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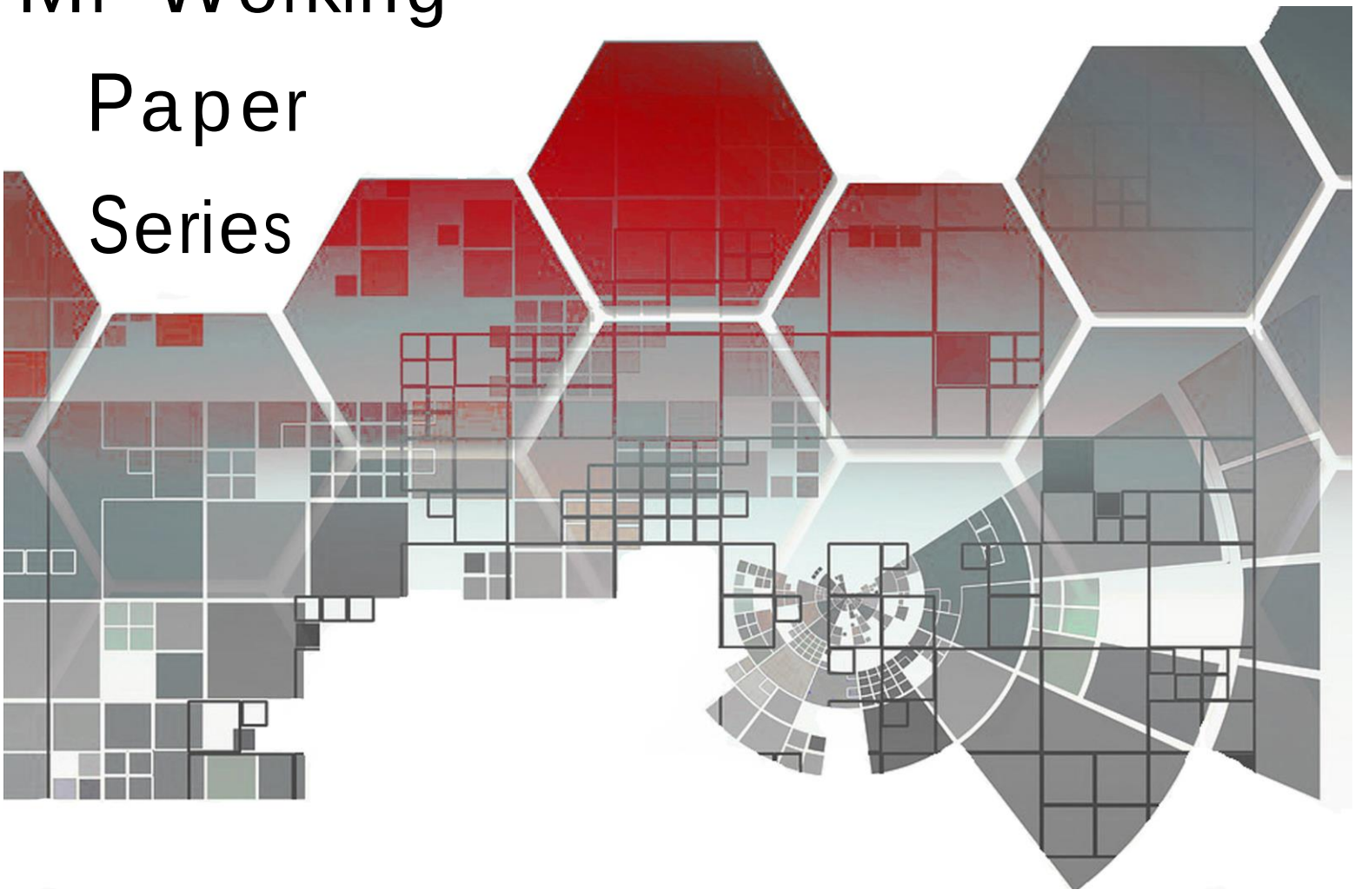

Justyna Klejdysz, Tom Zawisza

Transitions between Employment and Self-Employment in Response to Differential Taxation

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Abstract

How does the differential tax treatment of employees versus self-employed affect the decision to switch to self-employment? Using administrative data on the universe of taxpayers, we study the impact of a large tax cut for business owners in Poland on high-income individuals' decisions to transition from employment to self-employment. In 2004, the marginal tax rate for business owners in the top income bracket decreased from 40% to a flat rate of 19%, while employees remained subject to a progressive tax schedule with a top rate of 40%. We find a 17% increase in the probability of high-income employees switching to self-employment five years after the reform. The increase in entries to self-employment was driven by increased transitions to long-term solo self-employment (self-employment without dependent workers), especially in high-skilled service industries. In 2009, another reform reduced the tax differential. The entries from employment to self-employment temporarily decreased, but those who had previously switched to self-employment did not return to employment. These findings suggest that large tax differentials increased the attractiveness of self-employment as an alternative to employment but also increased the share of entrants to self-employment who do not hire workers.

Keywords: employment, self-employment, optimal taxation, income tax, high-income earners
JEL-Codes: D31, H2, J62, L26

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*Klejdysz: LMU Munich and ifo Institute (klejdysz@ifo.de); Zawisza: OECD and Institute for Fiscal Studies (tazawisza@gmail.com)

1 Introduction

In many countries, income from self-employment is subject to lower tax rates than income from employment (Milanez and Bratta, 2019).[1] Tax differentials can be justified by various economic arguments, including the promotion of entrepreneurship and the greater difficulty of taxing small business income compared to employment income.[2] Regardless of their economic justification, such differences create opportunities for tax arbitrage. Workers might consider selling their labor services under self-employment instead of employment, and firms may hire workers under alternative work arrangements (Boeri et al., 2020; Katz and Krueger, 2019).

Measuring the extent of switching behavior between employment and self-employment is crucial for several tax policy questions, such as understanding the distortions created by preferential tax treatment for the self-employed and determining the optimal tax rate differential between employment and self-employment. Despite the potential importance of this arbitrage behavior, there is little evidence regarding its magnitude. Existing literature has primarily focused on how tax incentives influence the choice of organizational form *among business owners*, such as incorporation decisions, and analyzed this choice with respect to the corporate share of economic activities and deadweight loss (Gordon and Slemrod, 1998; Goolsbee, 2004; Devereux et al., 2014; Bilicka and Raei, 2023). The impact of differential taxation between employment and self-employment is less well understood.

This paper fills this gap by asking how differences in the tax treatment of employment and self-employment affect the choice of employment form among high-income earners and, if they do, to what extent this is due to genuine entrepreneurial activity or reclassification of existing activity. Leveraging two large reforms in Poland, we examine the

[1] We define income from self-employment as income from unincorporated owner-managed businesses, such as sole proprietorships and partnerships. In most countries, such income is taxed on a pass-through basis. See section 2 for more details. We exclude owners of small incorporated businesses from this category because of the higher administrative costs of setting up such businesses, as well as the higher tax burden resulting from double taxation of such businesses. As a result, switching to the corporate form is unlikely to be the main margin of tax arbitrage in our setting.

[2] In particular, a typical economic justification for lower taxation of self-employment is that governments provide financial incentives to encourage entrepreneurship, job creation and investment, for example by compensating for the higher risks and costs associated with business activity through lower tax rates. Another is that self-employment income is more responsive to taxation. Empirical evidence suggests that the elasticities of taxable income are greater for the self-employed than for the employees, either due to their greater flexibility to adjust the supply of labor or due to income misreporting (Kleven and Schultz, 2014; Le Maire and Schjerning, 2013; Saez, 2010). All else equal, such larger elasticities justify lower marginal tax rates on self-employment, following the principles first articulated by Ramsey (1927).

impact of changes in the relative tax burden of employment and self-employment on transitions between employment and self-employment. As a result of the 2004 reform, owners of unincorporated businesses could choose to file under the existing progressive schedule with marginal tax rates of 19%, 30%, and 40%, or to file under the flat rate of 19% with fewer tax credits and deduction possibilities. Since employees could only file under the progressive schedule, the reform created a large difference in the average tax burden between employees and the self-employed. The 2009 tax reform flattened the progressive schedule by reducing the top marginal tax rate from 40% to 32%, thus reducing the tax differential and providing a unique setting to analyze taxpayers' responses to contrasting policy changes.

Using the panel structure of the data on the total population of taxpayers, we select the population of employees in 2000 and track transitions into and out of self-employment until 2014 within this population. This period covers both the flat tax reform in 2004 and a reform of the progressive schedule in 2009. Our empirical strategy uses a difference-in-differences approach. We compare taxpayers in the top two income percentiles before the reform (99-100 percentiles, the treatment group), who faced the largest change in tax incentives, to those in the previous two percentiles (97-98 percentiles, the control group), who experienced a smaller change in incentives. In addition to the immediate impact of the reform, our approach enables us to estimate the long-term impact of the 2004 reform and convert our estimates to elasticities.

We find a significant increase in the probability of transition from employment to self-employment among employees in the top two percentiles of the income distribution. The reform created a persistent change in the rate of transitions, which accumulated over time to a 1.9 pp. increase in the share of self-employed 5 years after the reform. This is equivalent to a 17% increase in the share of self-employment for the treated population of employees. The corresponding semi-elasticity of the share of individuals in self-employment in response to a 1 pp. change in the tax differential is high at 7.9 after 5 years, meaning that a 1 pp. increase in average tax differential between employees and self-employed led to an increase of 7.9% of the share of self-employed. The response is particularly pronounced and immediate among employees in the top 0.2% of the income distribution prior to the reform. Furthermore, we observe a temporary decrease in entries into self-employment among the group of high-income employees in response to the 2009 reform that reduced the marginal tax rate under the progressive schedule.

Next, we investigate how the share of self-employed at the top of the income distribution increases in response to changes in the tax differential. To this end, in addition to

analyzing transitions in and out of self-employment among employees, we also examine transitions in and out of employment among the self-employed. As before, we define the treatment and control groups as the top two and the next two percentiles, respectively, prior to the reform. We find significant but smaller responses in transitions from self-employment to employment in the population of self-employed. Overall in the population of employees and self-employed, we estimate the long-run semi-elasticity at 1.4, implying that a 1 pp. increase in tax differential at the top of the income distribution increases the share of self-employed by 1.4% in 5 years. We estimate the short-term semi-elasticity in the one-year horizon at 0.58.[3]

We analyze the nature of self-employment several years after entry, focusing on hiring behavior and the sector of business activity. Self-employed individuals can operate solo, hire employees, or be joint owners in a business. To investigate whether responses to the reform were driven by tax avoidance (i.e. income reclassification) or real business activity, we focus on the extent to which the increase in transitions from employment to self-employment was driven by transitions to solo self-employment. Solo self-employed are self-employed who are not hiring workers and are not partners in partnerships. Remaining solo self-employed for several years suggests a job with less entrepreneurial activity or a higher chance of dependent employment relationships. In addition, we describe the sectors in which these new entrants to business were operating. We estimate that 60% of the taxpayers who shifted to self-employment due to the reform were solo self-employed 7 years after the transition. Over 20% of the additional self-employed were employers or joint owners, while the rest left self-employment.[4] The share of solo-self-employed in the new entries to self-employment induced by the reform is higher than the proportion of solo-self-employed in the entries prior to the reform. The majority of new entries occurred in high-skilled service industries: finance, real estate, information, and professional services.

This paper contributes to the literature on tax policy and its influence on entrepreneurial entry. A few studies have empirically examined how changes to corporate and personal taxation influence entrepreneurial entry. Tazhitdinova (2020) studies new business entries into unincorporated and incorporated tax bases in response to a change in the tax

[3]For comparison, Tazhitdinova (2020) finds that a 1 pp. increase in tax savings from incorporation would lead to a 0.29% increase in switching from a personal to a corporate tax base, and a 0.33% increase in entrepreneurial entry in one year.

