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Tax Evasion and Self-Employment Decisions: Evidence From an Income Tax Reform in Chile*

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Abstract

This paper studies the causal effect of income tax evasion opportunities on the self-employment decision. Two peculiarities of the Chilean scheme enable us to identify this effect. First, in the Chilean tax design, self-employed and wage-earners are levied with equal marginal taxes, eliminating the differential tax effect. We disentangle two channels through an occupational choice model: taxable income and evasion. Second, we exploit a tax reform that exogenously affects agents' evasion decisions. Following a consumption-based approach, we obtain a tax evasion measure, and estimate two behavioral parameters: (i) the evasion elasticity to marginal tax rate equals 1.4; (ii) an increase of 1 percentage point in the evasion opportunity makes being self-employed 6.1 percentage points more likely. The evasion opportunity is a crucial determinant of the self-employment response to the policy change, mainly driven by agents' behavior near the first income bracket. While women-headed households' evasion behavior is less sensitive to a tax change, having higher education primarily drives this behavior.

JEL Classification: H24, H26, J24.
Keywords: Tax evasion, Occupational choice, Self-employment, Tax policy, Chile.

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1 Introduction

Self-employed workers' labor supply, investment, and income declarations are highly responsive to payroll and income taxes (Bosch and de Boer, 2019). These behavioral responses to tax changes may distort the agent's optimal employment choice (Wen and Gordon, 2014). Besides tax policies, other factors can distort occupational decisions. The self-employed are more prone to evasion than other employment types since self-reported income is the primary source of tax evasion (Slemrod, 2007; Kleven et al., 2011). Therefore, higher tax evasion opportunities in self-employment than in the wage-earner sector might stimulate workers to choose the former.[1] Still, little is known about tax evasion motivations to become self-employed. This study contributes to fulfilling this gap by identifying and measuring how tax evasion decisions affect workers' allocation into self-employment.

Identifying the effect of evasion on self-employment is challenging for multiple reasons. When the tax scheme levies self-employed and wage-earners differently, evasion incentives affect occupational decisions in two ways. One is the (pure) evasion effect. A second effect is determined by the tax difference across occupations and the income (mis)report. Therefore, isolating the evasion channel is crucial to identifying its impact on self-employment. In addition, measuring tax evasion is not straightforward, owing to self-employed workers self-reporting their income.[2] Last, tax evasion and occupational decisions are simultaneously determined since workers may anticipate their evasion behavior, leading to an endogeneity issue. This paper overcomes these issues from different edges using the Chilean setting, where the self-employed constitute a significant proportion of the local labor force.

Three main advantages arise from focusing on Chile's labor market. First, the Chilean income tax scheme equally levies self-employment and wage-earner sectors, removing the differential taxation channel. Second, the availability of an expenditure and income survey allows us to construct a tax evasion measure following a consumption-based approach (Pissarides and Weber, 1989; Hurst, Li and Pugsley, 2014, among others). Third, Chile implemented an income tax reform in 2013 that affected agents' evasion incentives. This reform gives us a quasi-experimental setting to overcome the simultaneity of tax evasion and self-employment decisions.

We elaborate upon a theory of how income tax evasion affects self-employment choices to determine the channels involved in this effect. This framework provides the critical features to identify the impact of evasion. We model an economy with two occupations: self-employed and wage-earners, where both sectors face the same tax scheme characterized by two income

[1] Kesselman (1989) and Watson (1985) use a general equilibrium model to provide theoretical evidence. Empirically, Bárány (2019), Gentry and Hubbard (2000), Bruce (2000), Schuetze (2000), Cullen and Gordon (2007), and Fossen and Steiner (2009) explore the effects of income tax variations between occupations on self-employment.

[2] See Schneider and Enste (2002); Alm (2012); Slemrod and Weber (2012) for a detailed discussion about the approaches for measuring tax evasion.

brackets, in line with the Chilean setting. We show that the effect of tax changes on the self-employment decision can be decomposed into two independent channels, weighted by their elasticities. The first is the effect of the tax rate on self-employment taxable income. The second is the effect of evasion on the occupational decision. The differential taxation effect disappears, and only the evasion channel affects the self-employment choice indirectly.

Then, following the methodology of Hurst, Li and Pugsley (2014), we estimate an income misreporting variable as a proxy of tax evasion by comparing households' Engel curves across occupation types. We use a pooled cross-section for 2007-2017 of the Household Budget Survey (*Encuesta de Presupuestos Familiares* - EPF) of Chile, administered by the National Statistics Institute (*Instituto Nacional de Estadísticas* - INE). This survey jointly measures individual and household income, expenditures, and employment characteristics. We classify a household as self-employed if its head is self-employed, considering alternative definitions for sensitivity analyses. Unlike Hurst, Li and Pugsley (2014), we adjust this method to incorporate the possibility of having heterogeneity in our income tax evasion measure at the household level. This assumption accounts for the fact that assuming the same tax evasion rate across agents would fail to capture workers' heterogeneous behavior across the income distribution that significantly affects occupational choices (see Albarea et al., 2020; Waseem, 2018; Engstrom and Hagen, 2017). We estimate an evasion rate of 10.89 percent of the taxable income in the self-employment sector, on average, for 2007-2017. Moreover, 84.71 percent of the self-employed evade taxes, with an average evasion rate of 12.87 percent.

Since tax evasion and self-employment are simultaneous decisions, we exploit the exogenous variation in the income tax rates driven by 2013 Chile's tax reform. Not having faced any marginal tax rate change, individuals in the lowest income bracket correspond to the control group in our Difference-in-Differences estimation. Although the labor tax scheme equally levies self-employed and wage-earners in Chile, self-employment provides an alternative to reduce the tax burden by sheltering income due to self-reporting. Thus, we follow an Instrumented Difference-in-Differences approach (see, for instance, De Chaisemartin and d'Haultfoeuille, 2018), using the tax change policy as an instrument for the tax evasion rate. Since this measure encompasses not only income misreporting but also some facility for evading, we interpret it as an indicator of evasion opportunity.

We identify that the tax reform significantly reduced tax evasion opportunities by two percentage points. Results are robust to desegregating by income tax brackets to make control and treatment groups more comparable, including an additional set of controls and accounting for agents' self-selection into income brackets and bunching. The estimated elasticity of evasion opportunity to the marginal tax rate is 1.4, with an evasion reaction more than proportional to the tax change. Moreover, we compare the elasticities obtained using alternative self-employed household definitions and show that households with self-employed partners or female heads are less sensitive to tax changes. This evidence suggests heterogeneous evasion behavior depending on household composition.

The evasion opportunity is a critical determinant of the self-employment decision. We estimate that a one percentage point increase in the tax evasion opportunity significantly increases the probability of being self-employed by 6.1 percentage points. The results satisfy the same sensitivity analysis evaluated in previous estimations. On the other hand, households with self-employed partners respond more strongly to evasion than the average, and the female-headed reaction is weaker. Considering the empirical evidence, we compute the size of the evasion channel obtained in our theoretical model using the estimated behavioral parameters. The evasion channel drives almost all the effects of the marginal income tax rate on self-employment probability.

Since evasion incentives may change depending on agents' characteristics, we expect heterogeneous patterns in self-employment and evasion motivations. We find that agents near the first income bracket threshold are more prone to move into self-employment when the marginal tax rate increases than to adjust their evasion behavior compared to the average worker. In the middle of the distribution, agents react proportionally in both variables to the tax change. At the top of the income distribution, taxpayers are less likely to react in self-employment or evasion. This behavior is consistent with wealthier taxpayers maintaining their evasion behavior to avoid alerting the fiscal authority and keeping their self-employment status to take advantage of evading possibilities. Therefore, any change in the marginal tax rate would substantially affect self-employment decisions in the bottom part of the income distribution while still meaningful in the middle part.

Moreover, we find heterogeneous evasion incentives depending on the household head profiles. Regarding gender gaps, women display a more meaningful evasion probability than men, although not significantly different, while the average self-employment effect is similar. Since female-headed households tend to be more vulnerable, the evasion behavior contributes to overcoming this issue. Simultaneously, women may want to move to the wage-earner sector whenever possible, as it gives them higher stability. Also, taxpayers with higher education, who may understand the tax system better, drive the effect of tax changes in evasion and self-employment. Indeed, less educated workers are less productive and have lower mobility across occupations. Therefore, the tax burden may offset their gains, restricting their self-employment decisions. Finally, the tax reform progressivity reduces the expected penalties of taxpayers who jump into a lower income bracket, thus having an inverse behavior than the average: their evasion increases while the self-employment rate falls.

This paper contributes to three strands of literature. First, it explores the motivations to be self-employed, providing empirical and theoretical evidence on tax evasion's impact and the channels. Some studies have explored the effects of income tax variation between occupations on self-employment (Gentry and Hubbard, 2000; Bruce, 2002; Schuetze, 2000; Cullen and Gordon, 2007; Fossen and Steiner, 2009; Bosch and de Boer, 2019; Wen and Gordon, 2014; Bruce, 2000; Parker, 2003), estimating a combination of direct and indirect effects. Contrary to these studies, the Chilean setting makes it possible to isolate the evasion channel on self-employment decisions. Closer to our study, in a cross-country analysis at the industry level for developed economies, Bárány (2019) shows that the tax differential across self-employment and wage-earner occupations raises misreporting for self-employed. Unlike this paper, we estimate tax evasion at the household level, allowing us to quantify the effects of income tax rate changes on tax evasion and self-employment choice at the micro-level.

Secondly, our paper contributes to enhancing tax evasion measurement at the household level. The seminal paper of Pissarides and Weber (1989) proposes a consumption-based method, comparing Engel curves to identify the average household income misreporting rate. Hurst, Li and Pugsley (2014), among others, extend this approach using income metrics to capture permanent consumption and show the identification implications by comparing different data sources. Other papers add on the implications of different individual and household characteristics (Cabral, Gemmell and Alinaghi, 2019; Kukk, Paulus and Staehr, 2020; Nygård, Slemrod and Thoresen, 2019, among others). While this literature finds heterogeneity among self-employed households, none allows for differential evasion rates at the household level. This extension enables us to capture tax evasion differences across the income distribution.

Finally, we contribute to the literature on agents' behavioral responses to tax changes in developing countries, a novel strand that mainly focuses on firms' behavior (for a survey, see Pomeranz and Vila-Belda, 2019). For agents' responses, most papers focus on high-income taxpayers' responses to personal income taxation (Tortarolo, Cruces and Castillo, 2020; Jouste et al., 2021; Bergolo et al., 2022), wealth (Londoño-Vélez and Ávila-Mahecha, 2021), and the income distribution (Bergolo et al., 2021). For evasion, the evidence focuses on the effect of audits on firms' behavior (Pomeranz, 2015; Carrillo, Pomeranz and Singhal, 2017). Still, no evidence exists on the links between income tax, evasion, and self-employment decisions. This paper provides new relevant evidence on the sensitivity of tax evasion to taxes and the effect of evasion on self-employment decisions in a developing country.

This study continues as follows. Section 2 describes the Chilean tax system's main characteristics and the income tax reform of 2013. Section 3 shows the theoretical model and the channels behind the effect of taxes on self-employment. Section 4 summarizes the data characteristics and explains the procedure to obtain the tax evasion measurement. Section 5 shows the effect of evasion on self-employment and the relevance of the evasion channel. Section 6 analyses the determinants of the main results and their heterogeneity. Finally, Section 7 concludes.

2 The Chilean Tax System and Income Tax Reform

This section describes the Chilean income tax system and the evolution of the workforce across the period studied. Moreover, it details the characteristics of the income tax reform exploited for the analysis.

2.1 Chilean Income Tax System

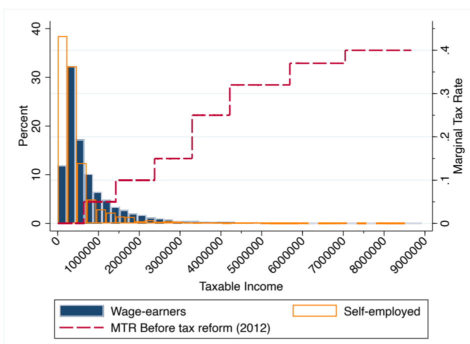
A global tax, namely the Complementary Global Tax (CGT), levies the Chilean workers' income, encompassing capital earnings from the firm's ownership (*First Category Tax*, FCT) and labor income (*Second Category Tax*, SCT). The SCT and CGT are progressive marginal taxes collected in May. For wage-earners, the SCT is declared monthly by employers, while self-employed report their earning when submitting an invoice. Taxpayers must submit an income declaration to the Chilean Internal Revenue Service (IRS) in April, contrasted with the monthly information to classify each taxpayer into an income tax bracket.

Since we focus on workers, we only consider changes in the SCT, excluding entrepreneurs from our data. Removing entrepreneurs eliminates the potential omitting variable bias driven by having different motivations and skills than the wage-earner and self-employed. Moreover, the transition probability between entrepreneurs and these other occupations is low (Perry et al., 2007) and this sample restriction eliminates potential problems surging from changes in incentives due to tax differences between FCT and SCT.[3]

The SCT comprises eight income brackets defined by a stable monetary unit, the Monthly Tributary Unit (*Unidad Tributaria Mensual* - UTM, in Spanish), adjusted by the CPI. This tax scheme levies self-employed and wage-earners equally, eliminating differential tax incentives across occupations. The taxable income is 83 percent of the gross income, comprising the gross income minus health insurance and pension contributions (payroll taxes).

In 2016/7, three-quarters of the Chilean workforce were wage-earners, and 22 percent were self-employed. Independently of the occupation type, most workers are exempt from paying taxes as their taxable income belongs to the first income bracket. The share of workers in the first income bracket is higher among self-employed than wage-earners, based on their reported income (Figure 1).

Figure 1: Occupation Densities and SCT



Note: The left y-axis shows the percentage of agents in the pre-reform period, and the right y-axis shows the marginal tax rate. The estimation does not consider sample weights. Source: Own elaboration based on the EPF and Chilean IRS data.

Wage-earners declare income and payroll tax through their employers (third-party report). On the other hand, self-employed workers submit invoices for their clients through IRS services. In this case, the taxpayer declares who, the worker or the employer, withholds a fixed percentage of the gross income accounting for the fiscal year income and payroll taxes. Since a worker can earn income from both sectors, the switching cost across occupations is null.

[3] Differences in marginal tax rates between FCT and SCT incentive changes to worker's labor status and to declare income as capital gains as an entrepreneur. See Flores et al. (2020) and Fairfield and Jorratt De Luis (2016) for a detailed explanation.

2.2 2013 Income Tax Change

Aimed at increasing the resources available for the educational system, the *Educational Reform* introduced in 2013 reduced the SCT labor taxes. Two elements explain this fact. First, the reform focused on the rise of the FCT (from 20 to 25 percent), given its relevance for increasing tax collection and improving income redistribution. Second, reducing the SCT marginal tax rates did not produce a meaningful distortion since tax collection from SCT was less than two-fifths of the FCT one. Moreover, the SCT policy was the only tax incentive affecting wage-earners and self-employed from 2006-2017. Although the policy attracted high interest from different policymakers and policy parties, taxpayers did not anticipate it.[4]

The reform reduced the SCT marginal tax rates of six of the eight income brackets. Table 1 shows the marginal tax rate before and after the policy and the changes in the marginal tax rates by income bracket. The marginal tax rate of the first income bracket stayed equal to zero. Instead, it affected agents taxed with a positive marginal rate. Therefore, it only changed evasion incentives for workers in income brackets two to eight. Notably, the tax reform produced no tax differential between self-employed and wage-earners since both occupations were still levied equally.[5]

Table 1: Income Tax Rates and UTM bounds for 2012 and 2013

Bracket	UTM 2012/3	Tax Rate 2012	Tax Rate 2013	$\Delta\%$	$\Delta(1-\tau)\%$
1	0 to 13.5	0.0%	0.0%	0.0%	0%
2	13.51 to 30	5.0%	4.0%	-20.0%	1.1%
3	30.01 to 50	10.0%	8.0%	-20.0%	2.2%
4	50.01 to 70	15.0%	13.5%	-10.0%	1.8%
5	70.01 to 90	25.0%	23.0%	-8.0%	2.7%
6	90.01 to 120	32.0%	30.4%	-5.0%	2.4%
7	120.01 to 150	37.0%	35.5%	-4.1%	2.4%
8	150.01 or more	40.0%	40.0%	0.0%	0%

Note: UTM, Monthly Tributary Unit. Source: Own elaboration based on the IRS.

The tax fall was progressive, going from 20 percent for the second and third income brackets to 5 percent for the top brackets. The magnitude of the net-of-tax marginal rate change is minimal to affect the occupational choice directly.[6] However, it may produces two effects on agents' decisions. First, it significantly diminishes the marginal gains for evading, which would imply a fall in evasion incentives. Second, since evasion would be less attractive, incentives to participate in the wage-earner sector may increase, ceteris paribus. Therefore, the tax policy would ultimately affect self-employment decisions through the evasion channel.

[4]Figure A1 in Appendix shows that "Educational Reform" and "Tax Reform" were out of the ten most searched topics in Google in 2013 and 2014.

[5]The only possible source of difference is for self-employed who are firm-owners. We drop those cases to avoid biased estimates.

[6]Using the net-of-tax marginal rate is critical to estimate behavioral response with multiple income sources, as can be self-employed and wage-earners (Kleven and Schultz, 2014).

3 Theoretical Model

This section presents a two-stage theoretical model to characterize the mechanisms behind the occupational and evasion decisions when the income tax rate changes. We show that two independent channels affect these decisions: taxable income and evasion.

3.1 Basic Framework

Consider an economy with a continuum of risk-neutral agents with two alternative occupations, self-employed and wage-earners, indexed by s and w, respectively.[7] Agents' utility depends only on consumption, entirely financed by their income (we assume no savings or borrowing). While employers pay wage-earners taxes, self-employed self-report their income, making it possible to misreport and evade taxes.[8] Consistent with the Chilean setting, taxpayers face the same tax scheme. Hence, workers choose an occupation based on their productivity and the misreporting possibility (as self-employed).

Agent's taxable income equals $z = z^i$, where $i \in \{s, w\}$. We assume that agent's productivity equals $n = \{n^s, n^w\}$, being an independent draw from a distribution function with support $[\underline{n}^i, \overline{n}^i]$. For simplicity, only one consumption good exists with a unitary price, produced in a competitive market with a linear technology that only uses labor. Therefore, $n^i = w^i$, and we can map the distribution of n^i to $z^i = w^i l(n^i)$, where l is the agent's labor supply. Thus, z^i has a distribution F_i with support $[\underline{z}^i, \overline{z}^i]$.

Let us define x^i as the reported income in sector i. As wage-earners cannot evade, $x^w = z^w$. However, reported income can differ from taxable income in sector s, such that $x^s = z^s - e$, where e is the evaded income.

