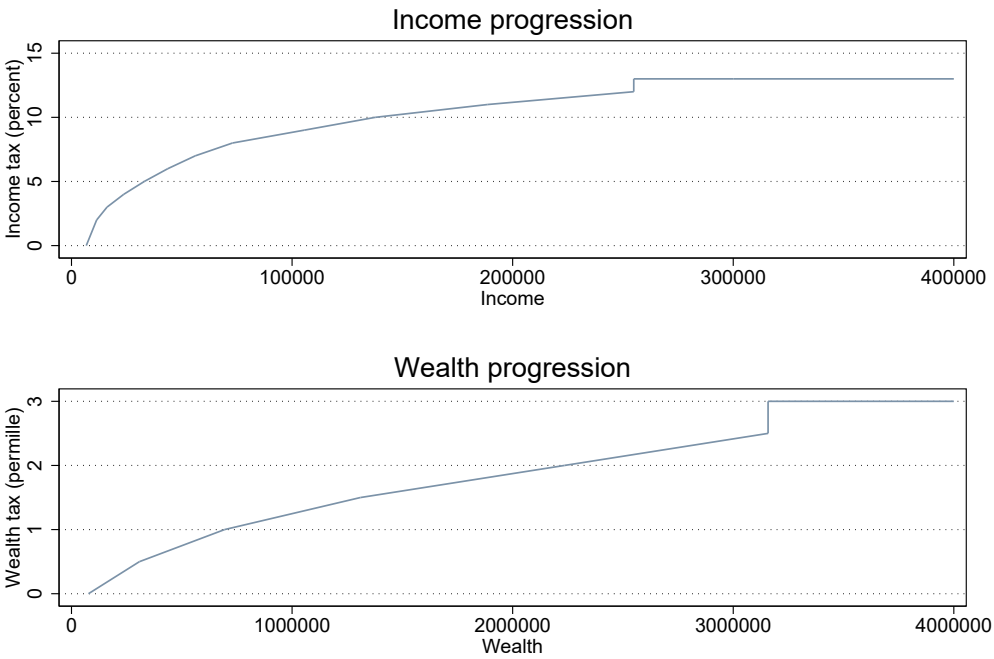
Table A2 shows that firm profits and firm equity are not statistically correlated with our truncated interest tax credit to tax bill and debit to tax bill ratios. This result suggests that firm profit and equity are not spatially concentrated as are high-income and low-income households. This result suggests that firms are not seeking to exploit the early payment mechanism. This is in line with what discussions with the officials of the tax office have revealed.

	Interest tax credit per tax bill				Interest tax debit per tax bill			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Average firm profit (in Mio. CHF)	-0.782	-0.877			47.811	45.599		
	(1.135)	(1.210)			(45.373)	(38.649)		
Average firm equity (in 1'000 CHF)			0.011	0.014			0.565	0.307
			(0.032)	(0.033)			(1.094)	(0.827)
Population density		-0.002		-0.002		0.046		0.048
		(0.001)		(0.001)		(0.040)		(0.043)
Tax rate firms (%)		-0.028**		-0.028**		0.127		0.103
		(0.011)		(0.011)		(0.089)		(0.075)
Share of unemployed		-0.150*		-0.147*		-0.341		-0.476
		(0.087)		(0.087)		(0.349)		(0.476)
Share of foreigners		0.003		0.001		-0.222		-0.169
		(0.047)		(0.047)		(0.218)		(0.195)
Share of social aid collectors		-0.106		-0.108		0.063		0.138
		(0.072)		(0.072)		(0.221)		(0.255)
Municipality fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.197	0.214	0.196	0.214	0.022	0.048	0.008	0.034
N	1190	1183	1190	1183	1190	1183	1190	1183

Clustered standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
The dependent variables are multiplied by 1'000.