[4]We can only track employer-employee links from 2008, obscuring early hiring dynamics post-transition. However, by assessing employment status several years post-transition, we can infer long-term business development beyond initial solo self-employment. The data also do not distinguish solo self-employed individuals in single versus multiple contractor arrangements.

incentive to incorporate in the UK and finds increased entries to business. However, when analyzing the new business entry, the nature of previous employment is not investigated due to data limitations.[5]

A related paper studying extensive-margin effects of tax differentials is Zawisza (2017), which considers the quantitatively smaller reduction in the tax incentive to switch in Poland as a result of the 2009 reform, using a smaller sample of taxpayers. It does not consider hiring or sectoral impacts. The literature tends to find small or no effects of preferential tax regimes for self-employed on the probability of switching from paid employment or on the new business entry in different settings (DeBacker et al., 2019; Aghion et al., 2017; Fossen and Steiner, 2009). Aghion et al. (2017) find that while increasing eligibility for self-employment regimes in France does not boost new business entry, simplifying these regimes significantly increases small business entry. In contrast to those studies, the Polish flat tax reform was large and economy-wide. Business income in Poland is predominantly taxed according to the pass-through concept (Bukowski and Novokmet, 2021), whereby business income is attributed to individuals and Poland has one of the highest shares of employment in pass-through entities in Europe (Alstadsæter et al., 2017). With the exception of DeBacker et al. (2019) previous research has not examined the characteristics of new entrants to business. We longitudinally track individuals who switch to self-employment and evaluate their entrepreneurial activity, using solo self-employment status and sector as a proxy.

Previous studies have investigated how the tax schedule's progressivity affects entrepreneurship, using structural or quasi-structural models (Wen and Gordon, 2014; Arulampalam and Papini, 2023). Tax schedules typically influence entrepreneurship through their convexity and the net-of-tax income differential between self-employment and wage employment. Theoretically, higher convexity is expected to discourage self-employment, whereas higher net-of-tax income differentials encourage it.[6] For some reforms, these effects can offset each other. The reform we analyze reduces tax convexity for the self-employed only and, at the same time, increases the tax differential, as the tax schedule of employees is unaffected. Arulampalam and Papini (2023) find that entry into self-employment – or equivalently, exit out of wage employment – is more sensitive to changes

[5]According to Tazhitdinova (2020): "Lower corporate tax rates make the corporate base attractive not only to the existing unincorporated self- employed, but also to regular employees, making "independent con tractor" work more attractive than regular wage employment. To what extent this form of income shifting happens in practice remains an open empirical question."

[6]Empirically, Bruce (2000); Parker (2003); Bosch and de Boer (2019) find no effect of net earnings differentials and Wen and Gordon (2014) find positive effect on self-employment. Bruce (2000) finds a positive effect of the difference in ATR (between self-employment and employment) on self-employment

in the two variables than exit from self-employment. This is also consistent with our findings showing that transitions from employment to self-employment are more sensitive to tax differentials than reverse transitions.

Several papers have studied the dual income tax system prevalent in Nordic countries, under which self-employment income is split into capital and labor parts based on an imputed return on capital, which are taxed separately. These studies have examined the shifting responses between progressively taxed labor income and proportionally taxed capital income (Selin and Simula, 2017; Harju and Matikka, 2016; Kleven and Schultz, 2014; Pirttilä and Selin, 2011). However, the primary focus of these studies has been on intensive-margin shifting responses, specifically the cross-elasticities among different tax bases, conditional on reporting nonzero income in both tax bases.

This paper offers new empirical insights into the choice between wage employment and solo self-employment, particularly when solo self-employment is considered a persistent occupational status. The self-employed represent a diverse group, ranging from true entrepreneurs to those who sell their labor, such as consultants and gig economy workers (Smith and Miller, 2023; Cieślik and van Stel, 2023; Lim et al., 2019). Solo self-employed and self-employed with employees typically sort into different occupations, with solo self-employment often concealing dependent employment relationships (Boeri et al., 2020). Although only a fraction of self-employed ever innovate or hire employees, much of the existing literature equates entrepreneurship with self-employment (Parker, 2004).

This paper is the first to study the extensive margin response (the decision to enter or leave self-employment) in response to the flat tax reform in Poland using administrative tax data. The Polish flat tax reform was previously analyzed by Kopczuk (2023), who documents a large increase in reported self-employed income among business owners.[7] This paper focuses instead on the change in the flows from employment to self-employment in response to a sizeable exogenous change in the tax incentive to switch experienced by high-income earners. The flat tax reform has been a subject of debate regarding its impact on income inequality Bukowski and Novokmet (2021); Brzezinski et al. (2022); Bukowski et al. (2023). This issue is particularly relevant as the increasing prevalence of business income at the top of the income distribution in many OECD countries tends to reduce the effective progressivity of the income schedule and may exacerbate inequality (Rubolino and Waldenström, 2020; Förster et al., 2014). Furthermore, there is an

[7]He moreover argues that the high elasticities of taxable income are likely to be largely due to the reduction in an avoidance response rather than real activity.

ongoing debate about the extent to which business income at the top of the income distribution reflects returns to labor. Recent research suggests considerable flexibility about whether such income is classified as employment or business income at the top of the income distribution (Smith et al., 2019; Delestre et al., 2022). This study contributes to our understanding of the nature of business income at the top of the income distribution, and the extent to which it may be driven by tax considerations.

The remainder of the paper is structured as follows. In Section 2 we present the institutional background of the 2004 reform. Section 3 outlines a simple framework that explains how extensive margin switching between employment and self-employment can affect the deadweight loss of tax reform. Section 4 describes the data and definitions that we use. In Section 5 we present descriptive evidence on what happened around the 2004 and 2009 reforms in terms of taxpayer decisions to declare self-employment. In Section 6 we describe the empirical strategy. In Section 7, we present the results of our estimation exercise and elasticity estimates. Section 8 presents various robustness checks. Section 9 quantifies the deadweight loss of the 2004 reform due to extensive margin switching. Finally, section 10 concludes.

2 Institutional Background

Legal forms of the businesses and business taxation in Poland. The main legal forms of business in Poland are sole proprietorship, companies (limited liability company and joint stock company), and partnerships (which can be civil law, unlimited, professional, limited, and limited joint stock partnerships).[8] Sole proprietorships and partnerships are not taxed at the entity level. Instead, the profit of an entity is distributed to its owners (partners). Partners in partnerships can be natural persons or legal persons.[9] Natural persons conducting non-agricultural business activity are subject to personal income taxation: progressive tax or flat tax since 2004.[10] Companies are

[8]The Polish names for these are, respectively: jednoosobowa działalność gospodarcza (sole proprietorship), spółka z o.o. (limited liability company), spółka akcyjna (joint-stock company), spółka cywilna (civil law partnership), spółka jawna (unlimited partnership), spółka partnerska (professional partnership), spółka komandytowa (limited partnership), spółka komandytowo-akcyjna (limited joint-stock partnership).

[9]An exception is a professional partnership that can only have natural persons as partners. Natural persons in partnerships have unlimited liability, except for limited partnerships, where it is possible to limit the liability of a partner who is a natural person.

[10]Two additional methods of taxing businesses are "tax card" (*karta podatkowa*) and lump-sum tax on registered revenues (*ryczałt od przychodów ewidencjonowanych*). The "tax card" is a fixed tax amount determined by local tax authorities, while the lump-sum tax on registered revenues is a proportional tax imposed on revenue from specific business activities, with the tax rate varying based on the type

subject to corporate income taxation. Corporate income tax (CIT) was 28% in 2002, 27% in 2003, and was reduced to 19% in 2004, where it remained subsequently.[11]

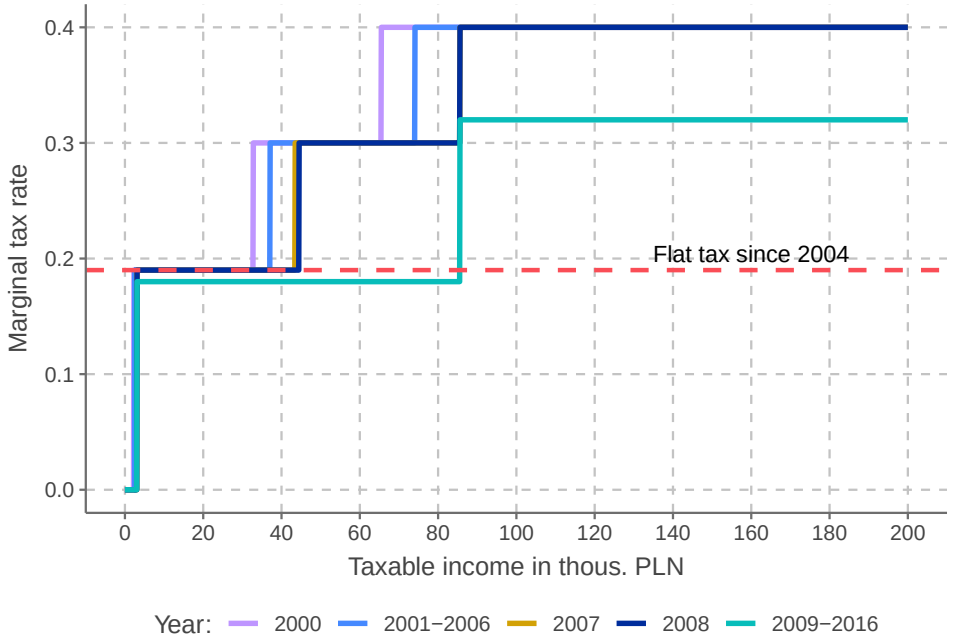
Definition of self-employed. The definition of self-employment we consider here is that found in the Polish tax system, namely natural persons conducting non-agricultural business activity. This includes sole proprietors and partners in partnerships (if they are natural persons). Such firms are effectively pass-through entities, whereby income passes through to the business owner and is subject to personal income taxation. The majority of self-employed are sole proprietors.

Personal income taxation. Differences in tax treatment between employees and the self-employed arise from both personal income tax and social security contributions. Most taxpayers are taxed under a progressive tax schedule that applies to the sum of the taxpayer's income from paid employment, self-employment, pensions, and taxable social benefits. Figure 1 shows the progressive tax schedule in the years 2000–2016. The Polish tax system maintained a progressive income tax with three tax brackets featuring marginal tax rates of 19%, 30%, and 40% through 2008. There was also an exemption from income tax for very low earners. The two income tax thresholds were 37 024 PLN and 74 047 PLN between 2002 and 2005, while the tax-free amounts were 518 PLN in 2002 and 530 PLN in 2003–2005. Between 2009 and 2018 there were two tax brackets with marginal tax rates at 18% and 32%. The income tax system permitted joint taxation with a spouse and preferential taxation for single parents.

of business. These methods do not allow for the deduction of business expenses. These schedules were targeted at small businesses engaged in traditional services or manufacturing that met specific criteria and are omitted in this analysis. Modern services, which include information technology and communications, finance and insurance, real estate and professional, scientific and technical activities, and administrative services, are predominantly taxed under a progressive or linear schedule (Chrostek and Krawczyk, 2018).

[11]The CIT rate was equalized with the personal flat tax rate, but in the incorporated tax base, business income is subject to double taxation.

Figure 1: Personal income tax schedule, 2000–2016



The social security contributions (SSC) include payments for health, pension, disability, sickness and work accident insurance. The calculation bases for SSC vary between employees and self-employed. For employees, the contribution base is gross salary. The total social security contributions on an employment contract are divided into the amount paid by employer and employee. There is a cap on the base, set at 30 times the average monthly gross wage in the national economy, which limits the amount of pension and disability contribution. In contrast, the SSC of self-employed are lump-sum payments.[12]

Flat tax regime. Starting January 1, 2004, taxpayers engaged in non-agricultural business activities and subject to personal income taxation were allowed to choose a flat tax rate of 19% instead of the progressive schedule. This option was available to existing business owners and those who started new businesses in 2004. It is important to note that this option was not available if a taxpayer intended to provide the same services to their previous employers within the same or previous tax year.[13] However,

[12]The SSC base for the self-employed is 60% of the average monthly gross wage in the national economy (75% for the health contribution) during the analyzed period. For employees, the base is the gross salary (approx. 81% of the gross salary for the health contribution). In 2003, the contribution rates relative to the contribution base for both employees and the self-employed were as follows: pension: 19.52%, disability: 13%, sickness: 2.45%, work accident: approx. 1.93%, and health insurance: 8%.