Workers pay a tax liability $T(x^i)$ in each occupation. We assume no tax deductions. Consistent with the Chilean setting, the tax scheme comprises two income brackets with marginal tax rates t_1 and t_2, where $t_2 > t_1$. The tax brackets threshold is exogenously determined and equal to A. In order to obtain a close form solution, we assume that $A = \overline{z}/2$, and $\overline{z}^s = \overline{z}^w$. Thus, if $x^i < A$, agents' tax liability is equal to $T(x^i) = t_1 x^i$, otherwise $T(x^i) = t_1 A + t_2(x^i - A)$, $\forall i \in \{s, w\}$.

3.2 Agents Decisions: Evasion and Occupational Choice

Agents make two decisions to maximize their utility. First, they select the employment sector $i \in \{s, w\}$. If agents choose sector w, their utility equals after-tax income, being the

[7] Risk-neutrality allows us to isolate uncertainty effect from audit probability rather than evasion incentives. Other papers that use similar assumptions are Chetty (2009) and Gorodnichenko, Martinez-Vazquez and Sabirianova Peter (2009).

[8] Wage-earners assumption eliminates the collusion between firms and workers to income misreporting. While Kleven, Kreiner and Saez (2016) demonstrate that third-party reports help tax enforcement, other papers show that only sometimes solves evasion (see, Bjørneby, Alstadsæter and Telle, 2021; Bergolo et al., 2021).

indirect utility $U^w(z^w) = z^w - T(z^w)$. If agents choose sector s, their expected after-tax income determines their utility.

Agents who choose the sector s must decide x^s maximizing their utility. Self-employed face an audit probability $\rho(x^s)$ determined by their income declaration. If audited, the government detects if the taxpayer is evading and charges a fine of $\pi \in (1, 2)$ on evaded tax. Thus, self-employed expected after-tax income equals $z^s - T(x^s) - \rho(x^s)\pi\,[T(z^s) - T(x^s)]$. For a closed-form solution, we assume a specific form of the audit function, $\rho(z^s - e) = 1 - (z^s - e)/\overline{z}$, so $\rho' = -1/\overline{z} < 0$. Under these assumptions, self-employed indirect utility is $U^s(z^s) = \max_{x^s}\{z^s - T(x^s) - \rho(x^s)\pi\,[T(z^s) - T(x^s)]\}$

The solution to this problem determines the optimal evasion decision. Since we assume that $\rho' < 0$, the self-employed's utility is concave, and there exists an interior solution (Yitzhaki, 1974). For simplicity in the characterization of the optimal evasion, we will refer to each section as e_j with $j \in \{1, 2, 3, 4\}$, so e_1 corresponds to e^* for $\underline{z}^s \le z^s \le A$ and so forth.

Lemma 1. *The optimal evasion decision e^* is as follows*

$$e^*(z^s, \rho, \pi, t_1, t_2) = \begin{cases} \dfrac{z^s}{2} - A\left(1 - \dfrac{1}{\pi}\right) & \text{if } \underline{z}^s \le z^s \le A \\ \dfrac{z^s}{2} - A\left(1 - \dfrac{1}{\pi}\right) - \dfrac{(z^s - A)}{2}\dfrac{(t_2 - t_1)}{t_1} & \text{if } A < z^s < Z_1;\ z^s - e < A \\ z^s - A & \text{if } Z_1 \le z^s < Z_2;\ z^s - e \ge A \\ \dfrac{z^s}{2} - A\left(1 - \dfrac{1}{\pi}\right) & \text{if } Z_2 \le z^s \le \overline{z}^s \end{cases} \tag{1}$$

where $Z_1 \equiv A\left[1 + \dfrac{t_1(2 - \pi)}{\pi t_2}\right]$ *and* $Z_2 \equiv \dfrac{\overline{z}^s}{\pi}$.

Proof.

See Appendix A.1. ■

The result in Lemma 1 gives the evasion for each section. In e_1, self-employed earn and declare less than A. Evasion only depends on the marginal tax rates when the taxpayer has an income higher than A but declares less than it (section e_2). Hence, changes in the marginal tax rate only affect the optimal decision when agents evade and jump to a lower income bracket. At e_2, agents jump to an interior section of the first bracket, while at e_3, they bunch at the threshold, as empirically shown by Saez (2010) and Kleven (2016).

The lemma below summarizes the consequences of tax changes for evasion. We invoke the envelope theorem for exposition purposes and assume that the impact on income is zero.

Lemma 2. *The effects of tax changes, defined by movements in t_1, t_2 and $\triangle t = t_2 - t_1$, on evasion (e^*) are*

1. *A raise in t_1 increases e^*.*

2. *A raise in t_2 decreases e^*.*

3. The larger the difference between t_2 and t_1, the smaller e^*.

Proof.

See Appendix A.2. ■

Lemma 2 shows that a decrease in either t_2 or $\triangle t = t_2 - t_1$ raises evasion, but a fall in t_1 reduces it. In e_2, agents face t_1, and a decrease in this rate diminishes evasion's marginal gains. However, if t_2 or $\triangle t$ fall, the owed taxes decrease, diminishing the expected penalties and encouraging evasion. Therefore, tax change has two opposite effects on evasion: (i) affecting evasion gains and (ii) through the expected penalties.

Chile's tax reform characteristics expose agents to different incentive changes. The difference in tax rate reduction between brackets decreases evasion incentives and, simultaneously, increases them by decreasing penalties (see Table 1). On the other hand, agents in tax brackets three to seven faced opposite effects. For those agents, the incentive to evade fell because of the tax cut, but simultaneously, their expected penalties fell, which may increase evading motivation. For agents in the second and eighth brackets, only evasion incentives fell. Therefore, we expect a reduction in evasion, on average, driven mainly by having a higher proportion of agents in the second bracket (see Figure 1) and the intensity of tax reduction.

Given e^* and the taxable income z^s, we define a threshold function $H(z^s, e^*)$. It equalizes the indirect utilities in both sectors, $U^w(H(z^s, e^*)) = U^s(z^s, e^*)$.[9] This function represents the minimum taxable income for which agents decide to work as wage-earners.

Lemma 3. *Given the optimal evasion e^*, the minimum income in the wage-earner sector to work as a wage-earner is defined by*

$$H(z^s, e^*) = \begin{cases} z^s + e_1 \dfrac{t_1(1-\rho(z^s-e_1)\pi)}{1-t_1} & \text{if } z^w \leq A \text{ and } z^s \leq A \\ \dfrac{z^s(1-\rho(z^s-e_2)\pi t_2)}{1-t_2} - \dfrac{(z^s-e_2)t_1 + A(t_2-t_1))(1-\rho(z^s-e_2)\pi)}{1-t_2} & \text{if } z^w > A \text{ and } A < z^s < Z_1 \\ \dfrac{z^s(1-\rho(z^s-e_3)\pi t_2)}{1-t_2} - \dfrac{(z^s-e_3)t_1 + A(t_2-t_1))(1-\rho(z^s-e_3)\pi)}{1-t_2} & \text{if } z^w > A \text{ and } Z_1 \leq z^s < Z_2 \\ \dfrac{z^s - (t_1 A + t_2(z^s-e_4-A)) - \rho(z^s-e_4)\pi t_2 e_4}{1-t_2} - A\dfrac{t_2-t_1}{1-t_2} & \text{if } z^w > A \text{ and } Z_2 < z^s < \overline{z}^s \end{cases} \quad (2)$$

Proof.

See Appendix A.3 ■

Again, we define sections as $H_j(z^s, e_j)$, such that $H_1(z^s, e_1)$ for $z^w \leq A$ and $z^s \leq A$ and so forth. The function in Lemma 3 characterizes one threshold level for each section of the optimal evasion function. Only $H_1(z^s, e_1)$ does not depend on both marginal tax rates. Also, given the optimal evasion, marginal tax changes only affect evasion in section $H_2(z^s, e_2)$.

[9] The indirect utility in the wage-earner sector is increasing in self-employment income and equals the self-employment's indirect utility if $e^* = 0$. Also, evasion increases self-employment's indirect utility. See Castillo (2023) for detailed proof.

3.3 Tax Change Effect on Occupational Decision

In the Chilean tax scheme, we can split taxpayers into those levied with zero marginal tax and those with a positive one. Therefore, we focus on the effect of t_2 on the threshold function and do not impose $t_1 = 0$ for a comprehensive variable definition. Since the threshold function comprises four sections, we only present a general characterization of the partial derivative.

Proposition 1. *Given the optimal evasion* e^* *and the threshold function* $H(z^s, e^*)$*, the overall effect of changes in* t_2 *on the threshold function can be summarized as*

$$\eta_{H,t_2} = \underbrace{\varepsilon_{z^s,t_2}\eta_{H,z^s}}_{\text{Taxable Income}} + \underbrace{\varepsilon_{e,t_2}\eta_{H,e}}_{\text{Evasion}}$$

where ε_{z^s,t_2} *is the elasticity of the taxable income in the self-employment sector,* ε_{e,t_2} *is the elasticity of evasion, and* η_{H,z^s} *and* $\eta_{H,e}$ *are the semi-elasticities of the threshold function concerning the taxable income and evasion, respectively.*

Proof.

See Appendix A.4 ■

The partial derivative captures the effect on the probability of self-employment given by a one percent change in t_2, expressed as a semi-elasticity, η_{H,t_2}. In the first term, the semi-elasticity to income, η_{H,z^s}, captures the income differential across occupations effect, evidencing how attractive it is to be self-employed. In the second term, the semi-elasticity to evasion, $\eta_{H,e}$, captures the evasion incentives in the self-employment sector, reflecting its gains. Thus, the weighted sum of the effect of taxable income and evasion over the threshold function is the effect of tax changes, which is associated with two channels:

1. Taxable Income Channel: Relies on the taxable gross income (before taxes and evasion) differences across sectors due to tax changes. Assuming that the substitution effect prevails, when taxes fall, taxable income rises ($\varepsilon_{z^s,t_2} < 0$). This change makes the self-employment sector more attractive, increasing the optimal threshold wage ($\eta_{H,z^s} > 0$). Thus, we expect a negative effect of the reform on self-employment.

2. Evasion Channel: Represents the evasion effect due to tax changes on self-employment. The threshold function decreases if taxes fall since the gains for evading also fall, reducing the evasion incentives ($\varepsilon_{e,t_2} > 0$) and making participation in the self-employment sector less attractive ($\eta_{H,e} > 0$). Therefore, we expect a positive effect.

Proposition 1 demonstrates that when both sectors face the same tax scheme as in the Chilean setting, the differential tax channel disappears. Therefore, it is possible to isolate the effect of evasion opportunity on self-employment exclusively through the evasion channel. Thus, evasion impacts self-employment decisions directly, encompassed by $\eta_{H,e}$ and, indirectly, by the evasion channel.

4 Data

This section describes the survey data used for the empirical analysis. It details the relevant definitions and summarizes the sample characteristics. Last, it briefly describes the methodology for estimating the tax evasion measure used later for the empirical analysis.

4.1 Relevant Definitions and Database

The data source for this study is the Household Budget Survey (*Encuesta de Presupuestos Familiares*- EPF) from Chile, collected by the National Institute of Statistics (*Instituto Nacional de Estadísticas* - INE). This cross-sectional data is a socioeconomic income and expenditure survey applied to households, including agents' occupation. The survey covers Gran Santiago and the regional capital cities, with some metropolitan areas (60 communes). For consistency of the expenditure and income measures, we only use three releases of the survey: 2006/7, 2011/2, and 2016/7.[10]

For two reasons, the survey's collection periods enable the estimation of the relationship between tax evasion and employment choice. First, the Educational Reform was implemented between the releases 2011/2 and 2016/7. Second, although short, the spanned period allows us to control for the presence of trends in workers' employment decisions.

We will measure tax evasion through Engel curves, which makes it essential to have accurate food expenditure and income variables. Regarding expenditure variables, the survey measures acquired consumption as the final expenditure.[11] The data collection time frame consists of 15 days, registering any expenditures, including recurrent expenses (water, electricity, contributions, rents, and others) from all household members aged 15 or older. We consider the expenditures in food consumption to estimate Engel curves. Since patterns of expenditures could differ for self-employed and wage-earners, restricting it to food expenditure mitigates this concern. Food expenditures are only expenses on food and non-alcoholic beverages. The primary income measure is after-tax total family income, including income as a wage-earner and self-employed, property income, and transfers (pension and financial income). All monetary variables are expressed in 2017 Chilean pesos using the CPI index.

We construct tax-related variables based on the agent's taxable income and use a tax calculator to estimate a proxy of the tax paid. For 2006/7, the taxable income is constructed from the after-tax income declaration and, for the remaining years, from the declared gross labor income. We use the after-tax income and tax scheme to calculate each taxpayer's tax liability for each year. Then, we assign each taxpayer to the corresponding income bracket using the taxable income and compute other tax variables.

In this survey, the household head is not necessarily the person with the highest income in the household, but the identified as such. We restrict the sample to households with a head aged 20-59 years who reports being self-employed or wage-earner in the main occupation. Domestic workers (mainly employed informally) and entrepreneurs (who might face capital

[10]For previous EPFs, the geographical coverage, expenditure, and income measures differ.

[11]This definition corresponds to household goods and services acquired and consumed.

taxation) are excluded. Also, we drop households with no reported income or expenditures or with zero head's income. We focus on employed workers and those who make occupational decisions, abstracting from the informality issue.

Table 2 shows descriptive statistics of the EPF sample. Most of the workers are male. Most workers have (complete or incomplete) high school or higher education, increasing the average education level across the period. The working population mainly comprises wage-earners (more than 75 percent), and around 21 percent are self-employed. Regarding households' profiles, they have four members, on average, and the percentage of single-parent families has increased from 26 percent in 2006/7 to 31 percent in 2016/7. Food consumption represents a meaningful share of total household reported income (on average, 18.4 percent of total expenditures).

Table 2: Summary Statistics of employed workers in age-group 20-59 years

VARIABLES	2006/7	2011/2	2016/7
Male	0.60	0.56	0.56
	(0.49)	(0.50)	(0.50)
Age-Group			
20-29 years	0.25	0.25	0.25
	(0.43)	(0.43)	(0.43)
30-39 years	0.28	0.25	0.27
	(0.45)	(0.44)	(0.44)
40-49 years	0.28	0.27	0.25
	(0.45)	(0.44)	(0.43)
50-59 years	0.19	0.23	0.24
	(0.39)	(0.42)	(0.42)
Education Level			
Primary School	0.14	0.14	0.10
	(0.35)	(0.35)	(0.31)
High School	0.50	0.47	0.43
	(0.50)	(0.50)	(0.50)
Higher Education	0.35	0.38	0.46
	(0.48)	(0.49)	(0.50)
Occupation Type			
Employer	0.02	0.02	0.02
	(0.15)	(0.15)	(0.14)
Self-employed	0.21	0.20	0.22
	(0.41)	(0.40)	(0.41)
Wage-earner	0.76	0.77	0.76
	(0.43)	(0.42)	(0.43)
Household Size	3.92	3.88	3.62
	(1.69)	(1.68)	(1.63)
Single-parent family	0.26	0.28	0.31
	(0.44)	(0.45)	(0.46)
Total Household Income	990,479	1,173,078	1,323,117
	(1,120,389)	(1,440,891)	(1,460,529)
Total Household expenditure	992,721	1,061,964	1,226,869
	(1,076,354)	(1,082,477)	(1,124,849)
Household Food Expenditure	183,131	193,532	226,910
	(124,384)	(144,336)	(164,214)

Note: Expenditure variables measure the effective expenditures on the consumption of goods and services acquired and used by the households. Income and expenditure variables are in Current Chilean Pesos. Standard Deviations are in parentheses. Source: Own elaboration based on the EPF data (2006-2017).

4.2 Measuring Tax Evasion

We estimate tax evasion following Hurst, Li and Pugsley (2014) (HLP henceforth). The authors quantify the extent of self-employed income under-report in the U.S. using household surveys through Engel curves. We extend this work by incorporating heterogeneity across households in the evasion measure.

Engel curves describe the relationship between workers' income and expenditure. By comparing differences in the Engel curves of wage-earners and self-employed, we infer the actual income of the last group and, thus, the self-employed income-reporting gap.

The measurement relies on four main assumptions:

1. All income groups report expenditure on food correctly,
2. Employees report income correctly,
3. Self-employed workers under-report their income,
4. Wage-earners and self-employed workers have the same food consumption preference, conditioning on observable characteristics.

Although this methodology is not without critique (see, for instance, Engstrom and Hagen, 2017; Kukk and Staehr, 2017), it is a widely used method, and its assumptions are validated for Chile's workforce (see Figure A2 in Appendix). First, total food expenditure density functions are similar between wage-earners and self-employed households' heads, ratifying assumption 1. Regarding assumptions 2 and 3, wage-earners cannot evade taxes (contrary to self-employed workers) since employers report their salary.[12] Comparing reported income density functions, households' income reports differ by head's occupation, thus reflecting misreporting and supporting these assumptions.

We consider two kinds of households: self-employed and wage-earners. Self-employed households are households where the head reports being self-employed in primary employment. As a robustness check, we use two alternative definitions. First, a household is self-employed if the head or the partner is self-employed; we denominate it as the "mix definition". This definition accounts for the possibility that tax evasion decisions could occur within the couple when any of them is self-employed (Hashimzade, Myles and Yousefi, 2021). We use HLP's sample restriction as a second definition, keeping only male-headed households without a self-employed partner; we denominate it as the "HLP definition".

As a first approximation, Figure 2 shows the non-parametric estimates of the total food expenditure Engel curves, estimated separately for wage-earners (green line) and self-employed (dashed blue line) households by data release. Both curves have a positive slope. However, wage-earners register a linear relationship between total household income and food expenditure, while for self-employed, there is a higher variability across the income distribution. Given that the difference between the Engel curves across occupation types

[12] See Kleven, Kreiner and Saez (2016) for a theoretical explanation of the collusion difficulties between agents and firms, Kleven et al. (2011) for an empirical demonstration that evasion is low in the wage-earner sector, and Slemrod (2019) for a general discussion.

varies across the income distribution, this fact evidences a heterogeneous evasion behavior for self-employed depending on the household income.

Figure 2: Non-parametric Estimates of Total Food Expenditure Engel Curves

(a) EPF VI: 2006/7 (b) EPF VII: 2011/2 (c) EPF VIII: 2016/7

Note: Non-parametric estimates of the natural logarithm of total food expenditure and household income control for a set of covariates. Source: Own elaboration based on the EPF data.

4.2.1 Regression Model

Applying the HLP methodology implies assuming an equal income misreporting rate for all self-employed households. However, the misreporting rate may depend on household characteristics, thus varying across household types.[13] Thus, we introduce heterogeneity in the income misreporting measure by including interaction terms between the self-employed household indicator and a set of household head characteristics (education level, age, and gender) in the regression model used by HLP. We estimate the following regression model, a first-order approximation of the Engel curve[14], using a pooled cross-section considering the years $t = \{2006/7, 2011/2, 2016/7\}$ to get the differential income in the occupations for a given consumption, ceteris paribus:

$$\ln c_{ikt} = \alpha + \beta \ln y_{ikt} + \gamma_0 D_{ikt} + \gamma_1' D_{ikt} \times Z_{ikt} + \Gamma' X_{ikt} + \delta_t + \varepsilon_{ikt} \tag{3}$$

where k is the occupation type of household i, whether wage-earner ($k = w$) or self-employed ($k = s$). $\ln c_{ikt}$ is the natural logarithm of food consumption expenditures in year t, and $\ln y_{ikt}$ is the natural logarithm of the current household income. Hence, β is the income elasticity common across occupations by assumption. D_{ikt} is a dummy variable that indicates whether the household i is self-employed in year t. This variable also interacts with indicator variables of household head characteristics Z_{ikt}. This vector includes age-group indicators (7 categories), education-level indicators (secondary and superior), and a male indicator. Thus, γ_1' is a vector of coefficients that capture the income difference between self-employed

[13] Cabral, Gemmell and Alinaghi (2019); Nygård, Slemrod and Thoresen (2019); Albarea et al. (2020) show the distributional effect of tax evasion using a consumption-based approach.