Table A2: Firm profit and equity

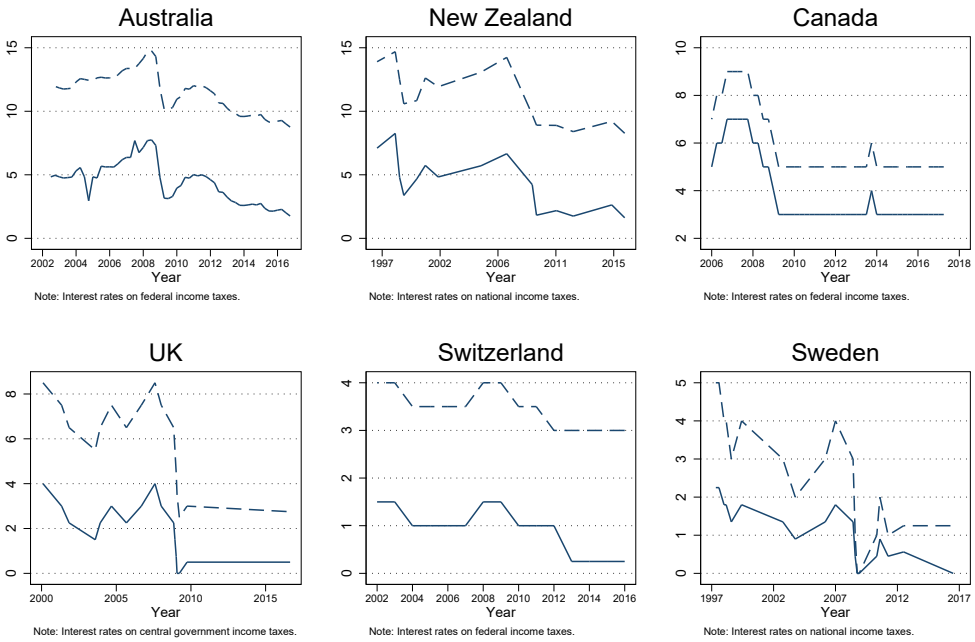
A4. Taxes in the canton of Zurich



Note: Tax rates for basic tariff.

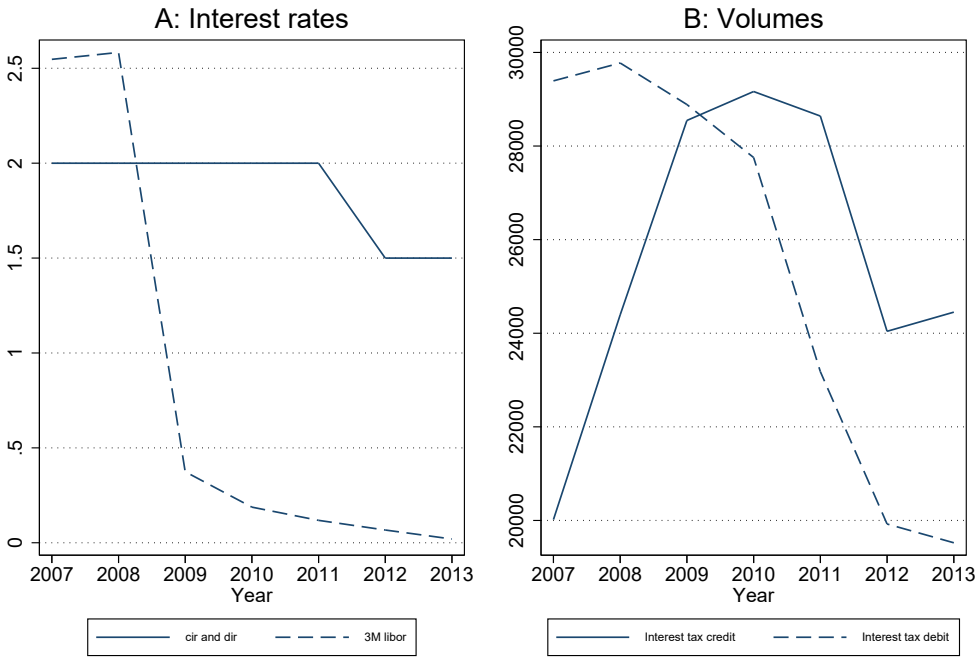
Figure A3: Cantonal tax structure for income and wealth

Figures



The y-axis is in %. Dashed lines are debit interest rates, solid lines credit interest rates. The figures are sorted by average tax wedge in descending order.

Figure 1: International comparison



Note: The credit and debit interest rates (cir/dir) as well as the 3M libor are in %, interest tax credit and debit are in 1,000 CHF.