[13]For example, if the employment contract was terminated in 2003, a taxpayer who wished to provide the same services to their former employer under a self-employment contract could choose the flat tax in 2005. However, this rule changed in 2010. Since May 20, 2010, it has not been allowed to choose the

there were no restrictions on choosing the flat tax if a taxpayer provided different services to their former employer. Opting for the flat tax involved forgoing most tax deductions and credits, including the possibility of joint filing and preferential taxation for single parents. Self-employed taxpayers were required to select their preferred form of taxation by January 20, 2004. The default form of taxation for new business owners was the progressive schedule, and once chosen, taxpayers were not allowed to change their form of taxation during the remaining course of the year. If a taxpayer selected the flat tax, it became the new default option for the following year.

Poland's Tax Reform Debate in 2003. The year 2003 was a time of heated discussions about the shape of the Polish personal tax system in 2004. There were proposals to introduce a top marginal tax rate of 50% on a progressive schedule, and proposals to encourage entrepreneurship by reducing taxes for self-employed. On 9 June 2003, following the referendum on EU accession, Prime Minister Leszek Miller proposed the introduction of a flat tax. However, the details of this flat tax - its scope, the feasibility of its introduction in 2004 and its overall implementation - were uncertain at the time. In particular, in mid-2003 it was generally not expected that the flat tax would be adopted as early as 2004 (Wprost, 2003).

The Polish Parliament finally ratified the flat tax legislation on 12 November 2003. In addition, in December 2004 the Parliament finally approved the introduction of an additional tax threshold of 600 000 PLN with an MTR of 50%. However, this was declared unconstitutional by the Constitutional Tribunal two months later due to an insufficient *vacatio legis* period. Although this law was never enacted, its consideration indicates that increasing progressive tax rates remained a viable policy option in 2003 and 2004, potentially influencing the impact of the flat tax reform on transitions from higher-taxed employment to lower-taxed self-employment. The decision to adopt a flat tax was influenced by political and economic factors. Proponents argued it would boost economic activity, shrink the informal economy, and simplify taxation for businesses. Additionally, the successful introduction of flat taxes in other post-transition economies, like Slovakia in 2004, likely influenced Poland's decision to pursue a similar reform.

Tax Reform in 2009. The 2009 tax reform flattened the progressive schedule by reducing the marginal tax rate in the lowest bracket by 1%, extending this bracket, and abolishing the middle bracket. The top marginal tax rate was reduced from 40% to

flat tax if a taxpayer is providing the same services to their former employer within the same tax year. For example, if the employment contract was terminated in 2010, a taxpayer who wanted to provide the same services to their former employer under a self-employment contract could choose the flat tax starting from 2011.

32%. This was the result of a law passed on 16 November 2006, which provided for the unfreezing of tax thresholds in 2007 and a change in tax rates in 2009. Other changes in the tax system that increased the attractiveness of the progressive schedule or employment around this time are the introduction of the child credit in 2007 for taxpayers who filed under the progressive schedule and the reduction of the disability insurance contribution in 2007-2008.

3 Conceptual framework

The theoretical framework which motivates our empirical analysis is based on a version of the stylized model of business entry in Scheuer (2014). It models taxpayers as making an intensive-margin decision on how much income to declare in a given tax base, as well as a decision on whether to report income as employment income or self-employment income.

3.1 Model

Individuals are assumed to have a quasi-linear utility of the form:

$$u(c, l, b; \theta, \theta_S) = c - 1\{b = 0, l > 0\}.\psi^E(l/\theta) - 1\{b > 0, l = 0\}.(\psi^S(b/(\theta^S)) + \phi(b; \theta)) \quad (1)$$

where c is consumption, b is the amount of self-employment income declared, l is the amount of labor income declared, and $1\{b = 0, l > 0\}$, as well as $1\{b > 0, l = 0\}$, are dummy variables equal to 1 if, respectively, any positive employment or self-employment income is declared. We will usually assume that business productivity (θ_S) has a linear premium over employment productivity (θ); $\theta^S = \tilde{\omega}\theta$, where $\tilde{\omega}$ is a premium (positive or negative) to engaging in self-employment.

We will assume that costs of being in self-employment $\phi(b)$ are proportional to the level of income:

$$\phi(b; \theta) = \phi(\theta) \times b, \quad (2)$$

The notation $\phi(\theta)$ reflects the fact that the cost is taken from a distribution which may depend on the employment productivity parameter θ. The variable-cost specification may be justified if it is more plausible that individuals respond to changes in the difference in the average tax rate rather than the absolute tax differential. A cost unrelated to income would imply that individuals are more likely to switch from employment to self-employment the farther up the income distribution they are from the threshold $\bar{b}$ at which

the marginal rate has been reduced. Conversely, if individuals respond only to changes in the difference in average tax rates, the increase in transitions with income will be attenuated.[14]

The function $\psi^K(.)$, where $K \in \{E, S\}$ indicates the tax base, is convex and implies increasing marginal costs of producing an extra unit of taxable income as taxable income increases. Specifically:

$$\psi^K(x) = \frac{x^{1+\frac{1}{\varepsilon_K}}}{1+\frac{1}{\varepsilon_K}}.$$

The budget constraints are:

$$b - T^S(b) \geq c \tag{3}$$

if the individual reports positive self-employment income, where $T^S(.)$ denotes the self-employment tax schedule and

$$l - T^E(l) \geq c \tag{4}$$

if the individual receives positive employment income, where $T^E(.)$ denotes employment tax schedule.

Furthermore, the functional form of $\psi^K(.)$ implies that the parameters ε_E and ε_S have a ready interpretation as elasticities of taxable income with respect to the marginal net-of-tax rate:

$$\varepsilon_K = \frac{\partial k}{k}\frac{1-\tau_K}{\partial(1-\tau_K)} \tag{5}$$

where $1 - \tau_K \equiv 1 - T^{K\prime}(k)$.

The first-order conditions for labor income and business income, conditional on being in the employment or self-employment tax base, are:

$$1 - T^{S\prime}(b) - \frac{1}{\theta^S}\left(\frac{b}{\theta^S}\right)^{\frac{1}{\varepsilon_S}} = 0 \tag{6}$$

and

$$1 - T^{E\prime}(l) - \frac{1}{\theta}\left(\frac{l}{\theta}\right)^{\frac{1}{\varepsilon_E}} = 0 \tag{7}$$

The solution yields the reported income supply functions $l(\theta)$ and $b(\theta)$.

The indirect utility for each tax base, excluding fixed costs, can furthermore be defined as:

$$v^K(\theta) = (1-\tau_K)k(\theta) - \psi^K(k(\theta)/\theta). \tag{8}$$

[14]But not eliminated, as the difference in average tax rates also increases with income as a result of the non-linearity of the baseline tax schedule under employment.

An individual with productivity θ chooses the self-employment tax base if the change in indirect utility relative to the employment tax base exceeds the difference in associated total variable costs of self-employment. The tax base choice for the individual is therefore determined by whether or not their total costs exceed the following threshold:

$$b \times \widetilde{\phi}(\theta) = v^S(\theta) - v^E(\theta)$$

If the costs are below this threshold, self-employment is beneficial for the taxpayer. $G_\theta(\widetilde{\phi})$ is the cumulative density function of the switching cost for a given θ, and the associated density function is $g_\theta(\widetilde{\phi})$. Consequently, the proportion of individuals of type θ reporting in the business tax base is $G_\theta(\widetilde{\phi})$, and the proportion in the employment tax base is $1 - G_\theta(\widetilde{\phi})$.

3.2 Parameters to be estimated

In our empirical analysis, we will estimate parameters quantifying the extensive margin switching response to the tax reform informed by the theoretical model. In Appendix A, we show that a change in the proportion reporting self-employment income as a result of tax reform is a function of the change in relative effective tax rates between employment and self-employment. In our empirical analysis, we will therefore estimate two complementary measures of the responsiveness of self-employment to relative effective tax rates.

Firstly, we will consider the response as measured by the ratio of the *percentage-point change* in the fraction of individuals in self-employment in response to the *percentage-point change* in the tax differential measured as a fraction of gross income:

$$r_\theta^{Av}(\widetilde{\phi}) = \frac{\partial G_\theta(\widetilde{\phi})}{\partial(\Delta T(b(\theta))/b(\theta))}. \tag{9}$$

Secondly, we will consider the semi-elasticity representing the *percent change* in the fraction of individuals in self-employment in response to the *percentage-point change* in the tax differential measured as a fraction of gross income:

$$\xi_\theta^{Av}(\widetilde{\phi}) = \frac{1}{G_\theta(\widetilde{\phi})} \frac{\partial G_\theta(\widetilde{\phi})}{\partial(\Delta T(b(\theta))/b(\theta))}. \tag{10}$$

In Appendix A, we show that the change in the fraction of individuals in self-employment G_θ in response to the change in the relative effective tax rates is a key behavioral parameter entering the deadweight loss calculations.

4 Data

Our dataset encompasses all Polish taxpayers from 2000 to 2018. The year 2000, the earliest available, provides four pre-reform years. We focus on taxpayers reporting income from employment or self-employment under either linear or progressive income tax schedules. The data include the taxpayer's age, gender, choice of tax form, and information about filing jointly with a spouse or a child. It offers rich financial details, such as income, costs, and tax liability, but lacks demographic variables like education or occupation. Spouses can be identified from population register data which can be merged with taxpayer data. Additionally, the dataset enables matches between employers, employees, and business owner industry codes from 2008 onwards.

Sample and variable definitions

Employment and self-employment income. Employment income includes gross income from employment contracts or contracts of mandate.[15] Self-employment income is the sum of non-agricultural business revenue less business costs, taxed under a linear or progressive schedule.

Gross income is the broadest income category, and it is the sum of employment income, self-employment income, and income from other sources taxed under a progressive schedule (for example, pensions, civil law agreements, taxable benefits). It is income before deducting social security contributions (SSC) paid by an employee and employee cost deduction.

Taxable income is the amount of income subject to income taxes, summed over the progressive and the linear tax bases. It is calculated as the gross income net of SSC and other deductions. Unless stated otherwise, taxable income refers to individual taxable income before adjustments for joint filing (dividing the combined income of spouses).

The *average tax rate (ATR)* is the sum of individual tax liability, social security contributions paid by an employee or self-employed (deductible part), and health insurance

[15] In Poland, employers have various options for hiring workers, with the employment contract being the most common. However, for more flexible arrangements, many opt for a contract of mandate in addition to or instead of an employment contract. The contract of mandate is used for executing specific tasks or projects and operates outside the Labour Code framework. An employment contract (*Umowa o pracę*) corresponds to *Stosunek służbowy, stosunek pracy, praca nakładcza, spółdzielczy stosunek pracy on the tax form.* A contract of mandate (*Umowa zlecenie*) corresponds to *Działalność wykonywana osobiście, o której mowa w art. 13 ustawy.*

contributions divided by gross income. The average tax rate does not include contributions paid by an employer.[16].

The *tax differential* is the difference in the average tax rate between employment and self-employment. In the paper, we usually evaluate tax differential among taxpayers within the same income percentile. A positive differential implies higher taxes under employment.

Sample of employees and self-employed. The main sample includes taxpayers whose combined employment and self-employment income constitutes the majority of their gross income in a given year. Individuals declaring only employment income but with unusually high costs or abnormally low SSC and health contributions relative to gross income are excluded.[17] In this sample, *employees* are taxpayers who do not report any self-employment income, while the *self-employed* report positive self-employment revenue.[18] The estimation sample, detailed in section 6, is a balanced panel of taxpayers who are in the sample of employees or self-employed each year from 2000 to 2014.

Income rank is a taxpayer's rank in taxable income within the sample of employees and self-employed, expressed on a scale from 1 to 100. Taxpayers with income ranks between 99 and 100 represent the top 1% of taxpayers with the highest taxable income.