[14] The non-parametric approximation of the Engel curve demonstrates the validity of this assumption

households and the average wage-earner household with a specific characteristic and equal consumption level, ceteris paribus.

The vector X_{ikt} includes a set of demographic controls, allowing a higher precision in identifying the transitory income. It includes indicators of whether the household head is male, has a partner, her education level attainment, her partner's employment status; a series of household size dummies; an indicator of whether there is at least one dependent child (younger than 15 years) in the household; and a dwelling tenancy status indicator as a proxy of household wealth. ε_{ikt} represents the transitory income's unpredictable components that are unobserved determinants of household consumption, and δ_t is a year-fixed effect.

Under the assumption that households can borrow and lend in asset markets, a more precise specification of the Engel curve would require using the permanent income instead of a combined measure with a transitory component. Provided that we have cross-sectional data, we cannot disaggregate these components. Therefore, we assume that current income is a good proxy of permanent income, as HLP shows.

The linear combination of γ' coefficients equals $-\beta(\ln y_{ist} - \ln y_{iwt})$, and the difference in permanent income across occupations gives the self-employed household reported income, $\ln \kappa_{iS}$. Therefore, $\ln \kappa_{is} = (\ln y_{ist} - \ln y_{iwt}) = -\frac{\gamma_0 + \sum_z \gamma_{1z}}{\beta}$ with z being the different household head combined characteristics. Accordingly, κ_{is} is the share of the total income that the self-employed reports, and $1 - \kappa_{iS}$ is the misreporting rate. This measure of misreporting income also captures other elements that favor evasion, such as institutional constraints and weak enforcement. Hence, we interpret this rate as a measure of evasion possibilities.

Unlike HLP, this approach allows for negative misreporting rates, i.e., $1 - \kappa_{ist} < 0$. A negative misreporting rate means self-employed households consume less than wage-earners for the same income. This result is expected due to borrowing constraints, budgetary pressures, or debts that self-employed usually face (Banerjee and Newman, 1998; Herkenhoff, Phillips and Cohen-Cole, 2021), which cannot be measured with the available data and it is captured by the error term in equation (3). We impute the negative misreporting rates as zero evasion, censoring our data without producing significant estimation bias.[15] This assumption may downward bias the coefficient estimated, providing a lower-bound of the average predicted evasion rate. However, this value is not statistically different from the average estimated evasion rate without substitutions (see Table 3, column (3)).

Potential endogeneity concerns arise from the Engel curve estimation. First, wealthier households might have higher expenditures and, at the same time, more spending may require a higher income. Moreover, a specific consumption taste may entail working extended hours or self-selecting into jobs with higher marginal returns. Besides, household income self-reports may be subject to Classical Measurement Error. To mitigate these issues for the tax evasion measure, we follow HLP and use an instrumental variable approach to estimate the Engel curves using the household head's ISCO-88 occupation group indicators as instruments for total household income.

[15] Negative misreporting rate is, on average, 15 percent of the sample, with low variability across years.

4.2.2 Tax Evasion Estimate

Table 3 summarizes the yearly estimation results of the tax evasion rate and compares them with the methodology in Hurst, Li and Pugsley (2014). We compare the result imputing zero misreporting to the negative values (*Evasion Rate*) with the corresponding cross-section estimation following the HLP's approach. Column (4) shows the average evasion rate for the overall period obtained in the pooled cross-section.

Table 3: Estimation of Tax Evasion: Evasion Rate and Percentage of Evaders

	EPF Survey			
	2006/7	2011/2	2016/7	Average
	(1)	(2)	(3)	(4)
Panel A: Main Specification				
Evasion Rate	11.44%	9.98%	11.26%	10.89%
HLP	16.21%	10.53%	8.62%	12.57%
	(0.054)	(0.074)	(0.094)	(0.043)
Panel B: Household Head Mix				
Evasion Rate	6.89%	6.36%	7.43%	6.89%
HLP	4.34%	4.09%	5.00%	5.26%
	(0.065)	(0.066)	(0.101)	(0.048)
Panel C: Household Head Occupation following HLP				
Evasion Rate	11.90%	9.93%	13.31%	11.71%
HLP	15.57%	6.42%	12.48%	13.77%
	(0.061)	(0.097)	(0.137)	(0.057)

Note: Evasion Rate refers to the mean misreporting rates over self-employed households, calculated after replacing negative misreporting rates with zero, and HLP refers to the methodology in Hurst, Li and Pugsley (2014). Yearly coefficients are calculated for each cross-section, while the average using the pooled cross-section. Standard errors are in parentheses and should be multiplied by 100 for interpretation. Source: Own elaboration based on the EPF data.

The main specification is in Panel A. The estimated average evasion rate in the self-employment sector for the period studied is 10.9 percent. Regarding the evolution of this measure, it rises after the tax changes policy, reaching a similar rate as in 2006/7. Introducing heterogeneity in the evasion measure across the household income distribution generates estimation results that are not statistically different from HLP's measure. This evidence validates our methodological change since it does not introduce, on average, any bias in our tax evasion measure. The income distribution of our evasion measure displays heterogeneous behavior (see Figure A3 in Appendix). Our tax evasion measure has a U-shape in the EPF survey 2006/7 and 2016/7 releases and an inverted U-shape in 2011/2, with a higher variability in the tails of the income distribution.

In Panel B, we apply the "Mix definition" in a sensitivity analysis, according to which a household is self-employed if the head or the partner is self-employed. In Panel C, we restrict the sample to male-headed households without a self-employed partner as in Hurst, Li and Pugsley (2014). Comparing the estimation results across household definitions, a stricter self-employed household definition (Panel A) produces higher misreporting rates than the definition using that the head or the partner is either self-employed (Panel B). The difference between these estimates reflects the differential behavior of households with a wage-earner head and a self-employed partner. In all panels, the evasion rate displays a U-shape. The comparison between panels A and C demonstrates the effect of focusing only on male-headed households without a self-employed partner, giving similar results. We look further at the implication of these differences in Section 5.

Further looking at the evolution of the evasion metrics, the evasion rate among evaders provides an intensive measure of evasion. For evaders, the average evasion rate in the period is 12.9 percent, and the average percentage of self-employed who evade taxes is 84.7 percent (see Table A1 in Appendix). The percentage of evaders varies across time, giving some intuition on the effects of the reform on the evasion rate. This percentage increased after policy changes. While these results appear counterintuitive since marginal taxes went down, the percentage of evaders in the self-employment sector metric also considers possible movements across occupations. Therefore, small-evasion self-employed may move to the wage-earner sector at the margin, increasing the average evasion rate and the percentage of evaders.

Finally, we also evaluate the predicted residuals of our estimation by year, occupation, and evasion status after imputing zero evasion when misreporting is negative (see Table A2 in Appendix). It is important to note that although the residual should be statistically zero by construction, the mean of each subgroup is similar. This result reinforces that assigning zero evasion to negative misreporting does not bias our measure since, on average, the unobservables are not significantly different for evaders and the whole sample of self-employed households. Consequently, adding heterogeneity to the HLP's approach does not bias our proxy of evasion.

5 Tax Evasion Effect on Self-employment Decisions

This section estimates the direct effect of evasion on self-employment and the evasion channel. First, we estimate the effect of tax reform on evasion opportunities and use it to identify the effect of evasion on self-employment. Later, we quantify the evasion channel using the derivation from Section 3, showing its relevance for the tax effect on self-employment.

5.1 Identification Strategy

Agents anticipate how much income to hide from the tax authority in self-employment occupation, as evidenced theoretically in Section 3, altering the comparison between occupations. The Chilean setting and the 2013 tax reform empirically address this problem. First, the tax system levies both self-employed and wage-earners equally, removing the differential taxation effect. Second, the reform affected the marginal tax rate of all income brackets except the lowest one, maintained a zero rate. Hence, only the evasion incentives of agents in the first income bracket remained unaltered. This quasi-experimental setting affected the agents' evasion incentives differently depending on the income bracket without directly changing their self-employment decisions. We exploit this tax policy to identify the causal effect of evasion opportunities on self-employment decisions.

The policy reform splits agents into those affected (treatment) and those not affected (control) by the tax fall. Following a difference-in-differences (DiD) approach, we control for factors that simultaneously affect both groups, like economic or sector fluctuations or demand-side effects, following the literature that begins with Feldstein (1995). In this case, we exploit the impact of the tax reform on evasion using a pooled cross-section.

The treatment status depends on two factors in this setting: the agent's income and the income brackets, which might generate some issues in the identification. Regarding the first, tax effects on taxable income might affect the treatment status. However, we will show in a robustness exercise that the tax effect on taxable income is not significant. Secondly, the brackets' thresholds are specified in UTM, a stable tributary monetary unit, which makes bracket thresholds equal across the period.

5.1.1 Empirical Model

In our empirical estimation, we keep only the household heads, imputing the corresponding household's evasion rate to them. As a first stage, we exploit the treatment intensity to identify the evasion behavior. We estimate the tax evasion response to the reform using the following DiD specification

$$Evasion_{ht} = \alpha_1 + \delta_{1t} + \phi_1 Policy_t \times T_h + \sigma_{11} T_h + \sigma_{12} Policy_t + X_{ht}\gamma_1 + \nu_{1ht} \tag{4}$$

$Evasion_{ht}$ is the share of tax evasion on total household reported income for household head h in year t, where $t = \{2006/7, 2011/2, 2016/7\}$. T_h is a dummy equaling one if the household head h belongs to the treatment group; $Policy_t$ is a dummy indicating if the year belongs to the new taxation regime (i.e., 2016/7). α_1 is a constant, and δ_{1t} is a year fixed effect. X_{ht} is a vector of household and individual socioeconomic characteristics. It includes dummies for being male, household head's marital status, age groups, education level, partner's occupation type, 1-digit ISCO-88 dummies, owner-dwelling, single-parent family, household size groups, having dependent children (i.e., younger than 15 years), and agent's gross income. Some households report low (high) food expenditures with high (low) head income, which might be associated with evasion behaviors that we cannot control with our data. Hence, we drop the food expenditure distribution's 10 percent lower- and upper-tails considering all the households in the survey to correct for any inconsistent answer that can potentially bias our estimates.[16] To address heteroscedasticity problems, we use robust standard errors.

[16]Food expenditure and household income relation is concave (Figure A4, Panel (a)) with a break around percentile 95 of food expenditure (Panel (b)), representing outliers or wrong reporting. Moreover, the sample restriction does not produce significant differences in the main estimations (Figure A5).

The coefficient ϕ_1 in equation (4) captures the average effect of tax policy change on tax evasion opportunities. Using it, we estimate the elasticity of evasion to the marginal tax rate $\varepsilon_{e,t}$, one component of the evasion channel in Proposition 1.

In the second stage, we estimate the critical relation of interest, the evasion incentive's effect on self-employment decisions, using the following regression model

$$SE_{ht} = \alpha_2 + \delta_{2t} + \beta_1 Evasion_{ht} + \sigma_{12} T_h + \sigma_{22} Policy_t + X_{ht}\gamma_2 + u_{2ht} \quad (5)$$

where SE_{ht} is indicates if household head h in year t is self-employed.

To address the identification problems mentioned above, we use the DiD regression model in equation (4) as the first stage following an Instrumented Difference-in-Differences (IV-DiD) approach (see De Chaisemartin and d'Haultfoeuille, 2018). Under the assumption that the individual unobserved determinants of tax evasion do not correlate with the tax rate policy change, the IV-DiD approach solves the endogeneity problem.[17]

We instrument $Evasion_{ht}$ with the interaction variable $Policy_t \times T_h$. Since the taxable income determines workers' tax income brackets, their treatment assignment is predetermined, and the policy change becomes a valid instrument of tax evasion. In equation (5), the coefficient β_1 identifies the effect of tax evasion opportunities on self-employment decisions, the key parameter to answer our principal research question. Using this parameter, we recover the occupational decisions semi-elasticity to Evasion, $\eta_{H,e}$, in Proposition 1. Joint with $\varepsilon_{e,t}$, this coefficient allows us to compute the magnitude of the evasion channel $\varepsilon_{e,t}\eta_{H,e}$.

Finally, the coefficient ψ_1 in the reduced form equation below captures the change in the probability of being self-employed due to the reform.

$$SE_{ht} = \alpha_3 + \delta_{3t} + \psi_1 Policy_t \times T_h + \sigma_{13} T_h + \sigma_{23} Policy_t + X_{ht}\gamma_3 + u_{3ht} \quad (6)$$

This semi-elasticity captures the overall effect of marginal taxes on self-employment decisions, necessary to estimate the occupational decisions' semi-elasticity to tax changes $\eta_{H,t}$ defined in Proposition 1. Hence, $\frac{\varepsilon_{e,t}\eta_{H,e}}{\eta_{H,t}}$ measures the relevance of the evasion channel in the overall effect of taxes on self-employment decisions.

5.1.2 Validity of Identification Assumptions

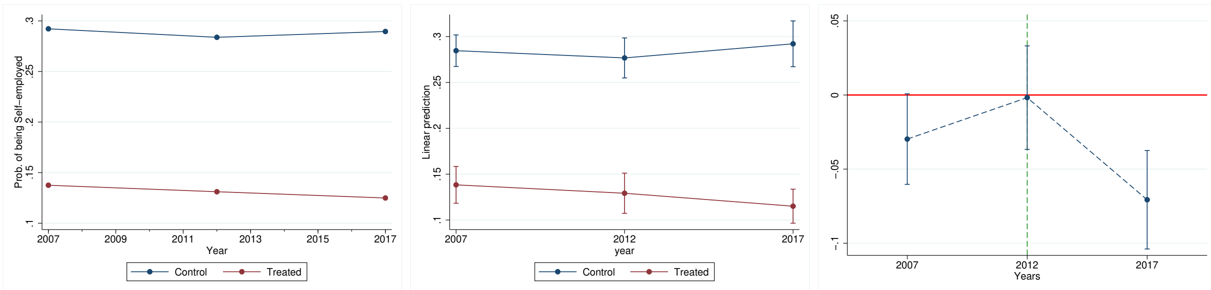
The empirical strategy must satisfy the DiD and Instrumental Variables (IV) assumptions for valid identification. Concerning DiD, parallel trends assumption ensures internal validity of the model, otherwise leading to biased estimates. Figure 3 shows the evolution of the self-employment probability for controls (blue line) and treated (red line) in non-parametric (panel (a)) and parametric (panel (b)) estimations. Trends are similar between groups, supporting the parallel trends assumption. Also, there is non-differential trends pre-reform in evasion rate (Figure A6 in Appendix).

Moreover, we perform a DiD event study, including interactions of the treatment indicator with year indicators to equation (4), excluding the intercept to avoid perfect multicollinearity.

[17]Other papers that follow a similar approach are Duflo (2001) and Sigurdsson (2019).

The difference in point estimates between groups (panel (c)) is not statistically significant before the policy intervention.

Figure 3: Parallel Trend Assumption on Self-employment Outcome



(a) Non-Parametric (b) Parametric (c) Event Study

Note: Non-parametric estimation plots a linear fit of the probability of being self-employed. Parametric estimation is the predicted value from the reduced form (6) with 95% CI. The event study plots the average mean difference between the treated and control groups. Source: Own elaboration based on the EPF data.

Another critical assumption is the compositional effect: the policy should not affect the composition differences between the control and treatment groups. To test this assumption, we run a DiD regression model similar to equation (4), using the controls in vector X as dependent variables, conditional on year-fixed effects. The coefficient $Policy \times T$ captures the differential effect between control and treatment groups due to the tax reform. Figure A7 shows that most variables are unaffected by the tax reform; only three out of seventeen coefficients differ from zero at a 1 percent significance level. However, the difference is small enough to argue that the effects are not economically significant.

Concerning the IV assumptions, the instrument's relevance is tested in equation (4). Table 4 shows that the instrument is relevant with a significant coefficient at 1 percent in each specification and an F-statistic larger than 10. Also, the weak identification and endogeneity tests (Table 5) show no evidence that the instrument is weak or endogenous.

The exclusion restriction relies on the potential workers' self-selection into treatment or control groups based on their behavioral responses to the tax reform. While the tax reform generated a quasi-experimental exogenous variation in occupational decisions, it could have affected the taxpayers' reported income, the variable that determines the exposure to the treatment. To address this potential issue, we follow the elasticity of the taxable income literature (see, for a review, Saez, Slemrod and Giertz, 2012) and use the pre-treatment data to obtain a predicted income without behavioral responses. Thus, we predict the declared income in 2017 by estimating the effect on the household head's reported income from the control variables and year-fixed effects in a pooled cross-section considering years $t = \{2006/7, 2011/2\}$. The pre-reform information allows us to predict the post-reform agent's income and, thus, treatment status in 2016/7, assuming that the reform did not change the agents' behavior directly.

5.2 Estimation Results

5.2.1 Tax Evasion Response to Policy Tax Change

Table 4 reports the baseline model (equation (4)). Pooled OLS estimation results are in columns (1) and (2), considering the treatment variable (our preferred specification) and its prediction, respectively. The last row provides the corresponding elasticities, considering the DiD interaction term estimates of the evasion rate change.

The tax reform reduced the evasion probability by 2 percentage points. Without addressing potential endogeneity concerns using the predicted treatment, the magnitude reduced almost half the effect at −1.04. Thus, omitting behavioral components causes a downward bias in the policy effect. Based on this estimated coefficient, we obtain the elasticity of evasion opportunity to the marginal tax rate (MTR) of 1.39. This result shows that evasion is highly sensitive to changes in the MTR. Similar results are obtained by instrumenting gross income with its prediction and using the predicted income (see Table A3 in Appendix).

This elasticity highlights the relevance of the MTR as an economic incentive for tax evasion. Kleven et al. (2011) also find a positive elasticity, but with a smaller magnitude before and after audits of 0.16 and 0.085, respectively. The poor tax administration capacity in Chile may explain the differences in the magnitude of the effects.