Figure 2: Volumes and interest rates

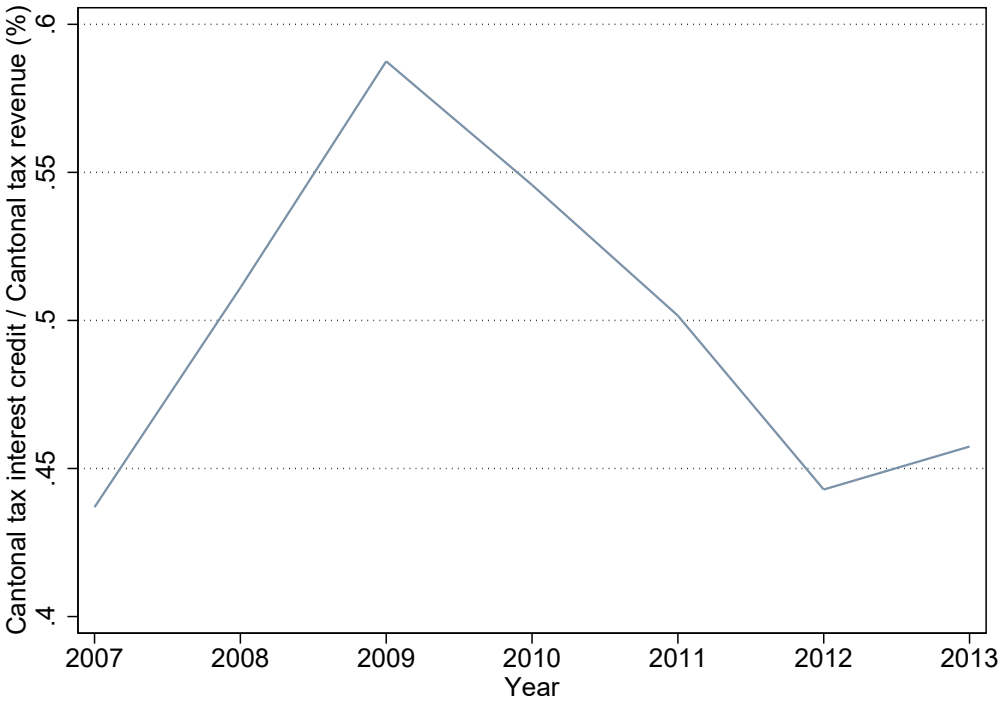
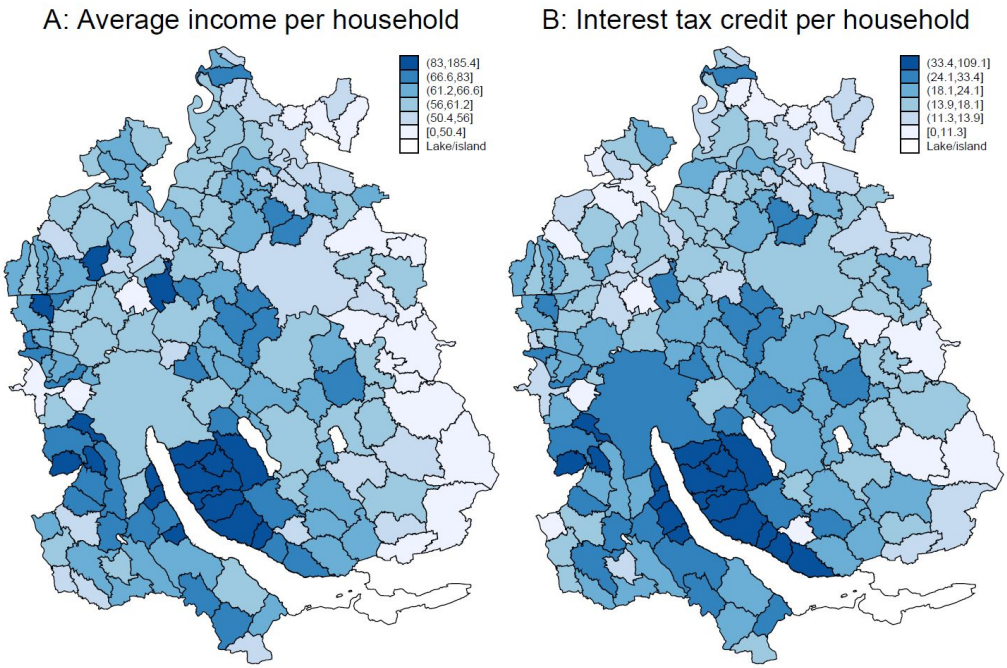
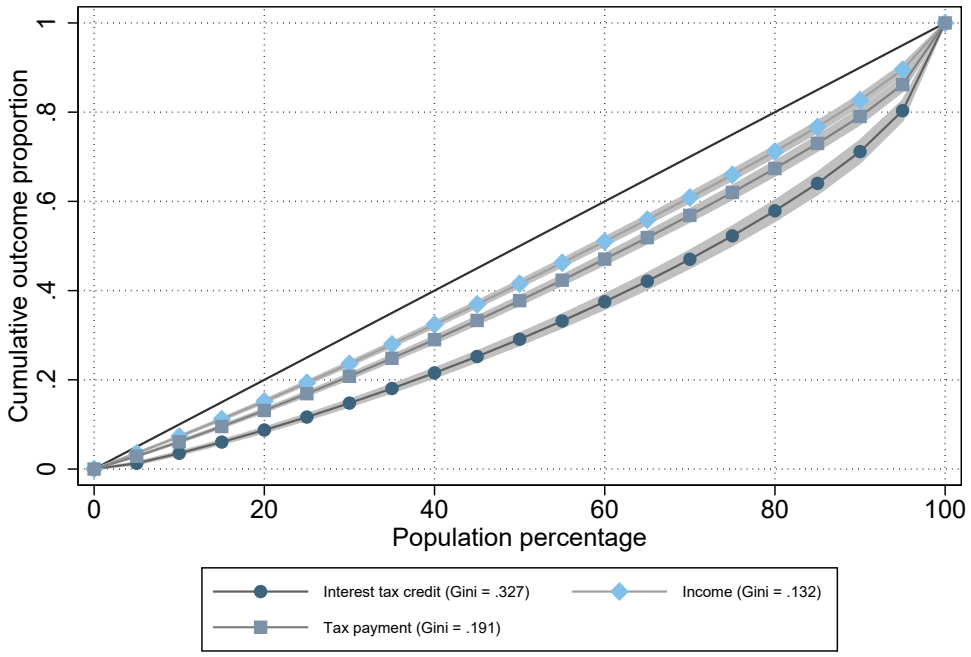