Transitions. We define a transition from employment to self-employment with a d-year horizon as follows: an employee in at time t is self-employed at time $t+d$, i.e. an individual obtains the majority of gross income from self-employment at date $t+d$ or obtains the majority of gross income from employment at time $t+d$ and in addition declares some self-employment income. Conversely, a transition from self-employment is defined as follows: a self-employed at time t is an employee at time $t+d$, i.e. an individual obtains the majority of gross income from employment at date $t+d$ and declares no self-employment income at date $t+d$.

Solo self-employed individuals are those who are not partners in a partnership and do not hire workers.

[16]The tax dataset provides us with the deductible portion of health insurance contributions. To calculate the total contribution amount, we divide the observed deductible portion by the prescribed deductible share of the total contribution.

[17]This exclusion mainly affects taxpayers whose income is largely exempt from SSC and health contributions, such as uniformed services or employees with a high share of sickness benefits.

[18]For example, an individual with self-employment revenue but zero self-employment income and the majority of income from employment is classified as self-employed.

5 Descriptive evidence

This section presents descriptive evidence on the effects of the 2004 and 2009 reforms on the share of self-employed and the transitions to self-employment within the sample of employees and the self-employed.

Change in the tax differential. Prior to the 2004 flat tax reform, the primary difference in tax paid by employees and the self-employed was due to social security and health contributions. The reform reduced the self-employment tax base by lowering the PIT rate for self-employment income. The flat rate schedule had a lower marginal tax rate compared to the top two brackets in the progressive schedule: 19% versus 19%, 30%, and 40%. The highest tax threshold (74,048 PLN) was in the 98th percentile of the taxable income distribution from 2000 to 2003.[19] Figure 2A illustrates the difference in average tax rates between employees and the self-employed before the reform (in 2001 and 2003) and after the reform (in 2005, 2007, and 2009). We observe a significant increase in the average tax rate differential for the top two percentiles. The tax differential between employees and the self-employed in the top 1% increased by 10 percentage points (pp), from 4% to 14%. In the next percentile, the differential increased by 4 pp.[20] The progressive schedule reform in 2009 reduced the tax differential along the income distribution. Compared to 2005, the tax differential in the top 1% of the income distribution was 4 pp lower in 2009. Figure 3A shows the tax differential within different percentiles of the income distribution over a longer time horizon, from 2000 to 2018.

Share of self-employed. Figures 2B and 3B illustrate the share of self-employed in the population of employees and self-employed by income rank. The income rank is computed for each year separately. The proportion of self-employed in the top percentile rose by 12 percentage points, from 0.5 in 2003 to 0.64 in 2004, and reached 0.74 in 2008. However, this increase also reflects the increased reporting of business income as a result of the 2004 reform, not just the switching between employment and self-employment. As documented by Kopczuk (2023), the introduction of the flat tax increased the reported income of the self-employed, leading to a re-ranking among working individuals. Bukowski

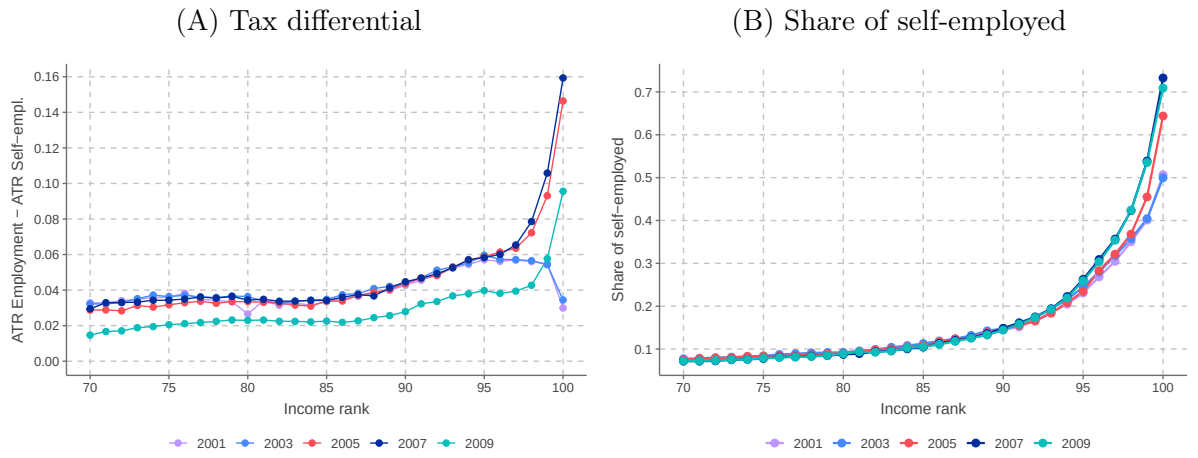
[19] Table B.1 in the Appendix shows the ranking of tax thresholds in the individual taxable income distribution in the sample of employees and self-employed.

[20] The tax differential in the top 1% is also influenced by the fact that the self-employed declared substantially higher average income than employees in the top 1%, especially post-reform (this is not the case for lower percentile groups where income is capped). The average taxable income in the top 1% was 218,000 PLN for employees and 297,000 PLN for the self-employed in 2003, and 272,000 PLN for employees compared to 430,000 PLN for the self-employed in 2005. The ATR of the self-employed was decreasing with income post-reform due to the lump-sum nature of SSC.

and Novokmet (2021) demonstrate that the substantial increase in top income shares from 2003 to 2008 was exclusively attributed to the growth in business incomes and that since 2005, business income has constituted the majority of the top 1% income. The persistent rise in gross income during this period can be attributed not only to enhanced tax compliance but also to real economic activity (Brzezinski et al., 2022; Bukowski and Novokmet, 2021). We provide additional evidence on re-ranking effects showing that the rise in upward mobility and increased persistence in self-employment explain nearly the entire increase in the share of self-employed in the top percentile between 2003 and 2005. These results are detailed in Appendix B.2.

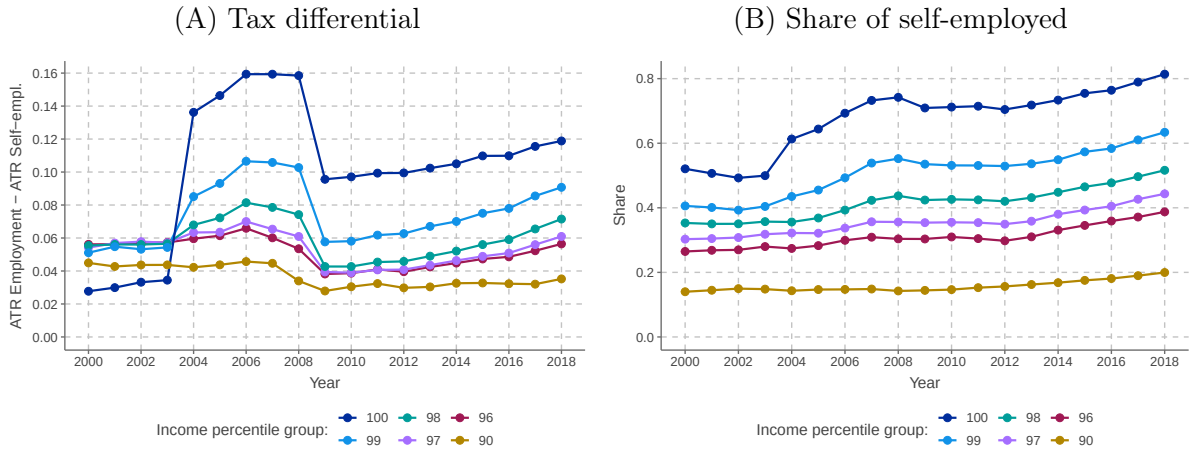
Transitions between employment and self-employment. Figure 4 illustrates 1-year transitions from employment to self-employment by income rank one year before transition. The rise in transitions in 2004 is not a short-term, one-time reaction to the change in tax differentials but rather a long-term change in the number of transitions for high-income earners in the employment tax base. Transitions from employment to self-employment only show up in Figure 3B if a taxpayer was in one of the top percentiles after transition into self-employment, which is less likely post-reform due to the re-ranking effects among self-employed. To address the issue of re-ranking in our empirical strategy, we ranked taxpayers according to taxable income in 2000, with the rank fixed in the following years.

Figure 2: Tax differential and share of self-employed by income rank



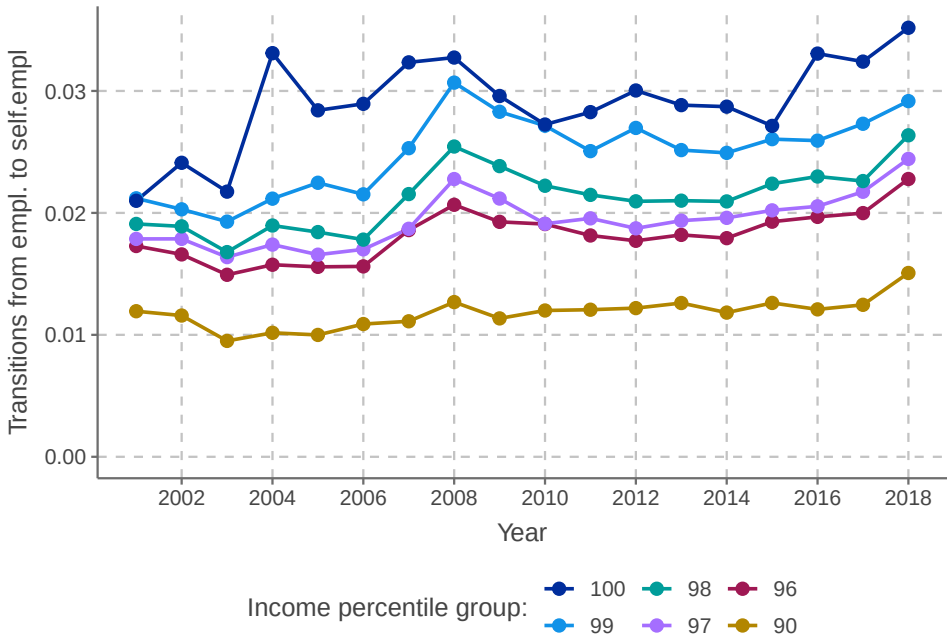
Note: Panel A shows the difference in the average tax rate (ATR) between employees and the self-employed by income rank in each year. ATR includes tax liability, health insurance contribution and social security contributions paid by an employee or self-employed, relative to gross income. Panel B shows the share of self-employed by income rank in each year. This analysis is based on the sample of employees and self-employed individuals each year, with income rankings determined within this sample annually.

Figure 3: Tax differential and share of self-employed over time



Note: Panel A shows the difference in average tax rate (ATR) between employees and the self-employed within different percentiles of income distribution in each year. ATR includes tax liability, health insurance contribution and social security contributions paid by an employee or self-employed, relative to gross income. Panel B shows the fraction of self-employed by in different percentiles of the income distribution in each year. This analysis is based on the sample of employees and self-employed individuals each year, with income rankings determined within this sample annually.

Figure 4: Transitions from employment to self-employment in one year



Note: The figure shows the proportion of employees who shifted to self-employment in one year by their income percentile in the year prior to the transition. For example, a point in 2001 at the 100th percentile represents the percentage of employees who were in the top income percentile in 2000 and transitioned to self-employment in 2001. This analysis is based on the sample of employees and self-employed individuals each year, with income rankings determined within this sample annually.