Additionally, we test how sensitive the estimated effect of evasion opportunity on self-employment decisions is to the variable used using an IV approach. We consider the net-of-tax marginal rate as an instrument for the evasion rate in the following regression model

$$Evasion_{ht} = \alpha_5 + \delta_{4t} + \phi_2 \ln(1 - MTR_{ht}) + X_{ht}\gamma_4 + \nu_{4ht} \quad (7)$$

$$SE_{ht} = \alpha_6 + \delta_{5t} + \beta_2 Evasion_{ht} + X_{ht}\gamma_5 + u_{5ht} \quad (8)$$

Column (3) in Table 4 shows the net-of-tax marginal rate estimated effect in equation (7). Similar to our main specification, we use the predicted income to obtain a predicted net-of-tax marginal rate to avoid self-selection problems (column (4)). These estimation results are consistent with previously estimated effects. A one percent increase in the net-of-tax marginal rate significantly decreases the tax evasion rate by 0.26 percentage points. The coefficient is slightly lower considering the predicted net-of-tax marginal rate (−0.22). Since those coefficients represent a semi-elasticity, these results reinforce the relevance of taxes in evasion behavior.

Results are robust to the alternative Mix and HLP self-employed household definitions (see Table A4 in Appendix). However, comparing the behavioral parameters between definitions, we find that households with self-employed partners or women heads are less sensitive to tax changes. This result reinforces that tax evasion is a household strategic decision and that household composition could drive heterogeneous behaviors. We further explore these results in the following section.

Table 4: Effect of Tax Reform on Tax evasion

Dep. Vble: Evasion Rate	(1)	(2)	(3)	(4)
Policy	0.0073**	0.0082**		
	(0.003)	(0.004)		
Treatment	0.0344***	0.0276***		
	(0.003)	(0.003)		
Policy × Treatment[a]	-0.0104***	-0.0206***		
	(0.004)	(0.004)		
Ln Mg Net-of-Tax Rate			-0.2620***	-0.2163***
			(0.021)	(0.021)
Observations	15,063	15,063	15,063	15,063
R-squared	0.212	0.208	0.215	0.208
F-statistic	33.71	33.86	35.03	33.98
Covariates	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Delta Tax[b]	-1.6%	-1.6%		
Mean Evasion[c]	2.6%	2.6%		
Mean Tax[d]	2.8	2.8		
Elasticity ($^a/_c/^b/_d$)	0.701	1.395		

*Notes: Columns (1) and (2) report POLS estimates of the tax policy change and tax policy change based on predicted treatment, and columns (3) and (4) of the effects of the net-of-tax marginal rate and its prediction, respectively, using the household sampling weights. Covariates includes: male indicator, age-group dummies, education-group dummies, marital status, partner's occupation type, household size dummies, owner dwelling indicator, single-parent family indicator, a child under 15 years in the family indicator, 1-digit ISCO-88 dummies, and agent's gross income (in Ln). Mean Evasion and Mean Tax are average weights for the whole sample. Robust standard errors are in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.*

5.2.2 Tax Evasion effect on Self-employment Decisions

Table 5 reports the estimation results of equation (5) and the sensitivity analysis of equation (8). Column (1) displays the pooled OLS estimate. In column (2), we use the tax policy change as an instrument for workers' tax evasion opportunity (IV-DiD), while in column (3), we use the predicted treatment to exploit the tax policy change. In column (4), we use the net-of-tax marginal rate as an instrument, and in column (5), the predicted net-of-tax marginal rate. All the estimations are robust to instrumenting gross income with its prediction or using the predicted income (see Table A5 in Appendix).

Focusing on column (3), our preferred specification, we find that an increase of 1 percentage point in the evasion opportunity increases the probability of being self-employed by 6.17 percentage points. The magnitude of the effect shows that evasion is a critical determinant of self-employment decision. No significant differences exist in not addressing the potential treatment endogeneity using the predicted treatment (column (2)). Also, comparing this result with column (1), the coefficient estimated by OLS is negativelly biased. This bias could be explained by workers' unobserved ability, according to which high-ability workers tend to evade less and be wage-earners. Finally, the results are robust (see column (5)).

Table 5: Effect of Tax Evasion on Self-employment

Dep. Vble: Self-employment	(1)	(2)	(3)	(4)	(5)
Evasion Rate[a]	2.9797***	6.5101***	6.1695***	7.0437***	7.0003***
	(0.059)	(2.045)	(1.108)	(0.532)	(0.630)
Policy		0.0034	0.0031		
		(0.012)	(0.013)		
Treatment		0.0030	0.0157		
		(0.064)	(0.027)		
Observations	15,063	15,063	15,063	15,063	15,063
R-squared	0.493	0.114	0.183	-0.010	0.001
F-statistic	248.4	67.97	71.84	64.50	64.73
F-stat. Weak Ident.		7.65	23.63	162.46	101.49
Covariates	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓
Mean Evasion[b]	2.6%	2.6%	2.6%		
Semi-elasticity ($a \times b$)	0.077	0.169	0.160		

*Notes: Column (1) reports POLS estimates, in columns (2) and (3) Evasion is instrumented using the tax policy change and its prediction, and in columns (4) and (5) the net-of-tax marginal rate, using the household sampling weights. Covariates includes: male indicator, age-group dummies, education-group dummies, marital status, partner's occupation type, household size dummies, owner dwelling indicator, single-parent family indicator, a child under 15 years in the family indicator, 1-digit ISCO-88 dummies, and agent's gross income (in ln). Mean Evasion is the average weight in the whole sample. Robust standard errors are in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.*

As evasion is exclusive of the self-employment sector, the result in Table 5 captures both the intensive margin (i.e., the changes in the incentive to remain self-employed) and the extensive margin (i.e., the changes in the incentive to move from wage-earner to self-employed sector). Since evasion falls by 0.11 percentage points and the self-employment rate reduction among treated was 0.92 percentage points, evasion explains 74% ($0.11 \times 6.17/0.92$) of the total effect of the tax reform on self-employment. This result evidences the critical impact of evasion on the self-employment decision.

The semi-elasticity of the occupational decision to evasion, $\eta_{H,e}$ in Proposition 1, reaches 0.16. This result is similar to the alternative evasion measure and sample composition restrictions (Table A6 in Appendix), and the point estimate comparison sheds light on the heterogeneity of the effect. The semi-elasticity estimation is significantly higher using the Mix definition than the main specification. This fact might arise from a different evasion behavior in self-employed households driven by households with self-employed partners. On the other hand, the estimated semi-elasticity is slightly higher in the HLP definition, showing that households with female heads respond less than others to evasion incentives. This result is interesting considering those households' (potential) vulnerability.

From Proposition 1, we obtain the magnitude of the evasion channel on the overall self-employment decision. The reduced form in equation (6) gives the occupational decision semi-elasticity to tax estimate, $\eta_{H,t}$, finding that the evasion channel entirely drives the effect of taxes on self-employment decision, while the income response is minimum.[18] Thus, in the context where different occupations face equal marginal tax rates, as in the Chilean setting, any income tax change affects self-employment decisions through evasion incentives. This result discloses that any tax reform should consider the effects of evasion on occupational choice since it is the primary adjustment mechanism.

5.2.3 Robustness

Our analysis concentrated on two results: the tax reform's effect on evasion and the evasion effect on self-employment. In both cases, we showed that the coefficients are statistically equal when instrumenting gross income with its prediction or adding the predicted income in the regression. However, some other potential concerns deserve further analysis.

Estimated coefficients may be biased if our control group (agents in the first income bracket) significantly differs in unobservable characteristics. The differences can be considerable if we compare this group with taxpayers at the top of the income distribution. To address this concern, we estimate equations (4) and (5), restricting the treatment group by income bracket or by income decile. We expect the differences between agents in treated and control groups to be more prominent as we move to more distant income groups. Regarding the income decile examination, since the control group represents more than half of the workforce, we only show the effect from the seventh income decile, where we start seeing treated agents. We display the average effects of the behavioral parameters and use the delta method to obtain the confidence intervals.

The coefficient estimates of the tax reform on tax evasion are not statistically different from our main result considering the different income brackets or deciles (see Figure A8 in Appendix). The corresponding estimated elasticities (Figure A9 in Appendix) are always significantly positive. Although the elasticities with the income brackets decomposition are not significantly different, differences in income deciles are significant. However, these discrepancies may be explained by differences in the share of treated agents in the sample in each decile, which is still relatively low within deciles groups 7 and 8. The evidence is compelling enough to show that our result is robust across the income distribution. The same analysis for the evasion effect on self-employment (Figure A10 in Appendix) shows that the coefficients are not significantly different. The estimation of the semi-elasticity supports this result (Figure A11 in Appendix).

Bunching at the first income bracket threshold may also bias our estimates since it may drive the agents' response in the form of income declaration adjustment (Le Maire and Schjerning, 2013). Since control and treated agents are jointly present in income decile 7 (and in income decile 8 in the other years), we show the estimated effect of evasion on self-employment obtained by excluding either one or both. This ensures that we account for any bunching effect near the possible threshold of the first income bracket. Figure A12, panel (a), in Appendix, shows these coefficients, finding that the main result is robust to bunching. Finally, in panel (b), we evaluate if results change when including additional controls, such as

[18] Reduced form results are available in Table A7 in Appendix, being column (2) the main specification.

the income deciles or brackets and household income. In all the estimations, the coefficients are not significantly different.

6 Analysis of the Effect

The tax policy affects the MTR faced by each income bracket in different proportions. Hence, the treatment intensity varies across the income distribution. Moreover, Proposition 1 shows that if we enable the behavioral parameters to vary depending on agents' profiles, the effect of taxes on self-employment decisions would be heterogeneous. Therefore, this section evaluates the potential heterogeneous results considering the different taxpayers' profiles.

6.1 Understanding the Evasion and Occupational Behaviors

We further study the tax policy and evasion effects by income bracket. Figure 4 shows the elasticity of evasion concerning the MTR (blue dashed line) and the semi-elasticity of the occupational decision to evasion (red dashed line). For both parameters, we present the point estimates (panel (a)) and the percentage difference effect (panel (b)), i.e., the percentage change obtained from including additional income brackets progressively.

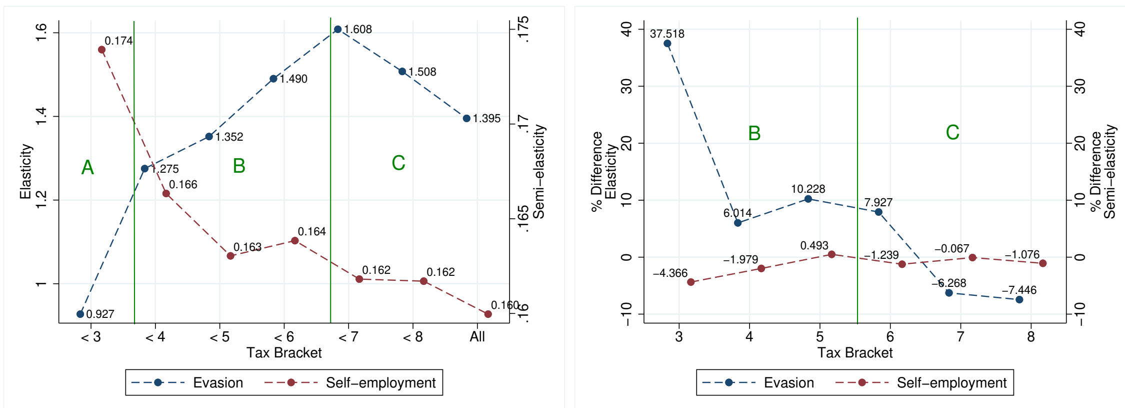
We can split the behavioral parameters into three zones. In zone A (around the first income bracket threshold), agents have a higher semi-elasticity of occupational decisions than the average, while the elasticity of evasion is lower (almost unitary). Thus, when the tax changes, agents are more prone to change their occupation than their evasion behavior relative to the average behavior. Incorporating the third income bracket into the sample (Panel (b)) increases the evasion elasticity by 37.5 percent, accompanied by a meaningful decrease in the occupational decision semi-elasticity of 4.3 percent. Therefore, agents in this zone significantly drive the overall occupational decision reaction to evasion opportunities. We can consider this effect as survivor behavior where agents evade taxes as self-employed when they have low productivity (La Porta and Shleifer, 2014).

In zone B, the evasion elasticity increases with each additional income bracket up to bracket 6 while the self-employment semi-elasticity decreases. The evasion elasticity increases by more than 6 percentage points with each additional bracket. Simultaneously, the semi-elasticity of self-employment is positive, although it falls to a magnitude close to the average. Hence, this middle-income group reacts significantly in both behavioral parameters.

Finally, zone C characterizes the contribution of higher-income taxpayers to the marginal effects. Both behavioral parameters fall (Panel (a)). Panel (b) shows a negative percentage change in the evasion elasticity and self-employment semi-elasticity, with low incentives to switch occupations. The considerable fall in evasion elasticity shows that high-income self-employed take advantage of self-reporting but limit evasion behavior to avoid auditing.

The tax reform produces a significant change in the MTR, but the net-of-tax marginal rate change is less meaningful (see Table 1). Hence, minor effects in the net-of-tax marginal rates do not produce a sufficient incentive to affect the occupational decision. Still, significant changes in the MTR alter the evasion incentive of some income deciles, driving changes in self-employment. Notably, the second and third income brackets faced a fall in their MTR of 20 percent, significantly affecting their evasion incentives. Consequently, the estimated occupation semi-elasticity is explained by the change in evasion incentives in this part of the income distribution. On the other hand, high-income taxpayers' evasion behavior is sensitive to tax changes, driving the average evasion elasticity obtained. Therefore, the effect of the self-employment semi-elasticity is driven by agents near the first income bracket, and the evasion elasticity is a result of an adding-up impact on middle and high-income taxpayers.

Figure 4: Behavioral Parameter Decomposition



(a) Tax Brackets (b) Percentage Difference

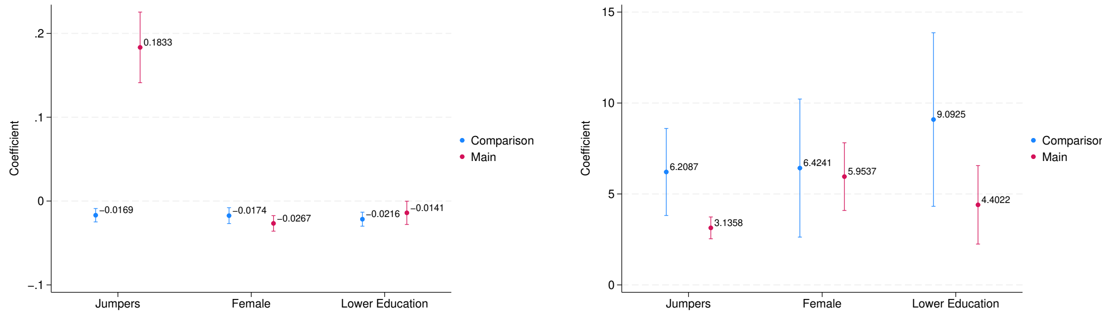
6.2 Characterising the Heterogeneity of the Effect

We focus on three main taxpayers' characteristics: gender gaps, education level, and the differential changes in evasion incentives. For the last, we evaluate the differential evasion incentives of penalties for a jumper, defined as an agent who underreports her taxable income to be levied according to a lower income bracket. The following regression model includes interaction terms to the main regressions for each of these variables to estimate the differential effects

$$
\begin{aligned}
Evasion_{ht} =& \alpha_1 + \delta_{2t} + \phi_1 Policy_t \times T_h + \phi_2 Policy_t \times T_h \times variable_{ht} + \sigma_1 T_h + \sigma_2 Policy_t \\
&+ \sigma_3 variable_{ht} + X_{ht}\gamma_1 + \nu_{1ht} \\
SE_{ht} =& \alpha_2 + \delta_{2t} + \beta_1 Evasion_{ht} + \beta_2 Evasion_{ht} \times variable_{ht} + \sigma_{12} T_h + \sigma_{22} Policy_t \\
&+ \sigma_{23} variable_{ht} + X_{ht}\gamma_2 + u_{2ht}
\end{aligned}
$$

where *variable* corresponds to a dummy that captures the profile of interest. For the comparison group, the coefficients ϕ_1 and β_1 show their corresponding effects. The effect of the studied group (i.e., being a jumper, female, or having lower education) is given by the coefficients $\phi_1 + \phi_2$ and $\beta_1 + \beta_2$. Figure 5 shows the estimation results for each group (see Tables A8 and A9 in Appendix for further details).

Figure 5: Heterogeneity Effects



(a) Evasion (b) Self-employment

Gender: We had already shown that considering only male-headed households without a self-employed partner (HLP definition), the effect of evasion opportunities on self-employment decisions is more meaningful. More vulnerable households are less prone to react in evasion and change occupation.[19] This result reflects differences in gender behaviors and from having a self-employed partner.

There are no significant differences in the behavioral parameters depending on gender. However, the difference in point estimates, which increase with income (see Figure A13 in Appendix), are consistent with women acting more honestly than men and reacting more to the tax policy change in evasion opportunity (see, Grosch and Rau, 2017; Torgler and Valev, 2010). This behavior would also explain why the effect of evasion opportunities on self-employment is slightly lower among women, similar to the evidence in the literature (Gërxhani, 2007; D'Attoma, Volintiru and Malézieux, 2020).

Female-headed households are usually more vulnerable than those with a male head since they tend to be single-parent families with low incomes. In Chile, we find that female heads live in households with fewer members, are more likely to be single, perceive lower income (personal and total), and have lower expenditures (see Figure A14, Panel (a), in Appendix). Hence, we expect that women react less to tax change because they face a more vulnerable context, with more persistent budgetary requirements than for men.[20]

Education: A higher education (complete or incomplete) is expected to provide a more comprehensive understanding of the tax system, which may increase evasion opportunities.[21]

On average, taxpayers with lower education are less sensitive than those with higher education, although not statistically significantly different (see Figure A15 in Appendix for further details). This evidence implies that the average effect of the policy change is mainly driven by highly educated taxpayers, in line with the argument that more sophisticated

[19]Taxpayers in the restricted HLP measure have a higher income, on average: \$895,801.8 vs. \$888,676.6.

[20]Similarly, Bruttel and Friehe (2014) find that current tax evasion depends on past incentives.

[21]Around 40% of the workers in the sample have a higher education, being 16.8% of them self-employed (against 28.4% of those with lower education). For a comparison between groups, see Figure A14, Panel (b), in Appendix

agents are more likely to react in evasion to tax changes (Benzarti, 2020; Almunia et al., 2022) and take advantage of the knowledge of the tax system as shown by Aghion et al. (2017). Moreover, workers with higher education are less likely to be self-employed than those with lower education when evasion gains fall.

Differential evasion incentives: Lemma 2 points out that evasion depends on the faced tax rate and the average penalty. Changes in the faced and owed MTR could produce opposite incentives since the former impacts the marginal gains from evading and the latter the expected penalties. By recovering the taxable income and contrasting it with the reported income, we identify the *jumpers* taxpayers. The coefficient of the interaction term thus gives the differential evasion incentives given by penalties.

Jumpers react significantly to the MTR change in the opposite direction than the average, increasing their evasion (see Figure A16 in Appendix for further details). Therefore, the penalty effect dominates their evasion behavior. Consequently, the average impact on self-employment is minor among jumpers compared to the average (Panel (b)). This result implies that a jumper requires a more meaningful variation in evasion opportunities to react similarly to the average, given the higher benefits they obtain from evasion.