Figure 3: Ratio of cantonal interest tax credit to cantonal taxes



Notes: Shown numbers are averages over 2007-2013. Avg. income per HH is denoted in 1'000 CHF and interest tax credit per HH in CHF. 168 municipalities as per December 31 2016 are shown. 3 municipality pairs that merged since 2013 are depicted as mean values.

Figure 4: Spatial correlation



Note: Full sample (N: 1190)

Figure 5: Lorenz curves

Tables

	Mean	St. deviation	Min.	Max.	N
Dependent variables:					
Credit per tax bill (× 1,000)	4.20	1.18	0.00	9.02	1190
Debit per tax bill (× 1,000)	4.71	9.57	0.00	329.98	1190
Income inequality measures:					
Avg. HH income (in CHF)	65572.77	23480.43	41585.00	581506.00	1190
p50 to p25 of HH income	1.86	0.16	1.53	2.66	1190
p75 to p50 of HH income	1.57	0.11	1.40	2.06	1190
Mean to p50 of HH income	1.24	0.30	0.93	9.38	1190
Mean to p75 of HH income	0.78	0.14	0.63	4.94	1190
Wealth inequality measures:					
Avg. HH wealth (in CHF)	437862.18	375215.48	140000.00	3324000.00	1190
p50 to p25 of HH wealth	14.49	8.61	5.65	70.00	991
p75 to p50 of HH wealth	5.14	1.40	2.59	13.00	1190
Mean to p50 of HH wealth	5.88	3.03	2.07	25.00	1190
Mean to p75 of HH wealth	1.10	0.34	0.67	4.37	1190
Controls:					
Population density	698.98	715.27	40.50	4365.30	1190
Municipality tax rate	118.10	14.66	77.70	136.48	1190
Share of unemployed	1.85	0.72	0.00	4.74	1190
Share of foreigners	16.15	7.82	3.00	45.30	1190
Share of social aid collectors	1.79	1.32	0.00	7.80	1183
Share of homeowners	0.48	0.13	0.12	0.75	1190

Note: 199 municipality/year observations have zero p25 wealth.