6 Empirical strategy

Informed by our model, we are interested in estimating the change in the probability of a taxpayer choosing self-employment in response to a change in the average tax differential between employment and self-employment. To estimate the magnitude of this parameter, we proceed in two stages. Firstly, we identify the effects of the 2004 and 2009 tax reforms, which altered the tax incentive to adopt self-employment, on the fraction of individuals choosing self-employment. We do this by comparing individuals who experienced a large change in tax incentives to a set of individuals who experienced a small change. We will do so in a way that is robust to the re-ranking of individuals as a result of intensive-margin responses to the reforms - we define treatment and control groups using characteristics before the reforms, fixing them using income rank in 2000. Secondly, we estimate the magnitude of these responses, including semi-elasticities, by finding the associated changes in tax incentives to adopt self-employment.[21]

We can identify the choice to adopt self-employment separately from intensive-margin responses by selecting a treatment and control group using characteristics observed before the implementation of the reform. If we abstract from entry into or exit from reporting any employment or self-employment income at all, the following expression describes the relationship between the change in the fraction of self-employed between t and $t+s$ and transitions between employment and self-employment between t and $t+s$:

$$\triangle Pr(S_{it}) \quad = \quad Pr(trans_{it+s}^{S \to E}) \times Pr(S_{it}) - Pr(trans_{it+s}^{E \to S}) \times Pr(E_{it}). \tag{11}$$

Above, $Pr(trans_{it+s}^{E \to S})$ denotes the net transitions from employment to self-employment and $Pr(trans_{it+s}^{S \to E})$ denotes the net transitions from self-employment to employment.[22] A net transition between t and $t+s$ is defined as:

$$\begin{aligned} Pr(trans_{it+s}^{S \to E}) &= Pr(S_{t+s}|E_t) \\ Pr(trans_{it+s}^{E \to S}) &= Pr(E_{t+s}|S_t). \end{aligned} \tag{12}$$

In our baseline empirical strategy, we estimate both net transition probabilities in response to the exogenous change in tax differentials between employment and self-employment

[21] This approach has the merit of transparency, and allows us to demonstrate graphically the impacts of the reforms on self-employment before proceeding to interpret the magnitude of the responses to the tax differential between employment and self-employment.

[22] *Net* transitions, since individuals transitioning from one tax base to another and returning before period $t+s$ will have no impact on the fraction in a tax base in period $t+s$.

around the 2004 introduction of the flat tax and the 2009 reform. We also estimate the change in the probability of self-employment $\triangle Pr(S_{it} = 1)$ directly as part of an alternative specification, which has the benefit of illustrating cumulative effects of changes in the flow of transitions on the share of individuals in self-employment many years after the reform.

6.1 Estimation Sample

Our baseline estimation sample consists of a balanced panel of employees and self-employed over 15 years, from 2000 to 2014. During this time, the two tax reforms discussed in Section 5 were implemented: the 2004 flat tax reform and the 2009 tax reduction under the progressive schedule. The flat tax reform increased the tax differential, while the progressive schedule reform decreased it. To ensure homogeneity between treatment and control groups, we partition the population into three sub-panels at the start of our sample in 2000: those who are employees in 2000, those who are self-employed and do not receive any employment income in 2000, and those who are self-employed and receive some employment income in 2000 and 2001.[23] We exclude observations with income rank larger than 99.95 in 2000 to ensure that the results are not driven by extreme cases.[24]

Treatment and control group. To define the treatment and control groups, we rank taxpayers according to their position in the individual taxable income distribution in 2000.[25] The treatment group is defined as the top two percentiles of the income distribution pre-reform in 2000, and the control group is defined as the next two percentiles (the 97th and 98th). Thus, the assignment of taxpayers to the treatment and the control group is constant over time. Individuals below the 99th-100th percentile cut-off are less likely to experience a large change in tax incentive of switching to self-employment. On the other hand, they are assumed to be close enough in unobserved characteristics to the treated group to constitute a suitable control group. As a robustness check, we repeat the analysis using different definitions of treatment and control group. Specifically, we use

[23]The share of self-employed increases with income rank resulting in important compositional differences across percentiles. Consequently, changes in the baseline proportion of self-employed affect the transition patterns. Furthermore, the two groups of self-employed, with and without employment income, exhibit different dynamics in the flows to employment. They may also be economically different: there could be more avoidance among those with mixed income. A worker can save on social security contributions by combining employment contract and self-employment. The transition behavior between self-employment and employment is more likely to be homogeneous within each sub-panel.

[24]This implies excluding taxpayers with taxable income larger than 520 thousands PLN in 2000. In the heterogeneity analysis, we include these observations again and exclusively look at the response at the top of the income distribution.

[25]The income rank is calculated within the sample of employees and self-employed.

different definitions of income to determine the income rank. We also use an alternative allocation into the treatment and control group which is less correlated with income rank, redefining the treatment status depending on whether a spouse is located in one of the higher tax brackets, similarly to Kopczuk (2023).

Table 1 reports descriptive statistics for the balanced panel of taxpayers. The population of employees is the largest and constitutes 58% of all taxpayers included in the panel, but their share decreases as income rank increases. Self-employed without employment income constitute 29% and their share increases with income rank. Prior to the reform, taxpayers in the control group were mostly exposed to the middle marginal tax rate, whereas the majority of taxpayers in the treatment group faced the top marginal tax rate. In the sub-panel of employees, 75% of those in the control group faced the middle tax rate and 13% faced the top marginal tax rate in 2002, accounting for joint filing. In the treatment group, the share of taxpayers facing the middle and the top marginal tax rate was 40% and 60%, respectively.[26] Taxpayers move across the percentiles of the income distribution over time, but they were assigned to the treatment and control percentiles once. In the sample of employees, almost 80% of the taxpayers in the top two percentiles in 2000 stayed in the top two percentiles in 2002. This share was still high at almost 50% in 2014. The share of taxpayers initially assigned to the 97-98 percentiles who progressed to the top two percentiles of the income distribution stabilizes at about 20%. The upward mobility of the self-employed in the control group was higher.

[26]For comparison, Table B.2 in the Appendix shows the summary statistics for each percentile 97-100 separately. Table B.3 shows the summary statistics for the cross-section of employees and self-employed in 2002 (without restricting the sample to taxpayers observed in each year between 2000 and 2014). Figure B.6 shows the persistence of taxpayers in the treatment group in the top two percentiles of the income distribution.

Table 1: Descriptive statistics: estimation sample

	Employees		Self-employed, no empl. inc.		Self-employed, mixed inc.	
	Percentiles		Percentiles		Percentiles	
	97-98	99-100	97-98	99-100	97-98	99-100
Number of taxpayers	58,917	49,370	17,081	32,059	14,813	14,714
Male	69.3%	76.7%	70.9%	73.5%	67.1%	71.1%
2002						
Age	41.1	41.9	42.0	43.3	42.6	43.6
Married	81.3%	83.3%	87.6%	88.8%	85.7%	87.1%
Filing jointly	74.2%	76.6%	76.3%	77.7%	77.1%	77.5%
Gross income	82,024	151,584	74,980	165,226	74,883	141,378
Average tax rate (ATR)	29.0%	30.9%	24.9%	26.7%	25.8%	27.6%
Share in top tax bracket	15.2%	54.1%	17.8%	50.3%	13.1%	44.0%
Share in middle tax bracket	61.8%	40.1%	42.4%	31.9%	54.0%	41.4%
Taxable income	68,961	133,805	68,961	155,533	64,799	127,424
Share in top 2	19.8%	77.2%	25.8%	64.2%	19.0%	61.8%
Share in top 4	67.7%	91.8%	50.7%	78.9%	53.1%	81.0%
2008						
Taxable income, 2008	111,955	204,111	189,953	405,402	135,217	245,380
Share in top 2, 2008	17.8%	54.8%	36.7%	64.2%	29.5%	53.7%
Share in top 4, 2008	53.2%	81.0%	55.0%	77.6%	55.4%	73.8%
2014						
Taxable income, 2014	137,876	235,827	193,261	376,738	154,210	251,038
Share in top 2, 2014	20.6%	47.6%	27.4%	47.5%	26.5%	42.6%
Share in top 4, 2014	47.1%	70.5%	41.5%	61.1%	48.3%	61.6%

Note: This table presents summary statistics in 2002 (two years before the reform) for a balanced panel of employees and self-employed between 2000 and 2014. The treatment group includes those in the top two percentiles of the income distribution in 2000, and the control group includes those in the next two percentiles. We divide the panel into three sub-panels: employees in 2000, self-employed with no employment income in 2000 and self-employed with employment income in 2000 and 2001. The share in the top 2 (4) percentiles represents the proportion of taxpayers in the top two (four) percentiles of the income distribution in a given year. Numbers that are not fractions of the population represent average values. Income variables are expressed in PLN.

6.2 Estimating reform impacts

Our identification strategy relies on comparing differences over time in the outcome variable of the treatment and control groups that are defined based on a taxpayer's position in the pre-reform income distribution. The time span of the estimation sample enables to capture the effects of both the 2004 flat tax reform which increased the tax incentive to be self-employed and the 2009 progressive schedule reform which reduced it.

Transitions between employment and self-employment. We begin by inspecting the impact of the on transitions between employment and self-employment using the canonical difference-in-differences specification:

$$\Delta y_{it} = \sum_{\substack{s=2001 \\ s\neq 2003}}^{2014} \beta_s \mathbb{1}\left[t = s\right] \times \mathit{Treated}_i + \delta_t + \gamma \mathit{Treated}_i + \varepsilon_{it} \tag{13}$$

where $\mathit{Treated}_i$ is a dummy for being in the treatment group, and δ_t are year fixed-effects. y_{it} represents self-employment status (with the variable equal to 1 if the individual is self-employed). In the sample of employees, Δy_{it} represents net transitions from employment to self-employment between $t-1$ and t. In the sample of self-employed, $-\Delta y_{it}$ represents net transitions from self-employment to employment. The parameters of interest, β_s, represent the change in transitions in each year relative to a pre-reform year, 2003. The standard errors are clustered at the taxpayer level.

We use the estimates to calculate the elasticity of the share of taxpayers in self-employment in response to the change in tax differential between employment and self-employment. To calculate the change in the share of self-employed between 2003 and 2008 we sum the of coefficients β_s for s between 2004 and 2008.[27]

Net transitions from employment to self-employment capture both transitions into self-employment and the return to employment of previously employed individuals who switched to self-employment in intermediate years. In addition to our baseline specification with net transitions Δy_{it} as the outcome variable, we decompose the net transitions and consider the entry into self-employment ($\mathbb{1}\left[\Delta y_{it} = 1\right]$) end exit out of self-employment ($\mathbb{1}\left[\Delta y_{it} = -1\right]$) as additional outcome variables.

The average effect of the flat-tax reform over 2004–2008 and the 2009 reform over 2009–2014 on the net transitions is estimated using the following specification:

$$\begin{aligned} \Delta y_{it} = {} & \beta_1 \mathbb{1}\left[t \geq 2004\right] \times \mathit{Treated}_i \\ & + \beta_2 \mathbb{1}\left[t \geq 2009\right] \times \mathit{Treated}_i + \delta_t + \gamma \mathit{Treated}_i + \varepsilon_{it} \end{aligned} \tag{14}$$

[27] There are two ways to evaluate the impact of the reform on the share of self-employed: by estimating the impact on the net transition behavior or by estimating the impact on the share of self-employed directly. Summing the impact of the reform on net transitions allows for baseline differences in net transitions between treatment and control. It can therefore be considered more robust and is our preferred method. Nevertheless, we believe that the approach of estimating reform effects on probabilities of self-employment has the benefit of transparency and we include it in the Appendix C.2. However, in practice, the differences in the predicted self-employment rates between the specifications (13) and (C.1) remain marginal within the time frame considered. Appendix E describes in more detail the relationship between the two approaches.

β_1 captures the average effect of the flat tax reform in 2004 and β_2 captures the additional effect of the 2009 reform of the progressive schedule.

Furthermore, to investigate whether the effects are heterogeneous based on a number of characteristics (including gender, age, filing status, and income level), we use the following triple difference specification:

$$\begin{aligned}\Delta y_{it} = &\beta_1 \mathbb{1}\left[t \geq 2004\right] \times \mathit{Treated}_i + \theta_1 \mathbb{1}\left[t \geq 2004\right] \times \mathit{Treated}_i \times G_i \\ &+ \beta_2 \mathbb{1}\left[t \geq 2009\right] \times \mathit{Treated}_i + \theta_2 \mathbb{1}\left[t \geq 2009\right] \times \mathit{Treated}_i \times G_i \\ &+ \beta_3 \mathbb{1}\left[t \geq 2004\right] \times G_i + \beta_4 \mathbb{1}\left[t \geq 2009\right] \times G_i \\ &+ \delta_t + \gamma_1 \mathit{Treated}_i + \gamma_2 G_i + \varepsilon_{it}\end{aligned} \tag{15}$$

where G_i is the indicator that changes in different specifications: an indicator for Male, Age ≤ 40, Single filer, and a group of indicators for different percentiles of income distribution.