This result is critical for the tax design. Jumpers differ significantly from non-jumpers (see Table A10 in Appendix). On average, jumpers evade more, are wealthier, are more likely men, and are more educated than non-jumpers. Thus, a policy that reduces the MTR without accounting for the potential effect on penalties will increase evasion and could increase inequality.

7 Conclusion

This study analyzes the relationship between income tax evasion and self-employment decisions. First, we develop a theoretical model demonstrating that when self-employed and wage-earners are levied under the same tax scheme, a marginal tax rate change affects self-employment decisions through taxable income and evasion. In this context, the differential taxation effect disappears, making it possible to isolate the evasion channel. On the other hand, the taxable income channel relies on the mechanical effect of tax changes on income (net of evasion).

Using Chilean survey data, we predict the evasion rate at a household level. We follow a consumption-based approach that compares Engel curves between self-employed and wage-earner households but adjusted this methodology to capture heterogeneity in evasion behavior.

Then, to capture the effect of evasion incentives on self-employment decisions, we follow an IV-DiD approach exploiting a tax reform in 2013 that affects only a part of taxpayers. The tax reform decreased the evasion opportunities by 2 percentage points, obtaining an elasticity to the MTR equal to 1.4. This result highlights the relevance of taxes in evasion. For the structural model, we obtain that a 1 percentage point increase in the evasion opportunities augments the probability of being self-employed by 6.17 percentage points, representing a

0.18 standard deviations increase in the self-employment rate. Therefore, evasion incentives are crucial determinants in the self-employment decision, obtaining a semi-elasticity of the occupational decision to evasion equal to 0.16. Finally, by estimating the semi-elasticity of self-employment decisions to the MTR, we show that the evasion channel drives the effect of change on the marginal tax rate on self-employment.

Motivated by the significant effect of evasion on self-employment, we study its drivers and heterogeneity. We show that the evasion effect on self-employment is driven by taxpayers' behavior near the first income bracket, and the effect on evasion is an adding-up result. Agents close to the first income bracket are more prone to change their occupation than their evasion behavior compared to the average worker. In the middle-income brackets, agents are prone to react in evasion and occupational choices. Finally, the wealthier agents preserve their evasion and occupational decisions, which evidences a more nuanced behavior to avoid alerting the IRS.

Regarding the heterogeneous behavior among workers, we show that women are less sensitive to MTR change in evasion opportunity but not in their occupation behavior than men. Woman-headed households tend to be more vulnerable than male-headed ones, which may be the reason for a more conservative evasion and self-employment behavior. Also, we find that the behavioral effects are partially driven by higher-educated agents who, understanding the tax system better, take advantage of its weaknesses to evade. Finally, agents who declare a lower income to fall in a lower tax bracket react to the MTR change in an opposite direction than others. From our theoretical model, this behavior is explained by the reduced expected penalties, given that the tax reform is progressive.

To conclude, this study shows that tax evasion is a meaningful driver of the self-employment decision, which makes it essential to consider these behavioral responses for any income tax change. Although the estimated average effects demonstrate that a tax cut reduces evasion, the behavior is the opposite for workers who jumped to a lower tax bracket. Moreover, the heterogeneous response of more vulnerable groups may impact welfare and inequality in ways that deserve to be explored. These parameters should be incorporated when policy-makers design income tax reforms as they are crucial considering the welfare implications that evasion and self-employment decisions have.

References

Aghion, Philippe, Ufuk Akcigit, Matthieu Lequien and Stefanie Stantcheva. 2017. Tax Simplicity and Heterogeneous Learning. Working Paper 24049 National Bureau of Economic Research.

Albarea, Andrea, Michele Bernasconi, Anna Marenzi and Dino Rizzi. 2020. "Income Underreporting and Tax Evasion in Italy: Estimates and Distributional Effects." *The Review of Income and Wealth* 66(4):904–930.

Alm, James. 2012. "Measuring, Explaining, and Controlling Tax Evasion: Lessons from

Theory, Field Studies, and Experiments." *International Tax and Public Finance* 19(1):54–77.

Almunia, Miguel, Jonas Hjort, Justine Knebelmann and Lin Tian. 2022. "Strategic or Confused Firms? Evidence from "Missing" Transactions in Uganda." *The Review of Economics and Statistics* pp. 1–35.

Banerjee, Abhijit and Andrew Newman. 1998. "Occupational Choice and the Process of Development." *Journal of Political Economy* 101(2):274–298.

Bárány, Zsófia. 2019. "Self-employment and Tax Evasion: Evidence from Industry–Occupation Data." *mimeo* .

Benzarti, Youssef. 2020. "How Taxing Is Tax Filing? Using Revealed Preferences to Estimate Compliance Costs." *American Economic Journal: Economic Policy* 12(4):38–57.

Bergolo, Marcelo, Gabriel Burdin, Mauricio De Rosa, Matias Giaccobasso and Martin Leites. 2021. "Digging into the Channels of Bunching: Evidence from the Uruguayan Income Tax." *The Economic Journal* 131(639):2726–2762.

Bergolo, Marcelo, Gabriel Burdin, Mauricio De Rosa, Matias Giaccobasso, Martin Leites and Horacio Rueda. 2022. "How do Top Earners Respond to Taxation? Evidence from a Tax Reform in Uruguay." *SSRN Working Paper* .

Bjørneby, Marie, Annette Alstadsæter and Kjetil Telle. 2021. "Limits to Third-party Reporting: Evidence from a Randomized field Experiment in Norway." *Journal of Public Economics* 203:104512.

Bosch, Nicole and Henk-Wim de Boer. 2019. "Income and Occupational Choice Responses of the Self-employed to Tax Rate Changes: Heterogeneity across Reforms and Income." *Labour Economics* 58:1–20.

Bruce, Donald. 2000. "Effects of the United States tax System on Transitions into Self-employment." *Labour Economics* 7(5):545–574.

Bruce, Donald. 2002. "Taxes and Entrepreneurial Endurance: Evidence from the Self-employed." *National Tax Journal* 55(1):5–24.

Bruttel, Lisa and Tim Friehe. 2014. "On the path dependence of tax compliance." *European Economic Review* 65:90–107.

Cabral, Ana, Norman Gemmell and Nazila Alinaghi. 2019. "Are Survey-based Self-employment Income Underreporting Estimates Biased? New Evidence from Matched Register and Survey Data." *International Tax and Public Finance* 28:284–322.

Carrillo, P., D. Pomeranz and M. Singhal. 2017. "Dodging the taxman: Firm misreporting and limits to tax enforcement." *American Economic Journal: Applied Economics* 9(2):144–64.

Castillo, Sebastián. 2023. "Tax policy design in a hierarchical model with occupational decisions." *International Tax and Public Finance* pp. 1–47.

Chetty, Raj. 2009. "Is the Taxable Income Elasticity Sufficient to Calculate Deadweight Loss? The Implications of Evasion and Avoidance." *American Economic Journal: Economic Policy* 1(2):31–522.

Cullen, Julie Berry and Roger H Gordon. 2007. "Taxes and entrepreneurial risk-taking: Theory and evidence for the US." *Journal of Public Economics* 91(7-8):1479–1505.

De Chaisemartin, Clément and Xavier d'Haultfoeuille. 2018. "Fuzzy Differences-in-differences." *The Review of Economic Studies* 85(22):999–1028.

Duflo, Esther. 2001. "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment." *American Economic Review* 91(4):795–813.

D'Attoma, John W, Clara Volintiru and Antoine Malézieux. 2020. "Gender, Social Value Orientation, and Tax Compliance." *CESifo Economic Studies* 66(3):265–284.
URL: *https://doi.org/10.1093/cesifo/ifz016*

Engstrom, Per and Johannes Hagen. 2017. "Income Underreporting among the self-employed: A Permanent Income Approach." *European Economic Review* 92(3):92–109.

Fairfield, Tasha and Michel Jorratt De Luis. 2016. "Top Income Shares, Business Profits, and Effective Tax Rates in Contemporary Chile." *Review of Income and Wealth* 62:120–144.

Feldstein, Martin. 1995. "The Effect of Marginal Tax Rates on Taxable Income: a Panel Study of the 1986 Tax Reform Act." *Journal of Political Economy* 103(3):551–572.

Flores, Ignacio, Claudia Sanhueza, Jorge Atria and Ricardo Mayer. 2020. "Top Incomes in Chile: A Historical Perspective on Income Inequality, 1964–2017." *Review of Income and Wealth* 66(4):850–874.

Fossen, Frank M and Viktor Steiner. 2009. "Income taxes and entrepreneurial choice: Empirical evidence from two German natural experiments." *Empirical Economics* 36(3):487–513.

Gentry, William M and R Glenn Hubbard. 2000. "Tax policy and entrepreneurial entry." *American Economic Review* 90(2):283–287.

Gorodnichenko, Yuriy, Jorge Martinez-Vazquez and Klara Sabirianova Peter. 2009. "Myth and Reality of Flat Tax Reform: Micro Estimates of Tax Evasion Response and Welfare Effects in Russia." *Journal of Political Economy* 117(3):504–554.

Grosch, Kerstin and Holger A. Rau. 2017. "Gender differences in honesty: The role of social value orientation." *Journal of Economic Psychology* 62:258–267.

Gërxhani, Klarita. 2007. "Explaining gender differences in tax evasion: the case of Tirana, Albania." *Feminist Economics* 13(2):119–155.

Hashimzade, Nigar, Gareth D Myles and Hana Yousefi. 2021. "Household tax evasion." *Journal of Public Economic Theory* pp. 985–1011.

Herkenhoff, Kyle, Gordon Phillips and Ethan Cohen-Cole. 2021. "The impact of consumer credit access on self-employment and entrepreneurship." *Journal of Financial Economics* 141(1):345–371.

Hurst, E., G. Li and B. Pugsley. 2014. "Are Household Surveys Like Tax Forms? Evidence from Income Underreporting of the Self-Employed." *The Review of Economics and Statistics* 96(1):19–33.

Jouste, Maria, Tina Kaidu Barugahara, Joseph Okello Ayo, Jukka Pirttilä and Pia Rattenhuber. 2021. "The Effects of Personal Income Tax Reform on Employees' Taxable Income in Uganda." *WIDER Working Paper* 2021/11.

Kesselman, Jonathan R. 1989. "Income tax evasion: an intersectoral analysis." *Journal of Public Economics* 38(2):137–182.

Kleven, Henrik J. 2016. "Bunching." *Annual Review of Economics* 8:435–464.

Kleven, Henrik J., Claus T. Kreiner and Emmanuel Saez. 2016. "Why can modern governments tax so much? An agency model of firms as fiscal intermediaries." *Economica* 83(330):219–246.

Kleven, Henrik J. and Esben A. Schultz. 2014. "Estimating Taxable Income Responses using Danish Tax Reforms." *American Economic Journal: Economic Policy* 6(4):271–301.

Kleven, Henrik J., Martin B. Knudsen, Claus T. Kreiner, Søren Pedersen and Emmanuel Saez. 2011. "Unwilling or unable to cheat? Evidence from a tax audit experiment in Denmark." *Econometrica* 79(3):651–692.

Kukk, Merike, Alari Paulus and Karsten Staehr. 2020. "Cheating in Europe: underreporting of self-employment income in comparative perspective." *International Tax and Public Finance* 27(2):363–390.

Kukk, Merike and Karsten. Staehr. 2017. "Identification of Household Prone to Income Underreporting: Employment Status or Reported Business Income?" *Public Finance Review* 45(5):599–627.

La Porta, Rafael and Andrei Shleifer. 2014. "Informality and Development." *Journal of Economic Perspectives* 28(3):109–126.

Le Maire, Daniel and Bertel Schjerning. 2013. "Tax bunching, income shifting and self-employment." *Journal of Public Economics* 107:1–18.

Londoño-Vélez, Juliana and Javier Ávila-Mahecha. 2021. "Behavioral Responses to Wealth Taxation: Evidence from Colombia." *mimeo* .

Nygård, Odd E, Joel Slemrod and Thor O Thoresen. 2019. "Distributional Implications of Joint Tax Evasion." *The Economic Journal* 129(620):1894–1923.

Parker, Simon. 2003. "Does tax evasion affect occupational choice?" *Oxford Bulletin of Economics and Statistics* 65(3):379–394.

Perry, Guillermo, William Maloney, Omar Arias, Pablo Fajnzylber, Andrew Mason and Jaime Saavedra-Chanduvi. 2007. *Informality: Exit and Exclusion.* World Bank Latin American and Caribbean Studies Washington DC: The World Bank.

Pissarides, Christopher and Guglielmo Weber. 1989. "An Expenditure-Based Estimate of Britain's Black Economy." *Journal of Public Economics* 39(7):17–32.

Pomeranz, Dina. 2015. "No taxation without information: Deterrence and self-enforcement in the value added tax." *American Economic Review* 105(8):2539–69.

Pomeranz, Dina and José Vila-Belda. 2019. "Taking State-capacity Research to the Field: Insights from Collaborations with Tax Authorities." *Annual Review of Economics* 11:755–781.

Saez, Emmanuel. 2010. "Do taxpayers bunch at kink points?" *American Economic Journal: Economic Policy* 2(3):180–212.

Saez, Emmanuel, Joel Slemrod and Seth H Giertz. 2012. "The Elasticity of Taxable Income with Respect to Marginal Tax Rates: A Critical Review." *Journal of Economic Literature* 50(1):3–50.

Schneider, Friedrich and Dominik Enste. 2002. *The Shadow Economy - An International Survey.* Vol. 106 Cambridge, MA: Cambridge University Press.

Schuetze, Herb J. 2000. "Taxes, economic conditions and recent trends in male self-employment: a Canada–US comparison." *Labour Economics* 7(5):507–544.

Sigurdsson, Jósef. 2019. "Labor Supply Responses and Adjustment Frictions: A Tax-free Year in Iceland." *mimeo* .

Slemrod, Joel. 2007. "Cheating ourselves: The economics of tax evasion." *Journal of Economic Perspectives* 21(1):25–48.

Slemrod, Joel. 2019. "Tax Compliance and Enforcement." *Journal of Economic Literature* 57(4):904–54.

Slemrod, Joel and Caroline Weber. 2012. "Evidence of the Invisible: Toward a Credibility Revolution in the Empirical Analysis of Tax Evasion and the Informal Economy." *International Tax and Public Finance* 19(1):25–53.

Torgler, Benno and Neven T. Valev. 2010. "Gender and Public Attitudes Toward Corruption and Tax Evasion." *Contemporary Economic Policy* 28(4):554–568.

Tortarolo, Dario, Guillermo A. Cruces and Victoria Castillo. 2020. "It Takes Two to Tango: Labour Responses to an Income Tax Holiday in Argentina." *Discussion Paper* 2020-07.

Waseem, M. 2018. "Taxes, Informality and Income Shifting: Evidence from a recent Paskitani Tax Reform." *Journal of Public Economics* 157(2018):41–77.

Watson, Harry. 1985. "Tax evasion and labor markets." *Journal of Public Economics* 27(2):231–246.

Wen, Jean-François and Daniel V Gordon. 2014. "An Empirical Model of Tax Convexity and Self-employment." *Review of Economics and Statistics* 96(3):471–482.

Yitzhaki, Shlomo. 1974. "Income tax evasion: A theoretical analysis." *Journal of Public Economics* 1(3):323–338.

Appendix

A Agents Decisions

We made several specific assumptions regarding some parameters in this model in order to obtain reduced-form results and simplify the economic exposure of the mechanism. First, we assume that $z^i \in [0, \overline{Z}]$. Second, $A = \overline{z}^i/2$. Third, $\rho(z^S - e) = 1 - (z^s - e)/\overline{z}^i$, so $\rho' = -1/\overline{z}^i < 0$.

A.1 Optimal Evasion: Proof of Lemma 1 and 2

Since the tax scheme is composed of two income tax brackets, four possible scenarios exist depending on the agent's income and income declaration position. For simplicity, we name each solution with the corresponding scenario number.

The first scenario is when $z^s \leq A$ and, consequently, $z^s - e < A$. In this case, self-employed agents maximize the following

$$\max_e U^s(C) = z^s - t_1(z^s - e) - \rho(z^s - e)\pi \left[t_1 z^s - t_1(z^s - e)\right]$$

Assuming an interior solution, the first-order condition (FOC) produces an optimal evasion equal to

$$e^* = -\frac{(1 - \rho(z^s - e)\pi)}{\rho'(z^s - e)\pi}$$

Replacing with the parameter characterization yields

$$e^* = e_1 = -\frac{z^s}{2} - A\left(1 - \frac{1}{\pi}\right)$$

The second scenario is when $z^s > A$ but $z^s - e < A$. In this case, self-employed agents solve the following problem

$$\max_e U^s(C) = z^s - t_1(z^s - e) - \rho(z^s - e)\pi \left[t_1 A + t_2(z^s - A) - t_1(z^s - e)\right]$$

The optimal evasion, given the FOC, is

$$e^* = z^s - \frac{(1 - \rho(z^s - e)\pi)}{\rho'(z^s - e)\pi} - \frac{t_1 A + t_2(z^s - A)}{t_1}$$

By replacing the audit function, we obtain

$$e^* = e_2 = \frac{z^s}{2} - A\left(1 - \frac{1}{\pi}\right) - \frac{(z^s - A)}{2}\frac{(t_2 - t_1)}{t_1}$$

Now, we look for the condition to guarantee the existence of this solution, i.e., $z^s - e^* < A$.

$$z^s - e^* = \frac{z^s}{2} + A\left(1 - \frac{1}{\pi}\right) + \frac{(z^s - A)}{2}\frac{(t_2 - t_1)}{t_1} < A = \frac{\overline{Z}}{2}$$
$$z^s < A\left[1 + \frac{t_1(2-\pi)}{\pi t_2}\right] \equiv Z_1$$

Therefore, e_2 is the solution for $z^s \in (A, Z_1)$.

The third scenario is when $z^s > A$ and $z^s - e \geq A$. In this case, we explore the condition using the Lagrange multiplier. The problem that agents solve is the following

$$\max_e U^s(C) = z^s - [t_1 A + t_2(z^s - A)] - \rho(z^s - e)\pi\left[t_1 A + t_2(z^s - A) - t_1 A - t_2(z^s - e - A)\right]$$
$$s.t \quad z^s - e \geq A \qquad (\lambda)$$

For a straightforward exposition, we first suppose that $\lambda = 0$, so $z^s - e > A$, finding the optimal evasion and characterizing the section where its solution holds. The optimal evasion from the FOC is

$$e^* = -\frac{(1 - \rho(z^s - e)\pi)}{\rho'(z^s - e)\pi}$$

In this case, we also ask about the condition for the existence of this solution. By replacing the audit function, we obtain

$$e^* = e_4 = \frac{z^s}{2} - A\left(1 - \frac{1}{\pi}\right)$$

The critical requirement is $z^s - e^* > A$, this implies

$$\frac{z^s}{2} + A\left(1 - \frac{1}{\pi}\right) > \frac{\overline{Z}}{2} = A$$
$$z^s > \frac{\overline{Z}}{\pi} \equiv Z_2$$

Therefore, e_4 is the solution for $z^s \in (Z_2, \overline{Z}]$. Notice that, if $\pi < 2$ we have $Z_2 > A$. Also, this assumption guarantee that $Z_2 > Z_1$. Therefore, we impose $\pi \in (1, 2)$.