Table 1: Summary statistics

	Dependent variable: Interest tax credit per tax bill (× 1,000)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
p50 to p25 of HH income	0.335	0.338						
	(0.343)	(0.340)						
p75 to p50 of HH income			-0.005	-0.022				
			(1.055)	(1.054)				
Mean to p50 of HH income					0.211***	0.211***		
					(0.035)	(0.035)		
Mean to p75 of HH income							0.390***	0.387***
							(0.068)	(0.067)
Population density		-0.002		-0.002		-0.002		-0.002
		(0.001)		(0.001)		(0.001)		(0.001)
Municipality tax rate		-0.023**		-0.023**		-0.022**		-0.022**
		(0.011)		(0.011)		(0.011)		(0.011)
Share of unemployed		-0.139		-0.146*		-0.142		-0.142*
		(0.087)		(0.086)		(0.086)		(0.086)
Share of foreigners		0.002		0.003		0.001		0.001
		(0.047)		(0.048)		(0.047)		(0.047)
Share of social aid collectors		-0.114		-0.108		-0.110		-0.110
		(0.072)		(0.072)		(0.072)		(0.072)
Municipality fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.197	0.212	0.196	0.211	0.199	0.214	0.199	0.214
N	1190	1183	1190	1183	1190	1183	1190	1183

Clustered standard errors in parentheses.

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

One municipality does not report information on social aid collectors and is thus dropped in columns (2), (4), (6) and (8).

Table 2: Income inequality

	Dependent variable: Interest tax credit per tax bill (× 1,000)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
p50 to p25 of HH income	-0.07	0.19						
	(0.35)	(0.34)						
p75 to p50 of HH income			-1.03	-0.80				
			(1.05)	(1.06)				
Mean to p50 of HH income					0.13*	0.18***		
					(0.07)	(0.05)		
Mean to p75 of HH income							0.25*	0.34***
							(0.13)	(0.08)
cir - 3M libor	0.22***	0.27***	0.22***	0.27***	0.21***	0.27***	0.21***	0.27***
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)
Population density		-0.00**		-0.00**		-0.00**		-0.00**
		(0.00)		(0.00)		(0.00)		(0.00)
Municipality tax rate		-0.03**		-0.03**		-0.03**		-0.03**
		(0.01)		(0.01)		(0.01)		(0.01)
Share of unemployed		0.04		0.03		0.04		0.04
		(0.08)		(0.08)		(0.08)		(0.08)
Share of foreigners		-0.07*		-0.06*		-0.07*		-0.07*
		(0.04)		(0.04)		(0.04)		(0.04)
Share of social aid collectors		-0.17**		-0.16**		-0.16**		-0.16**
		(0.08)		(0.08)		(0.08)		(0.08)
Municipality fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	No	No	No	No	No	No	No	No
R^2	0.077	0.109	0.078	0.110	0.078	0.111	0.078	0.111
N	1190	1183	1190	1183	1190	1183	1190	1183

Clustered standard errors in parentheses.

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

The results are robust to alternative opportunity cost measures such as the median savings rate, yields on one, five and ten year Swiss government bonds.

Table 3: Interest spread

	Interest tax credit per tax bill (× 1,000)					
	(1)	(2)	(3)	(4)	(5)	(6)
Mean to p50 of HH income	0.216***	0.214***				
	(0.033)	(0.034)				
Mean to p75 of HH income			0.235***	0.192**	-0.041	-0.239
			(0.054)	(0.061)	(1.607)	(1.595)
Population density		-0.002		0.002		-0.002
		(0.001)		(0.009)		(0.001)
Municipality tax rate		-0.023**		-0.238***		-0.022*
		(0.011)		(0.052)		(0.011)
Share of unemployed		-0.150*		-0.789*		-0.118
		(0.086)		(0.349)		(0.086)
Share of foreigners		0.003		0.040		0.003
		(0.047)		(0.555)		(0.048)
Share of social aid collectors		-0.108		-1.650***		-0.109
		(0.074)		(0.403)		(0.072)
Municipality fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.197	0.213	0.881	0.977	0.188	0.202
N	1183	1176	25	25	1165	1158

Clustered standard errors in parentheses.

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

Columns (1) and (2) include only observations with mean to median > 1, columns (3) and (4) with mean to p75 > 1 and (5) and (6) mean to p75 ≤ 1.