Solo self-employment and sector of business activity. Focusing on the subpanel of employees in 2000, we decompose the increase in the entries to business in year t according to the hiring status in $t+7$ and according to the sector of business activity in $t+7$. A self-employed can work independently as a solo self-employed individual, can employ other workers, or be a joint owner of an enterprise (a partner). We will focus on a demarcation between self-employed who are sole owners and do not hire employees and self-employed with employees or co-owners. We refer to the first group as solo self-employed. A limitation in our data is that we can only track employer-employee relationships starting from 2008, although our analysis spans from 2000 onwards. This limitation prevents us from observing the early employment dynamics immediately after transitioning to self-employment. However, examining the employment status of individuals seven years after their transition allows us to look at outcomes beyond the initial years of business activity.[28]

To identify the effect of the reform on solo self-employment seven years after transition use the specification (13) and (14) with outcome variables capturing hiring behavior. One outcome variable is whether an employee made an entry into self-employment in year t

[28] Arguably, initial solo self-employment can be merely a preliminary stage that eventually evolves into a business employing workers. Thus, looking at outcomes multiple years after the transition to self-employment may allow us to better proxy entrepreneurial activity. Another limitation of the data is that we are not able to differentiate between solo self-employed individuals in alternative work arrangements working for a previous employer and those actively engaged in entrepreneurial ventures (i.e. with multiple contractors). Nevertheless, maintaining a solo self-employed status for seven years post-transition implies a less entrepreneurial job or a higher likelihood of dependent employment relationships.

($\mathbb{1}[\Delta y_{it} = 1]$) and was solo self-employed in year $t + 7$. Another outcome variable is whether an employee made an entry into self-employment in year t and was an employer or partner in year $t + 7$. The remaining category is making an entry in year t and being out of self-employment in year $t + 7$. Similarly, we define a set of outcome variables indicating the sector of business activity 7 years after the entry to self-employment. Specifically, we define four broad categories of business activity: (1) Construction, mining and manufacturing, (2) Retail, wholesale trade, transportation, (3) Finance, real estate, information, professional and healthcare services, (4) Education, entertainment, food, hotels and other services.[29] The last category contains high-skilled service sectors that tend to be human-capital rich (Smith et al., 2019).

Assumptions. The main identifying assumption in the difference-in-differences specification is that the difference in transition rates in the top two percentiles relative to the next two percentiles would have stayed constant after 2004, absent the introduction of the flat tax. To verify if this assumption can be supported, we test for the parallel trends prior to the flat tax reform in the baseline sample and using alternative samples and treatment definitions. We also implement placebo tests in the alternative repeated cross-section specification, by defining a reform date prior to the actual reform year. The placebo tests do not reject the hypothesis that the observed effect is zero in the pre-reform years.

The major threat to empirical design are time-specific shocks coinciding with the reform. A notable concurrent event was the 2004 European Union enlargement, which included Poland. The concern is whether the enlargement had a different impact on the income distribution's top two percentiles compared to the following two percentiles. Several factors mitigate this concern. Firstly, the income distribution positions of the treated and control groups are proximate, reducing the likelihood of differential impacts. Second, the EU integration process had been unfolding for several years prior to official accession, suggesting that effects on the decision to become self-employed would likely have been gradual. Lastly, our analysis also documents taxpayer responses to tax differential changes in 2009 - well after the EU accession - which makes it unlikely that the effects observed in 2004 are attributable to EU enlargement or any other event occurring exclusively in 2004.[30]

[29]The categories are based on NACE industry codes. The sections included in each category: (1) B, C, D, E, F, (2) G, H, (3) J, K, L, M, N, Q, (4) I, O, P, R, S, T, U. Agricultural section (A) is excluded.

[30]There was also a reduction in the CIT rate in 2004. However, a limited liability structure is subject to dual taxation via both CIT and capital income tax. As discussed by Kopczuk (2023), the reduction in the CIT rate was rather expected to decrease business income subject to personal income taxation, potentially diminishing the observable impact of the flat tax reform.

7 Results

7.1 Reform impact on net transitions to and from self-employment

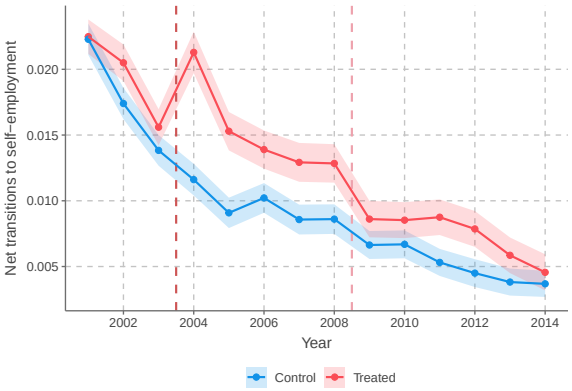
We begin by showing the impact of the reform on transitions between employment and self-employment. Figure 5 presents the raw means of outcome variables for both treatment and control groups over time, alongside difference-in-differences estimates based on equation (13).

Panels 5A and 5B show net transitions to self-employment starting with the population of employees in 2000. The observed downward trend in net transitions stems from our panel being initially composed only of employees in 2000, leading to zero exits from self-employment in 2001. Over time, exits from self-employment increased. Pre-reform trends appear parallel, though the data is limited to three years before the reform. There is a noticeable increase in transitions to self-employment after the introduction of the flat tax for the self-employed in 2004, exclusive to the treatment group, indicating an immediate reform-induced shift. The rise in net transitions to self-employment continues until 2009, when a decline is observed. This decrease aligns with the reduction of the top marginal tax rates from 40% to 32% in the progressive schedule and an adjustment of the top tax threshold, which reduced the tax incentive for transitioning from employment to self-employment, although to a lesser extent than the initial flat tax reform-induced increase. We interpret these results as suggesting that once individuals transition into self-employment, they are less sensitive to the changes in the tax differential, at least as long as the existing tax differential favors self-employment.

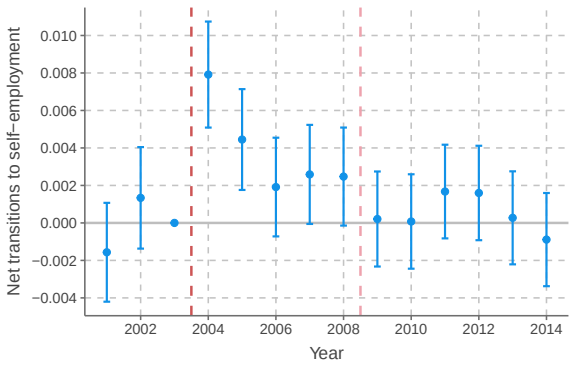
Panels 5C and 5D examine net transitions to employment among self-employed individuals in 2000 with no employment income, while Panels 5E and 5F look at self-employed individuals with mixed income in 2000 and 2001. Post-reform years mostly show negative estimates, indicating a lower transition rate to employment from self-employment in the treatment group, particularly in the first year post-reform. However, the post-reform differences are small, and many of them are not statistically significant.

Figure 5: Dynamic effect of the flat tax reform in 2004 on net transitions between employment and self-employment

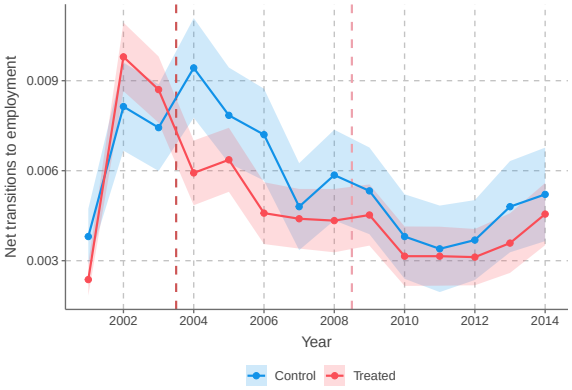
(A) Net transitions to self-employment (employees)



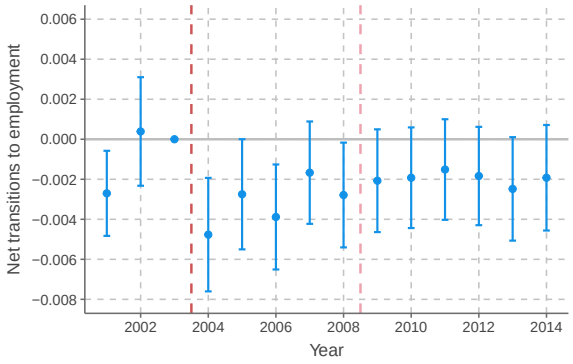
(B) Net transitions to self-employment (employees)



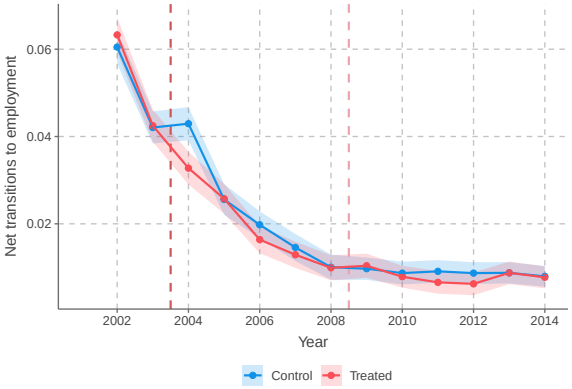
(C) Net transitions to employment (self-employed without employment income)



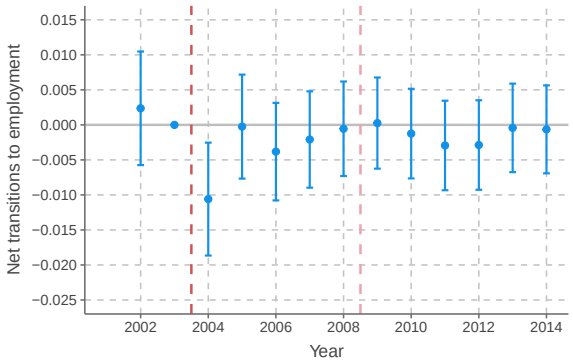
(D) Net transitions to employment (self-employed without employment income)



(E) Net transitions to employment (self-employed with employment income)