Now, we proceed to demonstrate that if $\lambda \neq 0$, the result from the FOC is $\lambda > 0$. This result implies that, in section $A < z^s < Z_2$ the optimal evasion is given by $e^* = e_3 = z_s - A$. From the FOC, we have

$$\lambda = t_2(1 - \rho(z^s - e)\pi) + \rho'(z^s - e)\pi t_2 e$$

By replacing the audit function and $e = e_3 = z^s - A$ we obtain

$$\lambda = t_2\left[\frac{\overline{Z} - z^s\pi}{\overline{Z}}\right] = t_2\left[1 - \frac{z^s}{Z_2}\right]$$

Since $Z_2 > z^s$, $\lambda > 0$ yielding that the solution for $A < z^s < Z_2$ is e_3. Also, e_3 is the solution for $z^s \in [Z_1, Z_2)$ because for $A \leq z^s < Z_1$ the solution e_2 brings a larger utility.

A.2 Effect of Tax Changes on Evasion: Proof of Lemma 2

Since only e_2 and Z_1 depend on t_1 and t_2, we analyze only the effect of tax changes in this zone. We assume that the tax effect on income does not exist, i.e., $\frac{\partial z^s}{\partial t_i} = 0$ for $i = \{s, w\}$.

We look for the effect of t_1, t_2 and $\triangle t = t_2 - t_1$ in e_2. These three effects allow us to give a complete characterization of the tax effect on evasion. First we see the effect of t_1

$$
\begin{aligned}
\frac{\partial e_2}{\partial t_1} &= - \left[\frac{At_1 - (t_1 A + t_2(z^s - A))}{(t_1)^2} \right] \\
&= \frac{t_2(z^s - A)}{(t_1)^2} > 0
\end{aligned}
$$

Since $z^s - A > 0$ in this zone, $\frac{\partial e_2}{\partial t_1} > 0$.

Now, we see the effect of t_2 over e^*

$$
\begin{aligned}
\frac{\partial e_2}{\partial t_2} &= - \frac{z^s - A}{t_1} < 0 \\
&= - \frac{\partial e_2}{\partial t_1} \frac{t_1}{t_2}
\end{aligned}
$$

Since $z^s - A > 0$ in this zone, $\frac{\partial e_2}{\partial t_2} < 0$. Moreover, given the effect of t_1, replacing the partial derivative and defining $\eta_{e_2,t_1} = \frac{\partial e_2}{\partial t_1} t_1$, the effect of t_2 on e_2 is the semi-elasticity of evasion concerning t_1 normalized by t_2, i.e., $-\frac{\partial e_2}{\partial t_2} = -\frac{\eta_{e_2,t_1}}{t_2}$.

Now, to see the effect of $\triangle t$, we replace $t_2 = \triangle t + t_1$ and $t_1 = t_2 - \triangle t$ in e_2. The partial derivative is

$$
\begin{aligned}
\frac{\partial e_2}{\partial \triangle t} &= - \frac{(z^s - A)t_1 - (-1)(t_1 A + t_2(z^s - A))}{(t_1)^2} \\
&= - \frac{z^s t_1 + t_2(z^s - A)}{(t_1)^2} < 0
\end{aligned}
$$

Since $z^s - A > 0$ in this zone, $\frac{\partial e_2}{\partial \triangle t} < 0$. Notice that the effect of tax differential is equal to $-\frac{z^s}{t_1} - \frac{\partial e_2}{\partial t_1}$; hence the differential effect can be decomposed into two terms, the effect of t_1 on evasion and the ratio between self-employment income and t_1.

A.3 Threshold Function: Proof of Lemma 3

Since we compare two indirect utilities $(U^w(H(z^s, e^*)) = U^s(z^s, e^*))$ in different possibles scenarios, we have more than four cases to inspect for (specifically, there are eight cases).

However, since we maintain equality in both utilities, all the other cases, different from those defined for evasion, drop out. This is because each one gives agents strictly more utility in one sector (self-employment or wage-earner, depending on the income comparison), producing the absence of the threshold function in the zone. We denominate each solution with a number associated with the optimum evasion section in each case.

The first case is $z^w, z^s \leq A$, so $z^s - e_1 < A$.

$$H(z^s)(1-t_1) = z^s - t_1(z^s - e_1) - \rho(z^s - e_1)\pi\left[t_1 z^s - t_1(z^s - e_1)\right]$$
$$H(z^s) = \frac{z^s - t_1(z^s - e_1) - \rho(z^s - e_1)\pi\left[t_1 e_1\right]}{1-t_1} \equiv H_1(z^s, e_1)$$

The second case is $z^w > A$ and $z^s > A$. This section has three possible options that characterize the other evasion scenarios. The fist option is $z^s < Z_1$.

$$H(z^s) - t_1 A - t_2(H(z^s) - A) = z^s - t_1(z^s - e_2) - \rho(z^s - e_2)\pi\left[t_1 A + t_2(z^s - A) - t_1(z^s - e_2)\right]$$
$$H(z^s) = \frac{z^s(1 - \rho(z^s - e_2)\pi t_2)}{1-t_2} - \frac{(z^s - e_2)t_1 + A(t_2 - t_1))(1 - \rho(z^s - e_2)\pi)}{1-t_2} \equiv H_2(z^s, e_2)$$

The second option is $Z_1 \leq z^s < Z_2$.

$$H(z^s) - t_1 A - t_2(H(z^s) - A) = z^s - t_1(z^s - e_3) - \rho(z^s - e_3)\pi\left[t_1 A + t_2(z^s - A) - t_1(z^s - e_3)\right]$$
$$H(z^s) = \frac{z^s(1 - \rho(z^s - e_3)\pi t_2)}{1-t_2} - \frac{(z^s - e_3)t_1 + A(t_2 - t_1))(1 - \rho(z^s - e_3)\pi)}{1-t_2} \equiv H_3(z^s, e_3)$$

The last option is $Z_1 \leq z^s \leq \overline{z}^s$.

$$H(z^s) - t_1 A - t_2(H(z^s) - A) = z^s - t_1 A - t_2(z^s - e_4) - \rho(z^s - e_4)\pi\left[t_1 A + t_2(z^s - A) - t_1 A - t_2(z^s - e_4)\right]$$
$$H(z^s) = \frac{z^s - t_1 A - t_2(z^s - e_4) - \rho(z^s - e_4)\pi t_2 e_4}{1-t_2} - \frac{A(t_2 - t_1)}{1-t_2} \equiv H_4(z^s, e_4)$$

A.4 Tax Effects on the Threshold Function: Proof of Proposition 1

To simplify the exposure of each effect, we show the partial derivative in each section separately. Also, we standardize the effect using behavioral parameters to obtain an estimable equation for the effect. From Lemma 3 it is clear that $\dfrac{\partial H_1(z^s, e_1)}{\partial t_2} = 0$, thus we focus on the others sections. The effect of t_2 change on $H_2(z^s, e_2)$ is

$$\frac{\partial H_2(z^s, e_2)}{\partial t_2} = \frac{H_2(z^s, e_2) - A}{1-t_2} + \frac{\partial z^s}{\partial t_2}\frac{\partial H_2(z^s, e_2)}{\partial z^s} + \frac{\partial e_2}{\partial t_2}\frac{\partial H_2(z^s, e_2)}{\partial e_2} - \frac{\rho(z^s - e_2)\pi(z^s - A)}{1-t_2}$$

The behavioral parameters that define the effect of t_2 on the threshold function are: $\frac{\partial z^s}{\partial t_2}\frac{\partial H_2(z^s, e_2)}{\partial z^s}$ and $\frac{\partial e_2}{\partial t_2}\frac{\partial H_2(z^s, e_2)}{\partial e_2}$.

Now, we obtain the effect of t_2 on $H_3(z^s, e_3)$.

$$\frac{\partial H_3(z^s,e_3)}{\partial t_2} = \frac{H_3(z^s,e_3)-A}{1-t_2} + \frac{\partial z^s}{\partial t_2}\frac{\partial H_3(z^s,e_3)}{\partial z^s} + \frac{\partial e_3}{\partial t_2}\frac{\partial H_3(z^s,e_3)}{\partial e_3} - \frac{\rho(z^s-e_3)\pi(z^s-A)}{1-t_2}$$

Similar to before, the structural parameters that capture the effect of t_2 on the threshold function are $\frac{\partial z^s}{\partial t_2}\frac{\partial H_3(z^s,e_3)}{\partial z^s}$ and $\frac{\partial e_3}{\partial t_2}\frac{\partial H_3(z^s,e_3)}{\partial e_3}$.

Finally, we obtain the effect of t_2 on $H_4(z^s, e_4)$.

$$\frac{\partial H_4(z^s,e_4)}{\partial t_2} = \frac{H_4(z^s,e_4)-A-(z^s-e_4-A)-\rho(z^s-e_4)\pi e_4}{1-t_2} + \frac{\partial z^s}{\partial t_2}\frac{\partial H_4(z^s,e_4)}{\partial z^s} + \frac{\partial e_4}{\partial t_2}\frac{\partial H_4(z^s,e_4)}{\partial e_4}$$

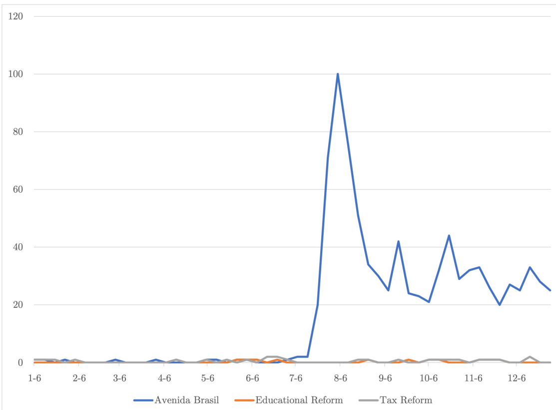
We can summarize the effect of t_2 on the threshold function with two structural parameters: $\frac{\partial z^s}{\partial t_2}\frac{\partial H_4(z^s,e_4)}{\partial z^s}$ and $\frac{\partial e_4}{\partial t_2}\frac{\partial H_4(z^s,e_4)}{\partial e_4}$.

From the above analysis is clear that the whole effect of t_2 on the threshold function can be summarized with the following structural parameters $\frac{\partial z^s}{\partial t_2}\frac{\partial H_(z^s,e^*)}{\partial z^s}$ and $\frac{\partial e}{\partial t_2}\frac{\partial H(z^s,e^*)}{\partial e}$. To obtain a more straightforward intuition, we make some arrangements

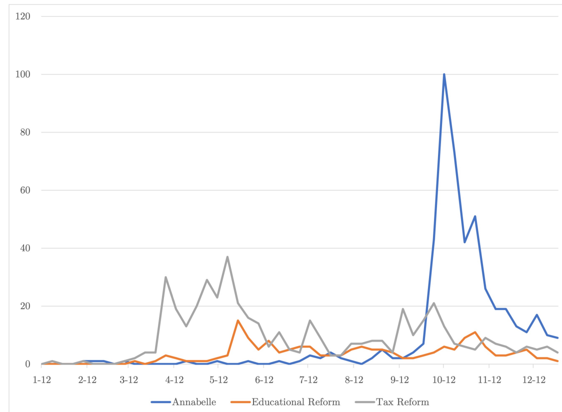
$$\begin{aligned}
\frac{\partial H(z^s,e^*)}{\partial t_2} &= \frac{\partial z^S}{\partial t_2}\frac{\partial H(z^s,e^*)}{\partial z^s} + \frac{\partial e^*}{\partial t_2}\frac{\partial H(z^s,e^*)}{\partial e} \\
&= \underbrace{\frac{\partial z^s}{\partial t_2}\frac{t_2}{z^s}}_{\varepsilon_{z^s,t_2}}\underbrace{\frac{\partial H(z^s,e^*)}{\partial z^s}z^s}_{\eta_{H,z^s}}\frac{1}{t_2} + \underbrace{\frac{\partial e^*}{\partial t_2}\frac{t_2}{e}}_{\varepsilon_{e,t_2}}\underbrace{\frac{\partial H(z^s,e^*)}{\partial e}e}_{\eta_{H,e}}\frac{1}{t_2} \\
\frac{\partial H(z^s,e^*)}{\partial t_2}t_2 = \eta_{H,t_2} &= \underbrace{\frac{\partial z^s}{\partial t_2}\frac{t_2}{z^s}}_{\varepsilon_{z^s,t_2}}\underbrace{\frac{\partial H(z^s,e^*)}{\partial z^s}z^s}_{\eta_{H,z^s}} + \underbrace{\frac{\partial e^*}{\partial t_2}\frac{t_2}{e}}_{\varepsilon_{e,t_2}}\underbrace{\frac{\partial H(z^s,e^*)}{\partial e}e}_{\eta_{H,e}}
\end{aligned}$$

B Tables and Figures

Figure A1: Google Trends Comparison: Educational and Tax reform



(a) 2013



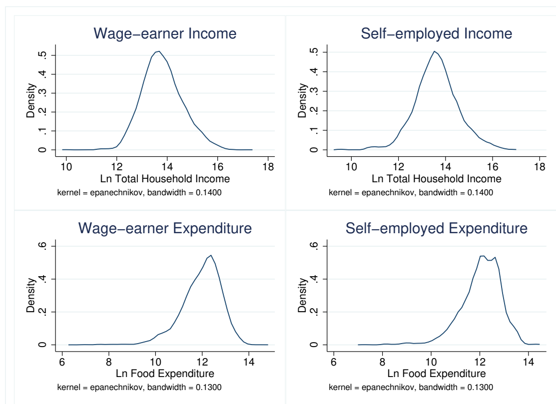
(b) 2014

Note: The numbers in the y-axis represent the search interest relative to the maximum value in the specified region and period list. The value 100 indicates the top popularity of the term, 50 implies half popularity, and 0 means there was not enough data for this term. Numbers in the x-axis show the week for the respective year. Source: Own elaboration based on the Google Trends data.

Figure A2: Density Function Comparison: Income and Expenditure

(a) EPF VI: 2006/7

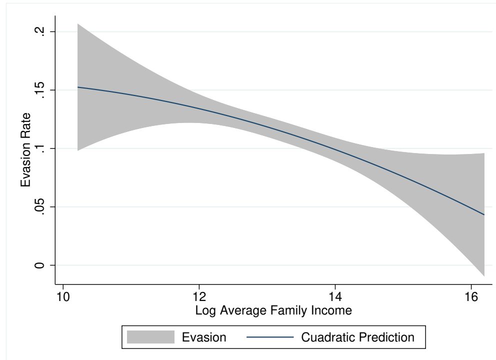
(b) EPF VII: 2011/2



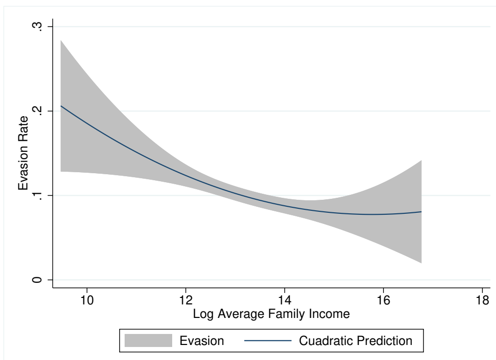
(c) EPF VIII: 2016/7

Note: Variables are expressed in natural logarithm. Densities are calculated for the household heads using the household sample weights. Source: Own elaboration based on the EPF data.

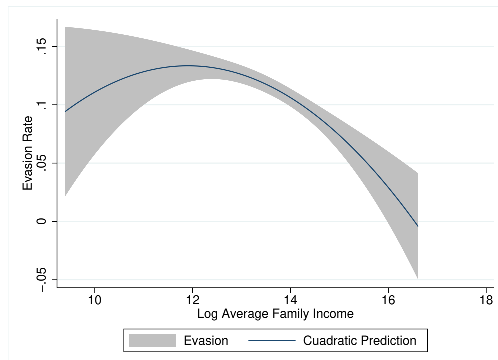
Figure A3: Predicted Evasion from the IV Regression Model



(a) 2006/7



(b) 2011/2



(c) 2016/7

Note: Non-parametric estimation results of the relationship between the evasion rate and the logarithm of the household. Predicted tax evasion is obtained from the IV estimation of equation (3). Source: Own elaboration based on the EPF data.

Table A1: Estimation of Tax Evasion: Tax Evasion Rate vs Intensive

	EPF Survey			
	2006/7	2011/2	2016/7	Average
Panel A: Main Specification				
Evasion Rate for Evaders	13.76%	11.76%	13.08%	12.87%
% of Evaders	83.16%	84.84%	86.13%	84.71%
Panel B: Household Head Mix				
Evasion Rate for Evaders	15.28%	13.82%	14.89%	14.66%
% of Evaders	45.09%	46.06%	49.88%	47.01%
Panel C: Household Head Occupation following HLP				
Evasion Rate for Evaders	16.75%	14.39%	17.37%	16.17%
% of Evaders	77.43%	76.33%	81.56%	78.44%

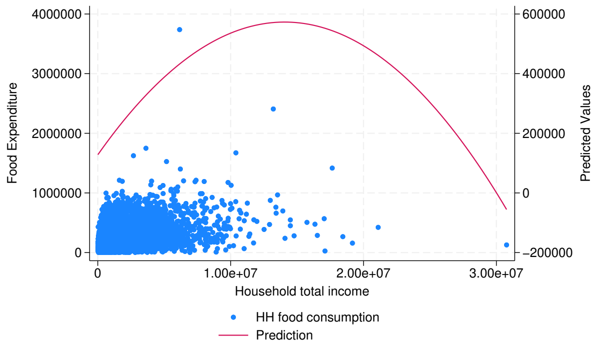
Note: Evasion Rate refers to the mean misreporting rates over self-employed households. Evasion Rate for Evaders is the percentage of misreporting among self-employed evader households. The means of the estimated coefficients were calculated after replacing negative misreporting rates with zero. Source: Own elaboration based on the EPF data.

Table A2: Estimation of Residuals in Tax Evasion Measure

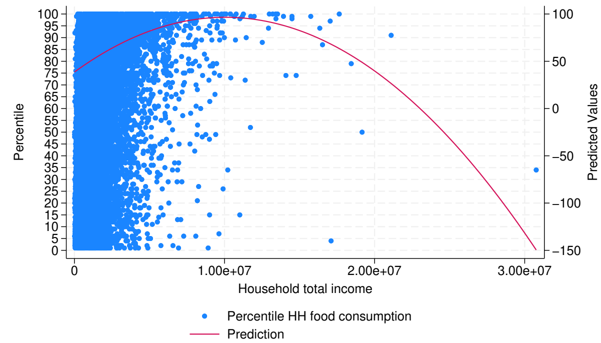
	Sub-sample		
Survey	Wage-earners	Self-employed	Evaders Self-employed
2006/7	0.000	0.009	0.001
	(0.6043)	(0.6124)	(0.6201)
Observations	4,552	1,478	1,236
2011/2	-0.018	-0.026	-0.029
	(0.6932)	(0.7043)	(0.7118)
Observations	4,122	1,235	1,047
2016/7	0.000	0.006	0.013
	(0.7048)	(0.7266)	(0.7041)
Observations	5,976	1,839	1,572

Note: Residuals are estimated from equation (3) by group and year. Standard deviation in parentheses. Source: Own elaboration based on the EPF data.