Table 4: High income ratios

	Dependent variable: Interest tax credit per tax bill (× 1,000)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
p50 to p25 of HH wealth	-0.005	-0.008						
	(0.007)	(0.007)						
p75 to p50 of HH wealth			0.003	0.023				
			(0.093)	(0.097)				
Mean to p50 of HH wealth					-0.024	-0.009		
					(0.035)	(0.039)		
Mean to p75 of HH wealth							-0.266	-0.225
							(0.265)	(0.260)
Share of homeowners		2.764		0.627		0.625		0.629
		(2.641)		(2.857)		(2.864)		(2.859)
Population density		-0.002		-0.002		-0.002		-0.002
		(0.002)		(0.001)		(0.001)		(0.001)
Municipality tax rate		-0.030**		-0.023**		-0.022**		-0.023**
		(0.012)		(0.011)		(0.011)		(0.011)
Share of unemployed		-0.166*		-0.145*		-0.147*		-0.146*
		(0.097)		(0.087)		(0.087)		(0.086)
Share of foreigners		0.023		0.003		0.004		0.004
		(0.051)		(0.048)		(0.048)		(0.047)
Share of social aid collectors		-0.090		-0.111		-0.108		-0.105
		(0.080)		(0.073)		(0.073)		(0.072)
Municipality fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.210	0.226	0.196	0.212	0.197	0.211	0.197	0.212
N	991	984	1190	1183	1190	1183	1190	1183

Clustered standard errors in parentheses.

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

In columns (1) and (2) 199 observations are dropped because p25 of household wealth is equal to 0.

Table 5: Wealth inequality

	Dependent variable: Interest tax debit per tax bill (× 1,000)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
p50 to p25 of HH income	-0.834	-0.589						
	(0.961)	(0.861)						
p75 to p50 of HH income			-2.141	-1.237				
			(2.740)	(2.137)				
Mean to p50 of HH income					-1.545***	-1.708***		
					(0.402)	(0.459)		
Mean to p75 of HH income							-2.954***	-3.270***
							(0.802)	(0.923)
Population density		0.048		0.048		0.049		0.049
		(0.044)		(0.044)		(0.044)		(0.044)
Municipality tax rate		0.110*		0.110*		0.108*		0.107*
		(0.065)		(0.065)		(0.064)		(0.064)
Share of unemployed		-0.509		-0.503		-0.528		-0.524
		(0.502)		(0.502)		(0.500)		(0.500)
Share of foreigners		-0.152		-0.153		-0.134		-0.137
		(0.182)		(0.181)		(0.176)		(0.176)
Share of social aid collectors		0.140		0.131		0.144		0.143
		(0.252)		(0.252)		(0.253)		(0.253)
Municipality fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.006	0.034	0.006	0.034	0.007	0.035	0.007	0.035
N	1190	1183	1190	1183	1190	1183	1190	1183

Clustered standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Income inequality and interest tax debit

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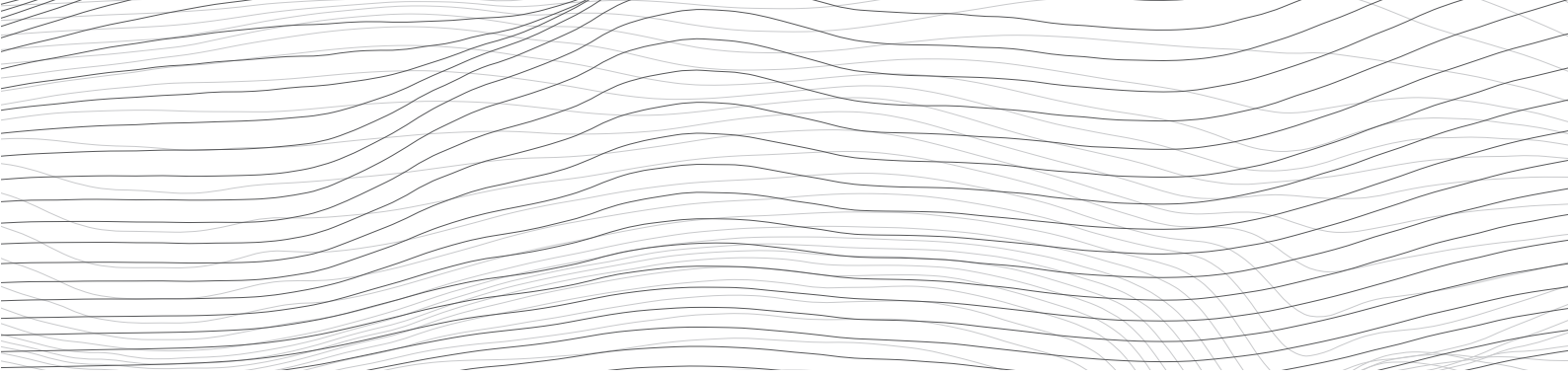

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