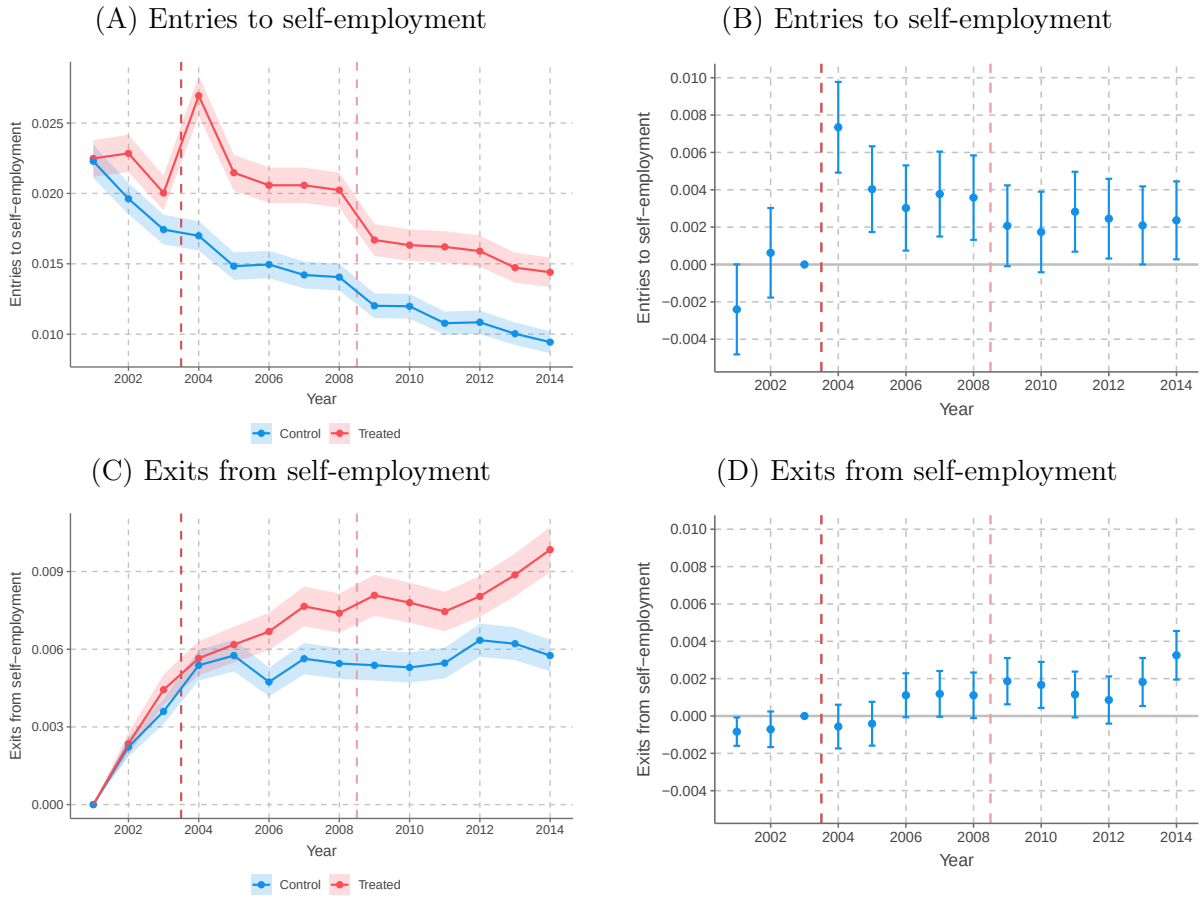
(F) Net transitions to employment (self-employed with employment income)



Note: Net transitions to self-employment in year t is the share of self-employed in year t less the share of self-employed in year $t-1$, calculated within the treatment and control group separately. Net transitions to employment in year t is the share of employees in year t less the share of employees in year $t-1$, calculated within the treatment and control group separately. The dashed vertical lines mark the 2004 flat tax reform (large increase in the tax differential) and the 2009 reform of the progressive schedule (smaller reduction in the tax differential). Figures on the left show sample averages with 95% confidence intervals. Figures on the right show difference-in-differences coefficients with 95% confidence intervals based on specification (13). Sample: balanced panel from 2000 to 2014 of employees in 2000 (panel A and B), balanced panel from 2000 to 2014 of self-employed with no employment income in 2000 (panel C and D) balanced panel from 2000 to 2014 of self-employed with employment income in 2000 and 2001 (panel E and F).

We decompose the net transitions in Figure 5A into entries from employment to self-employment and exits out of self-employment to employment. Figures 6A and 6B show the entries to self-employment and Figures 6C and 6D show the exits from self-employment to employment.[31] The observed changes in net transitions around both reforms were primarily driven by entries into self-employment rather than exits. This suggests that those who transitioned following the 2004 reform largely remained in self-employment, even after the 2009 reform reduced the tax differential and discouraged further transitions from employment to self-employment. Despite the 2009 reform being announced at the end of 2006, it does not appear to have affected entries to self-employment in anticipation of the reform.

Figure 6: Entries and exits out of self-employment in the population of employees



Note: Entries to self-employment in year t is the share of taxpayers in the population who declared self-employment income in year t and did not declare self-employment income in year $t-1$. The exits from self-employment is the share of taxpayers who do not declare self-employment income in year t and declared self-employment income in year $t-1$. Figures on the left show sample averages with 95% confidence intervals. Figures on the right show difference-in-differences coefficients with 95% confidence intervals based on specification (13). Sample: balanced panel from 2000 to 2014 of employees in 2000.

[31] The exits represent employees who made a transition to self-employment and are returning to employment. In Figure 6D the coefficient for 2001 is zero because individuals can transition back to employment in 2002 at the earliest.

The average effect on yearly employment to self-employment transitions, estimated using equation (14) is shown in Table 2. The 2004 reform increased net transitions to self-employment on average by 0.039 in the period 2004-2008. The 2009 reform of the progressive schedule reversed a large part of that increase by 0.0034 or 87%, in the period 2009–2014. Table C.1 in the Appendix reports the results for self-employment to employment transitions. On average, we observe a decrease in transitions to employment after the first reform, which is partly compensated by an increase in transitions to employment following the second reform. These findings are consistent with those of Zawisza (2017), who estimates the effects of the 2009 reform on transitions between employment and self-employment using a different methodology.

Table 2: Baseline effect and heterogeneity analysis: transitions from employment to self-employment

	Net transitions from employment to self-employment				
	(1)	(2)	(3)	(4)	(5)
Treated × Post 2004	0.0039***	0.0020*	0.0021**	0.0033***	
	(0.0007)	(0.0012)	(0.0008)	(0.0007)	
Treated × Post 2009	-0.0034***	-0.0040***	-0.0031***	-0.0025***	
	(0.0005)	(0.0009)	(0.0006)	(0.0006)	
Treated × Post 2004 × Male		0.0028*			
		(0.0014)			
Treated × Post 2009 × Male		0.0009			
		(0.0011)			
Treated × Post 2004 × Age≤ 40			0.0035***		
			(0.0013)		
Treated × Post 2009 × Age≤ 40			-0.0007		
			(0.0010)		
Treated × Post 2004 × Single filer				0.0035**	
				(0.0017)	
Treated × Post 2009 × Single filer				-0.0049***	
				(0.0014)	
Centile 99 × Post 2004					0.0024***
					(0.0008)
Centile 100 × Post 2004					0.0059***
					(0.0009)
Centile 99 × Post 2009					-0.0025***
					(0.0006)
Centile 100 × Post 2009					-0.0044***
					(0.0007)
Observations	1,516,018	1,516,018	1,516,018	1,516,018	1,516,018
Year FE	✓	✓	✓	✓	✓
Treated FE	✓	✓	✓	✓	✓

Note: The table reports the effect of the 2004 and 2009 reform on net transitions from employment to self-employment based on the specification (14) (column 1) and the triple difference specification (15) (columns (2)–(5)). The treatment group is defined as the 99th and 100th percentiles of the 2000 income distribution and the control group is defined as the 97th and 98th percentiles. Age and single filer status refer to the values of these variables in 2002. Standard errors are in brackets and are clustered at the taxpayer level. Sample: balanced panel from 2000 to 2014 of employees in 2000. * p<0.1, ** p<0.05, *** p<0.01.

7.2 Heterogeneous effects

Table 2 presents the results of our investigation of heterogeneities in the response to the reforms using specification (15). Columns (2)–(5) of Table 2 displays the results for transitions from employment to self-employment.

The stronger response among men can be attributed to men having a higher preference for self-employment, often working in sectors where self-employment is feasible, such as IT, finance, and top managerial positions. Additionally, men dominate the upper tail the income distribution and constitute approximately 70% of the estimation sample. The response was also stronger for younger employees (40 years old or younger in 2002) and stronger for single filers as opposed to taxpayers filing jointly with a spouse in 2002.[32] The larger response among single filers is because the flat tax schedule, lacking provisions for joint filing, tends to be less advantageous for taxpayers filing jointly compared to single filers. We also observe that the response of the taxpayers in the top percentile of the income distribution was more than twice as large as the response of the taxpayers in the next percentile. This difference corresponds to the difference in the tax incentive to switch, as measured by the average tax rate differential.[33] Table C.1 reports the results of heterogeneity analysis for transitions from self-employment to employment.

A particularly strong response is observed at the very top of the income distribution.[34] We focus on the population of high-income employees, splitting the treatment group into two subgroups: top earners in the top 0.2% of the income distribution in 2000 (approximately 2,800 taxpayers) and the remaining individuals in the top two percentiles in 2000. This group exhibits high income persistence, with 90% remaining in the top 1% and over 60% remaining in the top 0.02% by 2003. The results are illustrated in Figure 7. The response of top earners was particularly large with the net transitions increasing about three times compared to the pre-reform year. At the end of 2014, close to 30% of top employment income earners were in self-employment, with a very sharp increase in 2004.[35]

[32]The more pronounced response among younger workers might be attributed to a greater option value in discovering their entrepreneurial capabilities. With more working years ahead, younger workers have more time to use this information (Dillon and Stanton, 2017).

[33]For top 1, the differential increased by 6.2 pp., for the next percentile in the treatment group, by 3.6 pp. between 2003 and 2008.

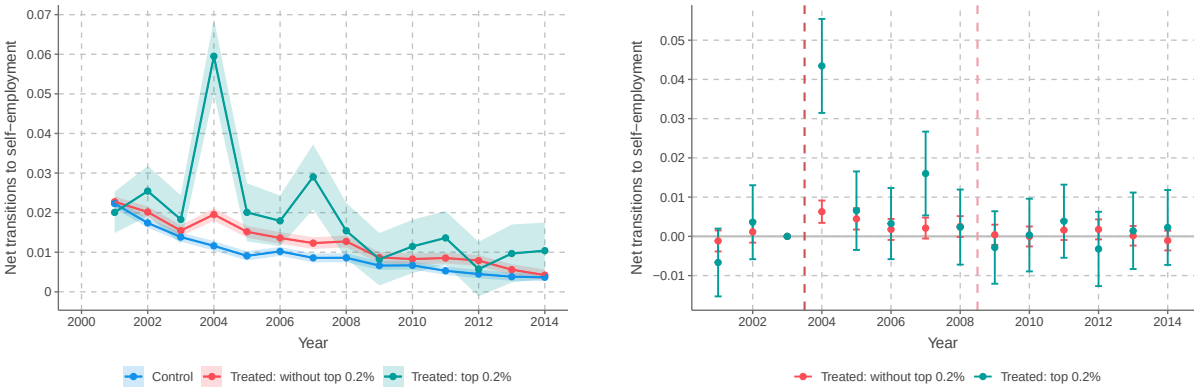
[34]We now include in the estimation previously rejected outliers.

[35]Among the highest income 0.2% of taxpayers who switched to self-employment between 2004 and 2006, 38% remained solo self-employed in 2014, and 39% were employers or joint-owners. The remaining share returned from self-employment to employment.

Figure 7: Heterogeneous effects by income level

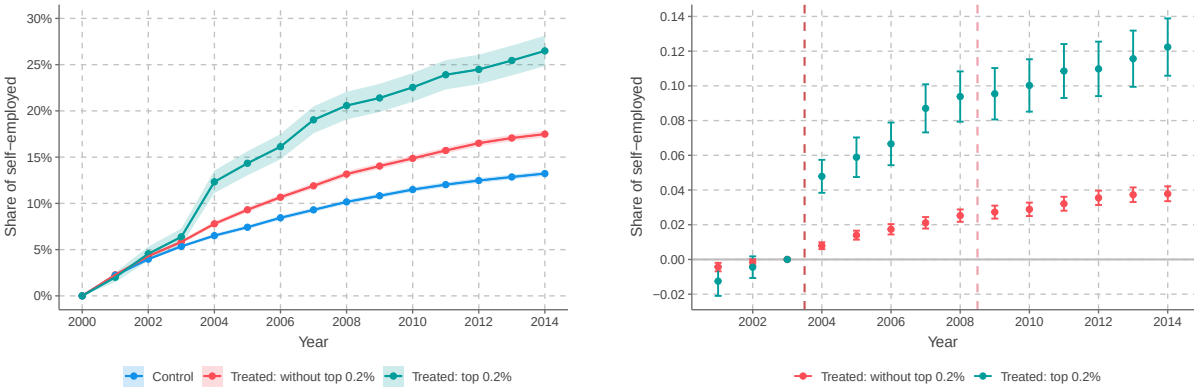
(A) Net transitions from employment to self-employment

(B) Net transitions from self-employment to employment



(C) Share of self-employed

(D) Share of self-employed



Note: Net transitions from employment to self-employment in year t is the share of self-employed in year t minus the share of self-employed in year $t-1$, calculated separately within the treatment and control groups. The treatment group is defined as the 99th and 100th percentiles of the 2000 income distribution and the control group is defined as the 97th and 98th percentiles. The dashed vertical lines mark the 2004 flat tax reform and the 2009 progressive tax reform. Figures on the left show sample means with 95% confidence intervals. The right panels show the difference-in-difference coefficients with 95% confidence intervals based on the specification (13). We estimate two equations, one with the treatment group of taxpayers in top 0.2% of the income distribution in 2000, and the second with the treatment group of taxpayers below this threshold. Sample: balanced panel from 2000 to 2014 of employees in 2000.