Figure A4: Distribution Food Consumption and HH Income



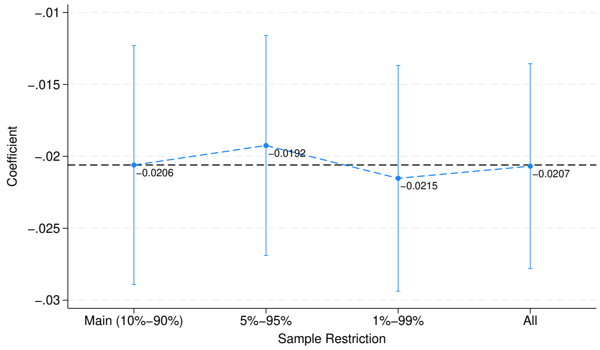
(a) Monetary Value



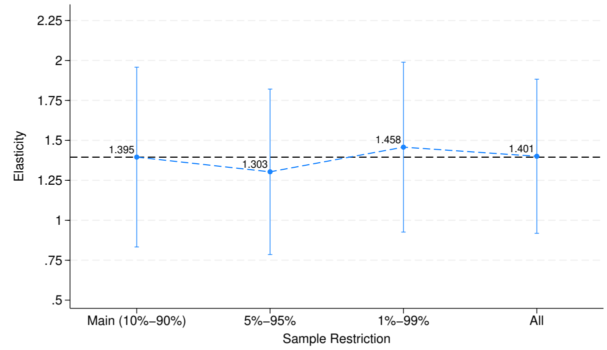
(b) Percentile

Notes: Prediction is made with a quadratic model using sample weights. Source: Own calculations based on the EPF data.

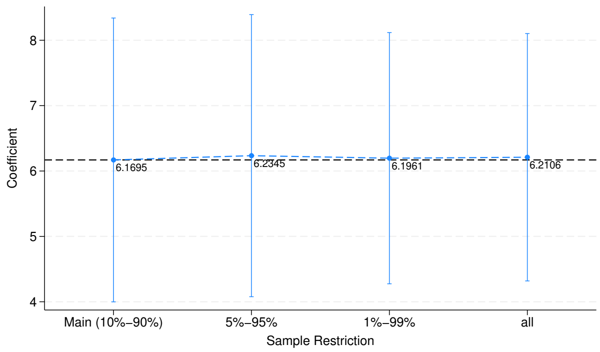
Figure A5: Robustness on Sample Restriction



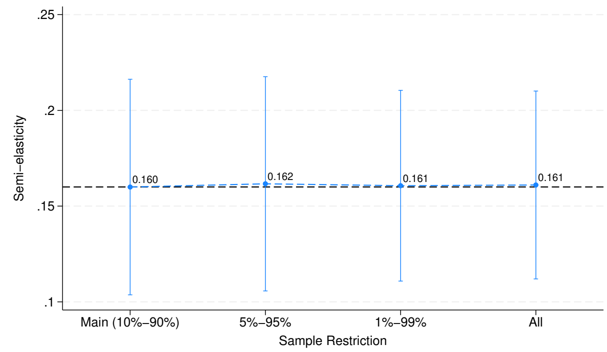
(a) Evasion



(b) Evasion Elasticity



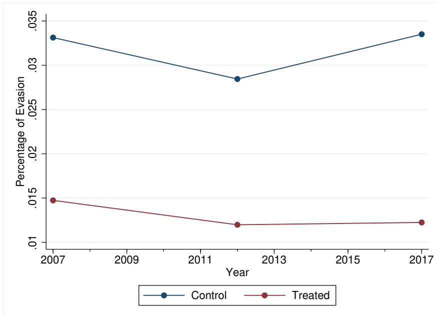
(c) Self-employment



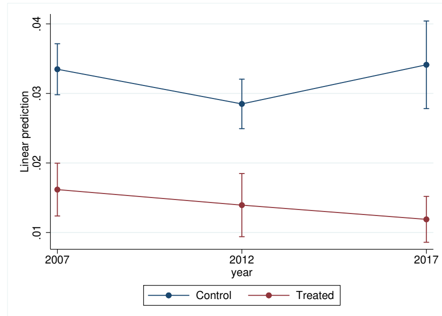
(d) Self-employment Semi-elasticity

Notes: Estimations are based on the main model, where only the sample restriction is changed. Sample restriction means the percentile of the food expenditure considered in the estimation, and it is indicated in the x-axis. The black dashed line represents the coefficient or the elasticity obtained in the main estimation. Source: Own calculations based on the EPF data.

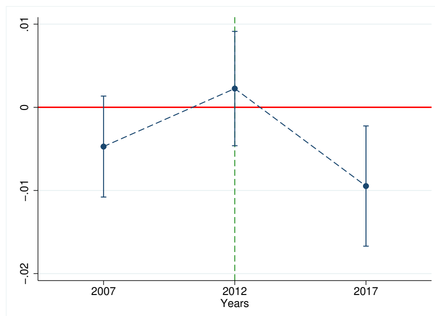
Figure A6: Parallel Trend Assumption on Tax Evasion Outcome



(a) Non-Parametric



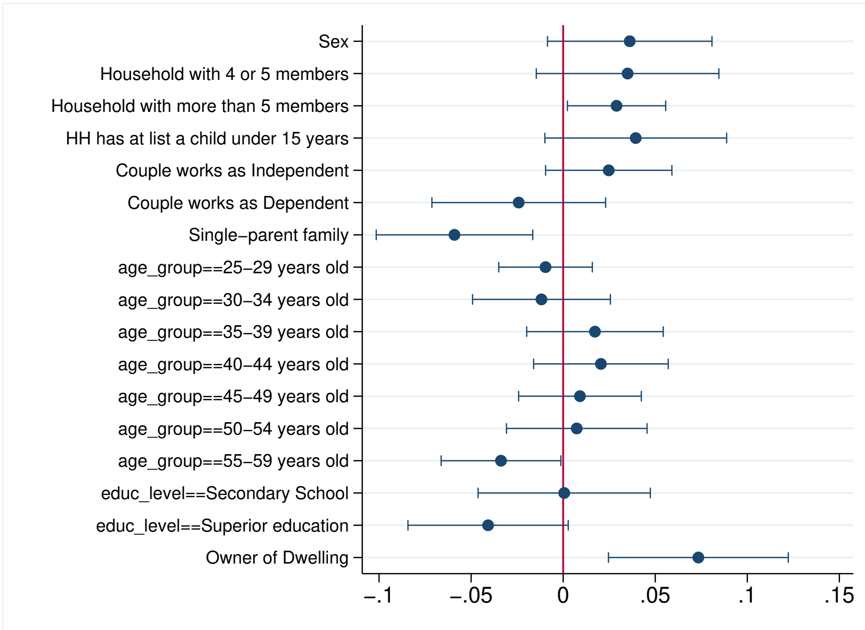
(b) Parametric



(c) Event Study

Note: Non-parametric estimation plots a linear fit of evasion rate estimation by the IV method. Parametric estimation is the predicted value from a regression. The event study plots the year difference between treated and controls in an equation similar to (4). Source: Own elaboration based on the EPF data.

Figure A7: Compositional Effect



Note: Parametric estimation results of the DiD using each variable as the dependent variable, with year fixed effect. Source: Own elaboration based on the EPF data.

Table A3: Effect of Tax Reform on Tax Evasion instrumenting Income and using predicted income

Dep. Vble.:	Instrumenting Income				Predicted Income			
Evasion Rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Policy	0.008**	0.013***			0.014***	0.011***		
	(0.003)	(0.003)			(0.003)	(0.003)		
Treatment	0.040***	0.035***			0.023***	0.028***		
	(0.004)	(0.004)			(0.003)	(0.004)		
Policy × Treatment[a]	-0.010***	-0.027***			-0.026***	-0.017***		
	(0.004)	(0.004)			(0.004)	(0.004)		
Ln Mg Net-of-Tax Rate			-0.292***	-0.282***			-0.112***	-0.223***
			(0.025)	(0.025)			(0.017)	(0.024)
Observations	14,987	14,987	14,987	14,987	15,061	15,061	15,061	15,061
R-squared	0.208	0.202	0.212	0.202	0.193	0.193	0.190	0.194
F-statistic	33.70	33.20	35.03	34.37	31.65	33.01	32.29	32.94
Covariates	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Delta Tax[b]	-1.6%	-1.6%			-1.6%	-1.6%		
Mean Evasion[c]	2.6%	2.6%			2.6%	2.6%		
Mean Tax[d]	2.8	2.8			2.8	2.8		
Elasticity ($^a/_c/^b/_d$)	0.707	1.800			1.730	1.151		

*Notes: Columns (1) and (2) report POLS estimates of the tax policy change and tax policy change based on predicted treatment, and columns (3) and (4) of the effects of the net-of-tax marginal rate and its prediction, respectively, using the household sampling weights. Covariates includes: male indicator, age-group dummies, education-group dummies, marital status, partner's occupation type, household size dummies, owner dwelling indicator, single-parent family indicator, a child under 15 years in the family indicator, 1-digit ISCO-88 dummies, and agent's gross income (in Ln). Mean Evasion and Mean Tax are average weights for the whole sample. Robust standard errors are in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations based on the EPF data.*

Table A4: EFFECT OF TAX REFORM ON TAX EVASION USING ALTERNATIVE HOUSEHOLD DEFINITIONS

Dep. Vble.:	Mix definition				HLP definition			
Evasion Rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Policy	0.004**	0.005**			0.015**	0.020***		
	(0.002)	(0.002)			(0.006)	(0.006)		
Treatment	0.020***	0.017***			0.029***	0.021***		
	(0.003)	(0.002)			(0.006)	(0.005)		
Policy × Treatment[a]	-0.005*	-0.010***			-0.013*	-0.028***		
	(0.003)	(0.003)			(0.008)	(0.008)		
Ln Mg Net-of-Tax Rate			-0.171***	-0.128***			-0.239***	-0.180***
			(0.015)	(0.016)			(0.036)	(0.037)
Observations	15,063	15,063	15,063	15,063	7,200	7,200	7,200	7,200
R-squared	0.301	0.299	0.304	0.299	0.217	0.216	0.220	0.215
F-statistic	59.29	60.45	61.58	60.59	26.34	27.07	27.28	26.75
Covariates	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Delta Tax[b]	-1.6%	-1.6%			-1.6%	-1.6%		
Mean Evasion[c]	2.2%	2.2%			3.0%	3.0%		
Mean Tax[d]	2.8	2.8			2.8	2.8		
Elasticity ($^a/_c/^b/_d$)	0.392	0.823			0.766	1.660		

*Notes: Columns (1) and (2) report POLS estimates of the tax policy change and tax policy change based on predicted treatment, and columns (3) and (4) of the effects of the net-of-tax marginal rate and its prediction, respectively, using the household sampling weights. Covariates includes: male indicator, age-group dummies, education-group dummies, marital status, partner's occupation type, household size dummies, owner dwelling indicator, single-parent family indicator, a child under 15 years in the family indicator, 1-digit ISCO-88 dummies, and agent's gross income (in Ln). Mean Evasion and Mean Tax are average weights for the whole sample. Robust standard errors are in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations based on the EPF data.*

Table A5: EFFECT OF TAX EVASION ON SELF-EMPLOYMENT INSTRUMENTING INCOME AND USING PREDICTED INCOME

Dep. Vble.:			Instrumenting Income					Predicted Income		
Self-employment	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Evasion Rate[a]	2.948***	6.790***	6.443***	7.351***	7.330***	3.058***	7.361***	5.774***	6.566***	7.179***
	(0.064)	(2.072)	(0.838)	(0.606)	(0.608)	(0.057)	(0.943)	(1.143)	(0.946)	(0.665)
Policy		0.006	0.006				0.006	0.010		
		(0.012)	(0.012)				(0.013)	(0.011)		
Treatment		0.008	0.029				-0.021	0.036		
		(0.081)	(0.028)				(0.021)	(0.031)		
Observations	14,987	14,987	14,987	14,987	14,987	15,061	15,061	15,061	15,061	15,061
R-squared	0.490	0.055	0.131	-0.083	-0.077	0.483	-0.083	0.258	0.107	-0.036
F-statistic	240	64.57	68.39	60.45	60.85	251.1	58.71	75.65	68.47	62.44
F-stat. Weak Ident.		4.02	21.62	64.29	59.92		39.67	17.54	41.29	82.42
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mean Evasion[b]	2.6%	2.6%	2.6%			2.6%	2.6%	2.6%		
Semi-elasticity ($a \times b$)	0.076	0.176	0.167			0.079	0.191	0.150		

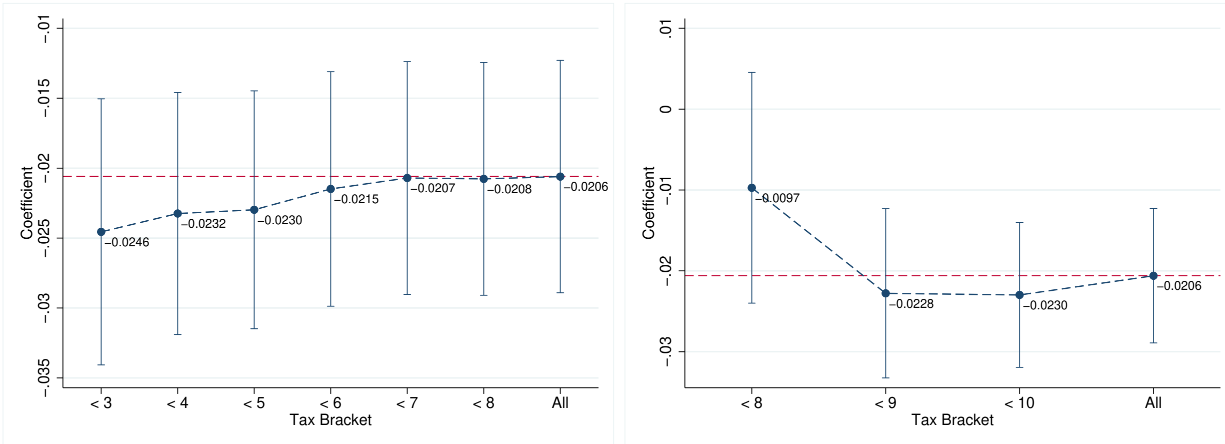
*Notes: Column (1) reports POLS estimates, in columns (2) and (3) evasion is instrumented using the tax policy change and its prediction, and in columns (4) and (5) the net-of-tax marginal rate, using the household sampling weights. Covariates includes: male indicator, age-group dummies, education-group dummies, marital status, partner's occupation type, household size dummies, owner dwelling indicator, single-parent family indicator, a child under 15 years in the family indicator, 1-digit ISCO-88 dummies, and agent's gross income (in ln). Mean Evasion is the average using sample weights in the whole sample. Robust standard errors are in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations based on the EPF data.*

Table A6: Effect of Tax Evasion on Self-employment using alternative Household definitions

Dep. Vble.:		Mix definition				HLP definition				
Self-employment	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Evasion Rate[a]	2.334***	13.650*	12.300***	10.806***	11.833***	3.054***	6.071**	5.385***	8.349***	8.056***
	(0.070)	(6.983)	(3.377)	(1.000)	(1.390)	(0.107)	(2.783)	(1.358)	(1.140)	(1.427)
Policy		-0.011	-0.007				-0.023	-0.018		
		(0.021)	(0.018)				(0.021)	(0.016)		
Treatment		-0.050	-0.017				0.058	0.074***		
		(0.132)	(0.053)				(0.067)	(0.023)		
Observations	15,063	15,063	15,063	15,063	15,063	7,200	7,200	7,200	7,200	7,200
R-squared	0.333	-2.269	-1.686	-1.126	-1.501	0.516	0.196	0.327	-0.475	-0.368
F-statistic	175.4	18.71	22.13	28.22	24.28	138.5	46.06	51.87	31.06	32.20
F-stat. Weak Ident.		3.42	11.76	122.27	67.06		3.20	11.43	43.68	23.83
Covariates	✓	✓	✓	✓	✓					
Year FE	✓	✓	✓	✓	✓					
Mean Evasion[b]	2.2%	2.2%	2.2%			3%	3%	3%		
Semi-elasticity ($a \times b$)	0.051	0.301	0.271			0.092	0.182	0.162		

*Notes: Column (1) reports POLS estimates, in columns (2) and (3) evasion is instrumented using the tax policy change and its prediction, and in columns (4) and (5) the net-of-tax marginal rate, using the household sampling weights. Covariates includes: male indicator, age-group dummies, education-group dummies, marital status, partner's occupation type, household size dummies, owner dwelling indicator, single-parent family indicator, a child under 15 years in the family indicator, 1-digit ISCO-88 dummies, and agent's gross income (in ln). Mean Evasion is the average using sample weights in the whole sample. Robust standard errors are in parentheses. Significance level: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Source: Own calculations based on the EPF data.*

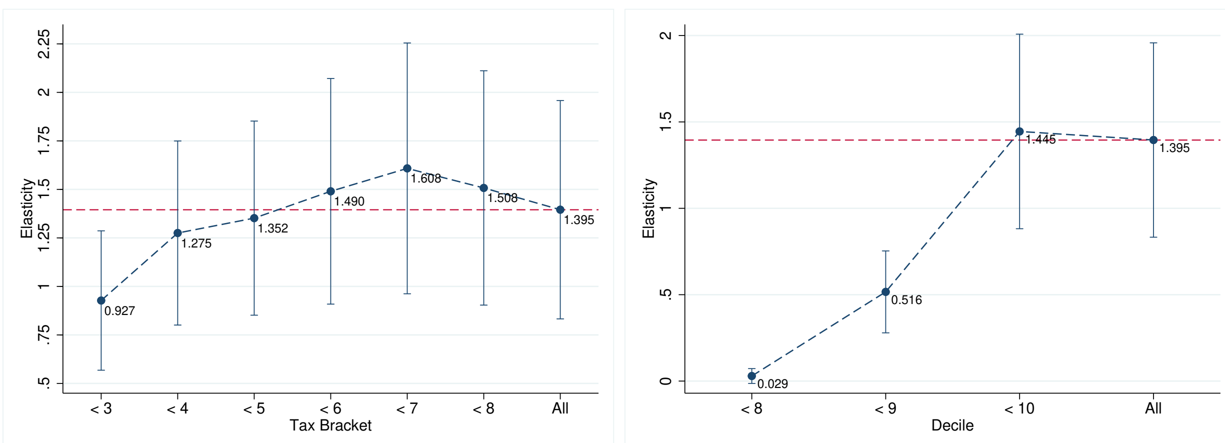
Figure A8: Decomposition of the Policy Reform Effect



(a) Income Bracket (b) Income Decile

Source: Own calculations based on the EPF data.

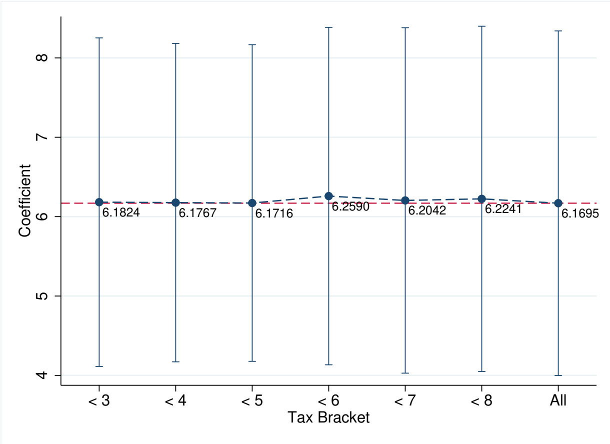
Figure A9: Heterogeneity of the Evasion Elasticity



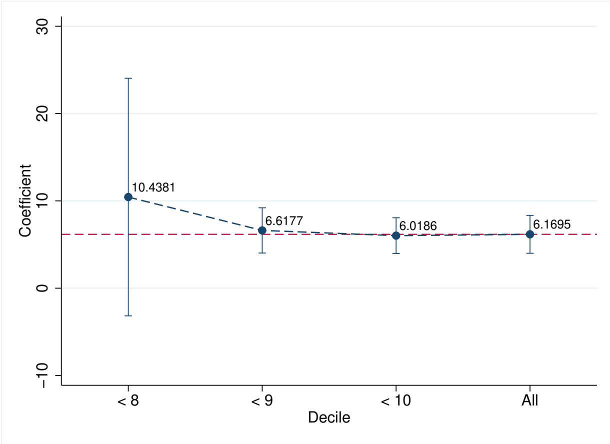
(a) Income Bracket (b) Income Decile

Source: Own calculations based on the EPF data.

Figure A10: Decomposition of the Effect



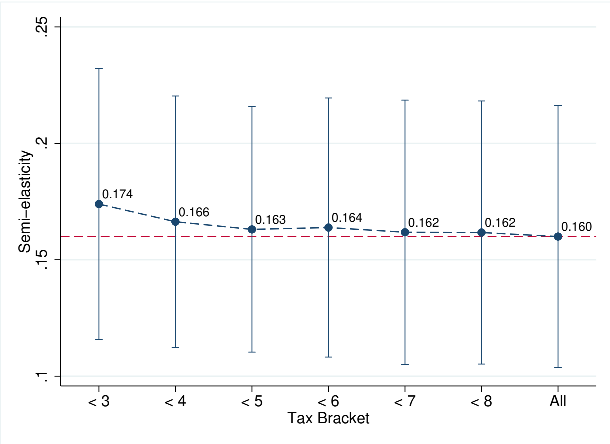
(a) Income Bracket



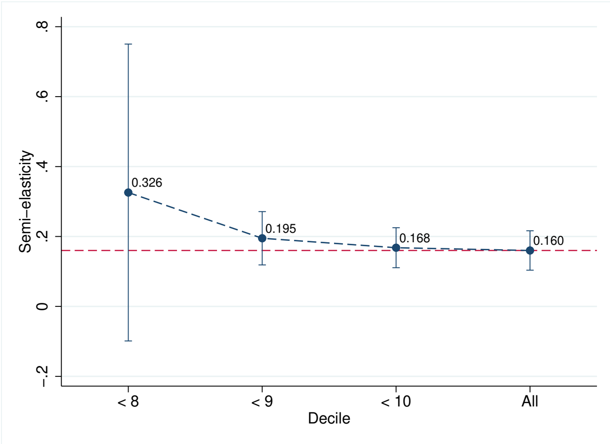
(b) Decile

Source: Own calculations based on the EPF data.

Figure A11: Heterogeneity of the Self-employed Semi-elasticity



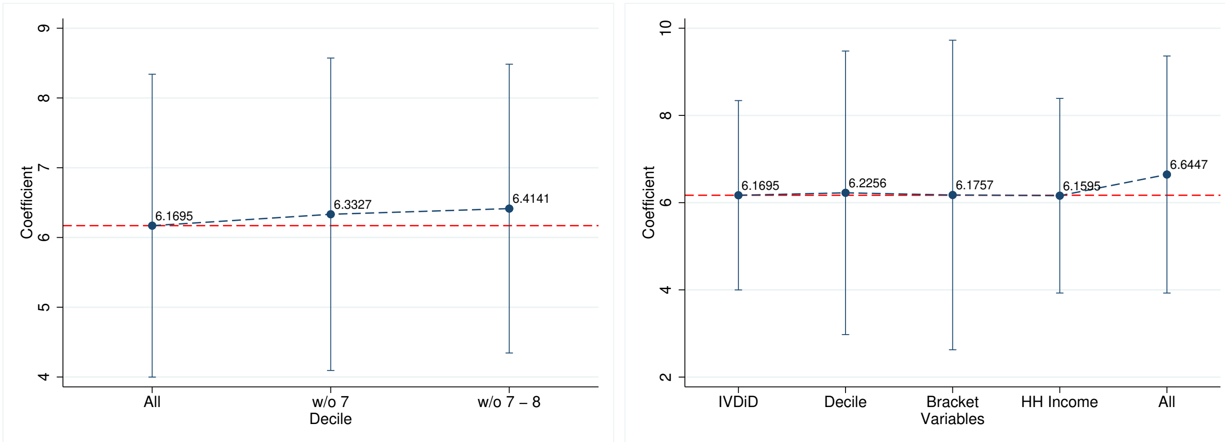
(a) Income Bracket



(b) Income Decile

Source: Own calculations based on the EPF data.

Figure A12: Robustness of the Coefficient



(a) Bunching (b) Controls

Source: Own calculations based on the EPF data.

Table A7: Reduced Form: Effect of Tax Reform on Self-employment

Dep. Vble: Self-employment	(1)	(2)
Policy	0.044***	0.054***
	(0.014)	(0.014)
Treatment	0.227***	0.186***
	(0.014)	(0.014)
Policy × Treatment[a]	-0.069***	-0.127***
	(0.017)	(0.018)
Observations	15,063	15,063
R-squared	0.243	0.236
F-statistic	108.6	106.2
Covariates	✓	✓
Year FE	✓	✓
Delta Tax[b]	-1.6%	-1.6%
Mean Tax[c]	2.8%	2.8%
Semi-elasticity ($(a/b) \times c$)	0.121	0.223

*Notes: Columns (1) and (2) report POLS estimates of the tax policy change and tax policy change based on predicted treatment, using the household sampling weights. Covariates includes: male indicator, age-group dummies, education-group dummies, marital status, partner's occupation type, household size dummies, owner dwelling indicator, single-parent family indicator, a child under 15 years in the family indicator, 1-digit ISCO-88 dummies, and agent's gross income (in Ln). Mean Tax is the weighted average for the whole sample, and Delta Tax is the weighted MTR difference in the whole sample. Robust standard errors are in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations based on the EPF data.*

Table A8: Heterogeneity Effect: Evasion

Dep. Vble: Evasion	(1) Jumpers	(2) Female	(3) Education
Policy × Treatment[a]	-0.0169***	-0.0174***	-0.0216***
	(0.004)	(0.005)	(0.004)
Policy × Treatment × vble[b]	0.2002***	-0.0092*	0.0076
	(0.021)	(0.005)	(0.006)
Constant	0.4901***	0.4261***	0.4310***
	(0.026)	(0.027)	(0.026)
Observations	15,063	15,063	15,063
R-squared	0.288	0.208	0.207
F-statistic	41.32	32.93	35.13
Total Effect $(a+b)$	0.1832	-0.0266	-0.0140
Std. Error	0.0214	0.0047	0.0070
P-value	0	0	0.0466

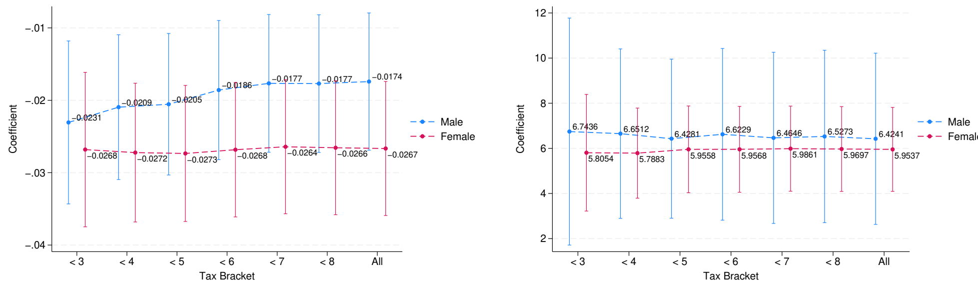
*Notes: The dummy vble represents the respective indicator for the group studied in each column. Robust standard errors are in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations based on the EPF data.*

Table A9: Heterogeneity Effect: Self-employment

Dep. Vble: Self-employment	(1) Jumpers	(2) Female	(3) Education
Evasion Rate[a]	6.2087***	6.4241***	9.0925***
	(1.221)	(1.936)	(2.434)
vle × Evasion Rate[b]	-3.0729***	-0.4704	-4.6903*
	(1.112)	(1.929)	(2.606)
Constant	0.2588	0.3816	0.4246
	(0.514)	(0.411)	(0.450)
Observations	15,063	15,063	15,063
R-squared	0.315	0.167	0.059
F-statistic	95.22	69.65	70.53
Total Effect $(a+b)$	3.1358	5.9537	4.4022
Std. Error	0.3061	0.9495	1.1005
P-value	0	0	0

*Notes: The dummy vble represents the respective indicator for the group studied in each column. Robust standard errors are in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations based on the EPF data.*

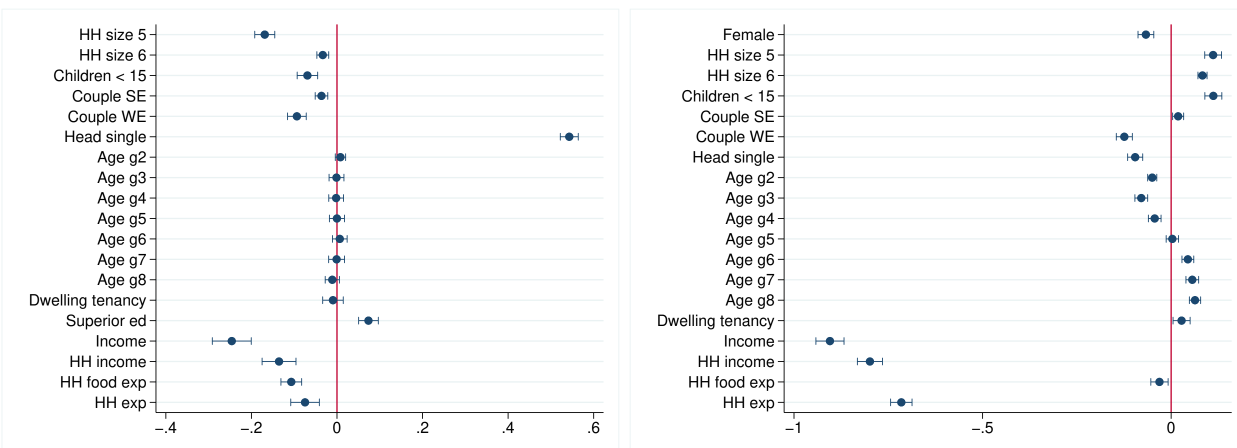
Figure A13: Gender Gaps in the Effects on Evasion and Self-employment



(a) Evasion (b) Self-employment

Notes: The model in panel (a) is $Evasion_{ht} = \alpha_1 + \delta_{2t} + \phi_1 Policy_t \times T_h + \phi_2 Policy_t \times T_h \times Female_{ht} + \sigma_1 T_h + \sigma_2 Policy_t + X_{ht}\gamma_1 + \nu_{1ht}$, *and in panel (b)* $SE_{ht} = \alpha_2 + \delta_{2t} + \beta_1 Evasion_{ht} + \beta_2 Evasion_{ht} \times Female_{ht} + \sigma_{12} T_h + \sigma_{22} Policy_t + X_{ht}\gamma_2 + u_{2ht}$, *where* $Evasion_{ht}$ *is instrumented with* $Policy_t \times T_h$ *and* $Evasion_{ht} \times Female_{ht}$ *with* $Policy_t \times T_h \times Female_{ht}$. *Average plots* ϕ_1 *and* β_1 *and Female is* $\phi_1 + \phi_2$ *and* $\beta_1 + \beta_2$.

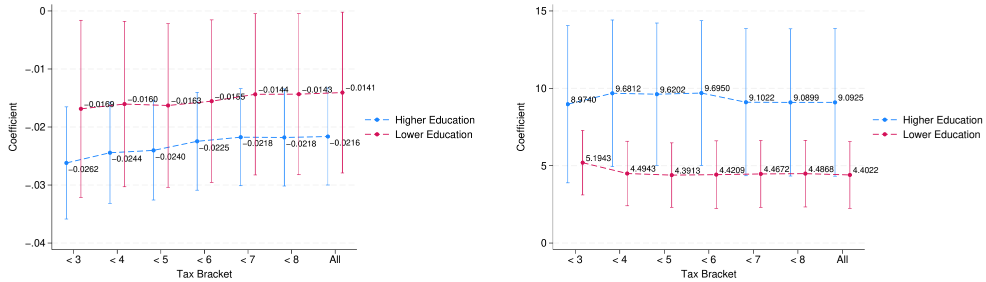
Figure A14: Comparison of the Observable Variables by Group



(a) Gender Gap (b) Without Higher Education

Source: Own calculations based on the EPF data.

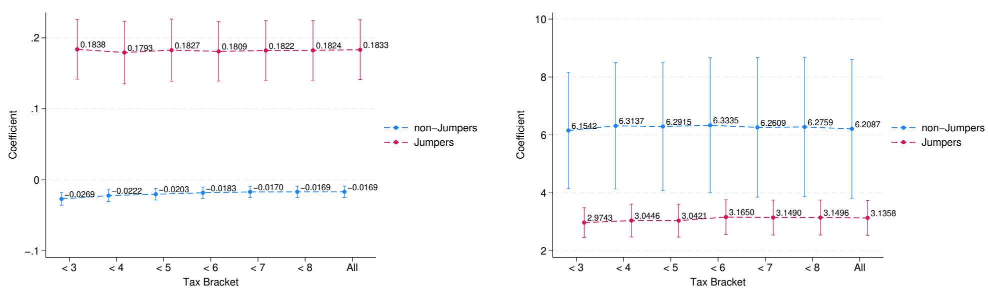
Figure A15: Effects on Evasion and Self-employment by Education level



(a) Evasion (b) Self-employment

Notes: The model in panel (a) is $Evasion_{ht} = \alpha_1+\delta_{2t}+\phi_1 Policy_t \times T_h+\phi_2 Policy_t \times T_h \times LowerEd_{ht}+\sigma_1 T_h+\sigma_2 Policy_t+\sigma_3 LowerEd_{ht}+G_{ht}\gamma_1+\nu_{1ht}$*, and in panel (b)* $SE_{ht} = \alpha_2+\delta_{2t}+\beta_1 Evasion_{ht}+\beta_2 Evasion_{ht} \times LowerEd_{ht}+\sigma_{12}T_h+\sigma_{22}Policy_t+\sigma_{22}LowerEd_{ht}+G_{ht}\gamma_2+u_{2ht}$*, where* $Evasion_{ht}$ *is instrumented with* $Policy_t \times T_h$ *and* $Evasion_{ht} \times LowerEd_{ht}$ *with* $Policy_t \times T_h \times LowerEd_{ht}$*. Vector G excludes education dummies from vector X. Average plots* ϕ_1 *and* β_1*, and w/o Higher Education are* $\phi_1+\phi_2$ *and* $\beta_1+\beta_2$*.*

Figure A16: Tax Evasion penalty drivers Evasion and Self-employment behaviors



(a) Evasion (b) Self-employment

Notes: The regression model in panel (a) is $Evasion_{ht} = \alpha_1+\delta_{2t}+\phi_1 Policy_t \times T_h+\phi_2 Policy_t \times T_h \times Jumper_{ht}+\sigma_1 T_h+\sigma_2 Policy_t+\sigma_3 Jumper_{ht}+X_{ht}\gamma_1+\nu_{1ht}$*, and in panel (b) is* $SE_{ht} = \alpha_2+\delta_{2t}+\beta_1 Evasion_{ht}+\beta_2 Evasion_{ht} \times Jumper_{ht}+\sigma_{12}T_h+\sigma_{22}Policy_t+\sigma_{23}Jumper_{ht}+X_{ht}\gamma_2+u_{2ht}$*, where* $Evasion_{ht}$ *is instrumented with* $Policy_t \times T_h$ *and* $Evasion_{ht} \times Jumper_{ht}$ *with* $Policy_t \times T_h \times Jumper_{ht}$*. Coefficients plotted in Average correspond to* ϕ_1 *and* β_1 *and in Jumper to* $\phi_1+\phi_2$ *and* $\beta_1+\beta_2$*.*

Table A10: Characterization of taxpayers according to their Jumping behavior

	Total		Jumpers		non-Jumpers		Means difference	
	Mean	sd	Mean	sd	Mean	sd	Difference	t-stat
Evasion rate	3%	0.08	7%	0.14	2%	0.07	-0.04***	(-13.80)
Self-employed	24%	0.42	32%	0.46	23%	0.42	-0.09***	(-7.98)
Treatment	33%	0.47	48%	0.50	32%	0.47	-0.19***	(-15.77)
Individual Total Income	$888676.57	1106318.13	$1681403.58	1465735.86	$804075.51	1025265.20	-950469.67***	(-27.34)
Household total income	$1191460.22	1356219.63	$1707721.58	1477445.69	$1136364.00	1330905.52	-681736.84***	(-18.80)
Male	70%	0.46	82%	0.39	69%	0.46	-0.14***	(-13.91)
20-24 years old	3%	0.16	1%	0.11	3%	0.16	0.01***	(4.70)
25-29 years old	8%	0.27	7%	0.26	8%	0.27	0.01	(0.97)
30-34 years old	13%	0.33	22%	0.42	11%	0.32	-0.10***	(-10.22)
35-39 years old	14%	0.35	16%	0.37	14%	0.35	-0.03**	(-2.95)
40-44 years old	16%	0.37	15%	0.36	16%	0.37	0.01	(1.43)
45-49 years old	17%	0.37	18%	0.38	16%	0.37	-0.01	(-0.80)
50-54 years old	17%	0.37	11%	0.31	18%	0.38	0.05***	(7.04)
55-59 years old	14%	0.34	9%	0.29	14%	0.35	0.04***	(6.19)
Higher education	38%	0.49	57%	0.50	36%	0.48	-0.22***	(-18.61)
Observations	19,202		1,920		17,282			

*Notes: Jumpers are defined as agents who report a lower income than their actual taxable income, falling in a lower income bracket than the corresponding according to their actual taxable income. Means are calculated considering the household sampling weights. Means difference reports the t-statistic of the test of difference in means between jumpers and non-jumpers. Significance level: *** p<0.01, ** p<0.05, * p<0.1.*
Source: Own calculations based on the EPF data.