7.3 Elasticity of switching

We use our estimates to our baseline specification (13) to calculate the long-term effects of the reform on the proportion of individuals choosing self-employment. We compute the response of the share of self-employed to the change in average tax rate in the following way:

$$\beta^{SE} = \frac{\Delta y^{(2004-2008)}}{\Delta(tax\ differential)} = \frac{\Delta y^{(2004-2008)}}{\Delta(\tau^E - \tau^S)} \tag{16}$$

where $\Delta y^{(2004-2008)}$ is the cumulative change in the share of self-employed between 2004 and 2008 based on estimates obtained from regression (13). $\Delta(\tau^E - \tau^S)$ is the change in the in average tax rates differential between 2003 and 2008 (and between the treatment group and the control group). The tax differential in a given year is the difference between the average tax rate of employees and the average tax rate of self-employed. The average tax rates are computed within subpopulations. For example, in the population of employees we take the average tax rate of employees less the average tax rate of self-employed who switched from employment to self-employment. Since the tax treatment of employees did not change significantly around the 2004 reform and between the treatment and control group, the change in the tax differential represents the change in ATR on income under self-employment before and after the flat tax reform.

We also transform the estimates to semi-elasticity as follows:

$$\varepsilon^{SE} = \frac{\%y^{(2004-2008)}}{\Delta(tax\ differential)} = \frac{\Delta y^{(2004-2008)}}{y_0^{2008}} \times \frac{1}{\Delta(\tau^E - \tau^S)} \tag{17}$$

where y_0^{2008} denotes the counterfactual share of self-employed in the treated group, obtained by subtracting cumulative effect on transitions from the observed share of self-employed in 2008.

Table 3 shows the step-by-step calculations for the subpopulations of employees and the self-employed in 2000, separately. In the population of employees in 2000, the share of self-employed increased by 1.9 pp., or 17% relative to counterfactual, over the 5 years post-reform. The increase in the tax differential between 2003 and 2008 in the treatment group was 2.1 pp. higher than the increase in the tax differential in the control group. Again, the tax differential is calculated within the initial population of employees. Thus, we compare the average tax rate of employees to the average rate of the self-employed who previously were employees. In sum, a 1 pp. increase in tax differential increases the share of employees in self-employment by 0.9 pp. in 5 years, in the population of employees. Semi-elasticity implies that a 1 pp. increase in tax differential increases the share of the self-employed by 7.9% in the population of employees.

Table 4 combines the responses obtained in the populations of employees and self-employed to calculate the responsiveness of the share of taxpayers to tax differentials between employment and self-employment using equation (11). We estimate the cumulative effect of the reform on the share of self-employed to be 1.8 pp. This effect is derived from average treatment effect on the treated population, which is 99-100 percentiles of the income distribution in 2000. We find that 1 pp. increase in tax differential increases the share of self-employed by 0.7 pp. or 1.4% in 5 years, where 1.4 represents the estimated

semi-elasticity parameter. For comparison, using cross-country regressions, De Mooij and Nicodème (2008) estimate a 1.02 pp. and Lejour and Massenz (2021) estimate a 0.32 pp. responsiveness of the corporate form to 1 pp. tax differential versus the pass-through form among previously existing firms. Using the population of business taxpayers in the UK, Tazhitdinova (2020) finds that a 1 pp. increase in tax savings from incorporation would lead to a 0.29% increase in switching from a personal to a corporate tax base, and a 0.33% increase in entrepreneurial entry in one year. In other words, we find that taxpayers in our study are similarly if not more responsive to the tax incentives to choose self-employment as the responsiveness of business owners is to tax incentives to incorporate by these authors.

Table 3: Elasticity calculations for subpopulations of employees and self-employed

	Employees	Self-employed, no empl. inc.	Self-employed, mixed inc.
Share in self-employment			
1. Observed share in self-employment	0.1348	0.9535	0.7965
2. Cumulative estimated effect (p.p.)	0.0193	0.0159	0.0173
	(0.0052)	(0.0052)	(0.0148)
3. Counterfactual share in self-employment (1. - 2.)	0.1155	0.9377	0.7792
	(0.0052)	(0.0052)	(0.0148)
4. Percentage change in the share of self-employed (2./3.)	0.1675	0.0169	0.0222
	(0.0526)	(0.0057)	(0.0194)
Tax differential			
5. Absolute change in ATR 2003-2008 for the treatment group	0.0486	0.0361	0.0289
6. Absolute change in ATR 2003-2008 for the control group	0.0275	0.0037	0.0025
7. Percentage point change in tax incentive (6. - 5.)	0.0211	0.0323	0.0264
8. Response (2./7.)	0.9150	0.4902	0.6543
	(0.2462)	(0.1619)	(0.5605)
9. Semi-elasticity (4./7.)	7.9237	0.5228	0.8397
	(2.4893)	(0.1756)	(0.7352)

Note: The cumulative estimated effect on transitions between employment and self-employment represents the change in the share of self-employed in each of the three subpopulations: employees in 2000, self-employed with no employment income in 2000 and self-employed with employment income in 2000 and 2001. Each subpopulation is observed in a balanced panel between 2000 and 2014. The treatment group is defined as the 99th and 100th percentiles of the 2000 income distribution and the control group is defined as the 97th and 98th percentiles. The cumulative estimated effect is the sum of the coefficients estimated using the specification (13) between 2004 and 2008. Absolute change in ATR 2003–2008 is the difference in ATR in percentage points between employees and self-employed within a given subpopulation. In the population of employees, the difference in ATR is between employees and self-employed who were previously employees. In the population of self-employed, the ATR difference is between employees who were previously self-employed and self-employed. Standard errors calculated using the delta method.

Table 4: Aggregate elasticity calculations for the population of employees and self-employed

	2004	2008
1. Cumulative estimated effect (p.p.)	0.0073	0.0179
2. Counterfactual share in self-employment	0.4901	0.4912
4. Change in tax incentive (p.p.)	0.0257	0.0257
3. Percentage change in share in self-employment (1./2.)	0.0148	0.0364
5. Response (1./4.)	0.2833	0.6956
6. Semi-elasticity (2./4.)	0.5780	1.4160

Note: The table shows aggregate elasticity calculations for the population of employees and self-employed between 2000 and 2014. The cumulative estimated effect is the weighted sum of the cumulative effects for each subpopulation. The cumulative effect is obtained from the specification (13). The absolute change in ATR is the weighted sum of the difference in ATR in percentage points between employees and self-employed within three subpopulations. The weights in the above calculations are constructed as the number of taxpayers in the treatment group in each sub-population divided by the total number of taxpayers in the treatment group. Table C.3 in the Appendix details the components of those calculations.

7.4 Impact by hiring behavior and sector

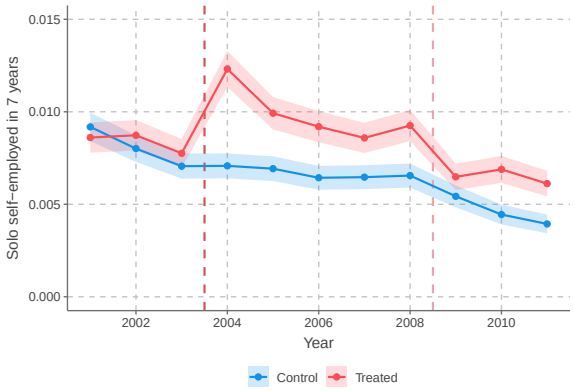
Hiring behavior. To investigate whether those entering self-employment were more likely to become solo self-employed than to hire employees or become partners, we decompose the entries into self-employment observed in Figure 6A depending on the hiring status seven years from the entry.[36] Specifically, an individual entering self-employment in year t may, in $t+7$, be classified as solo self-employed, an employer/partner, or have exited self-employment and returned to employment.

Figure 8A shows the raw averages of solo self-employment status and employer/partner status seven year after transition to self-employment, along difference-in-differences estimates based on equation (13) in Figure 8B. The sample is the population of individuals who were employees in 2000. The data show a pronounced surge in solo self-employment in 2004 that exceeds the rise in the share of employers or partners by a factor of 2 in absolute terms. This pattern suggests that the growth in self-employment entries, as observed in Figure 6A, was mainly driven by an increase in solo self-employment over the long term.

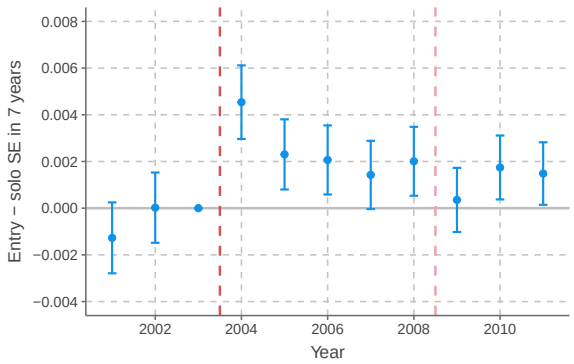
[36]The selection of a seven-year horizon is due to the fact that employer-employee linkages are observed since 2008. See Section 6 for details.

Figure 8: Entries to self-employment and solo self-employment status seven years after transition

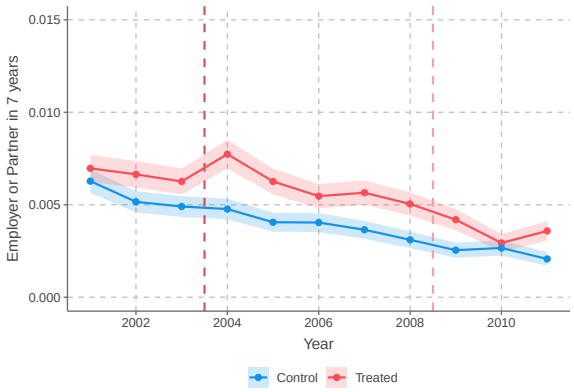
(A) Entry in t and solo self-employment $t+7$



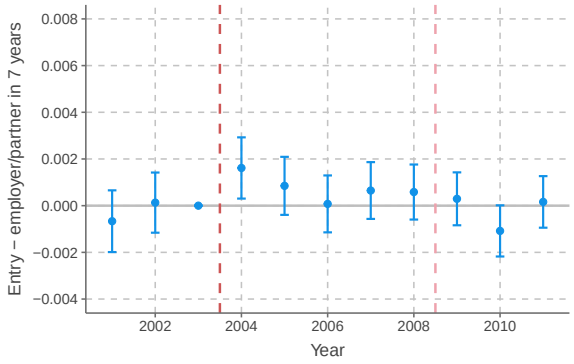
(B) Entry in t and solo self-employment $t+7$



(C) Entry in t and employer/partner $t+7$



(D) Entry in t and employer/partner $t+7$



Note: Entries to self-employment in year t and solo self-employment in $t+7$ is the share of taxpayers who declared self-employment income in year t, did not declare self-employment income in year $t-1$ and were solo self-employed in year $t+7$. Entries to self-employment in year t and employer/partner in $t+7$ is the share of taxpayers who declared self-employment income in year t, did not declare self-employment income in year $t-1$ and were employers or joint owners in year $t+7$. The figures on the left show sample averages with 95% confidence intervals. The figures on the right show the difference-in-difference coefficients based on the specification (13) with 95% confidence intervals. Sample: balanced panel from 2000 to 2014 of employees in 2000.

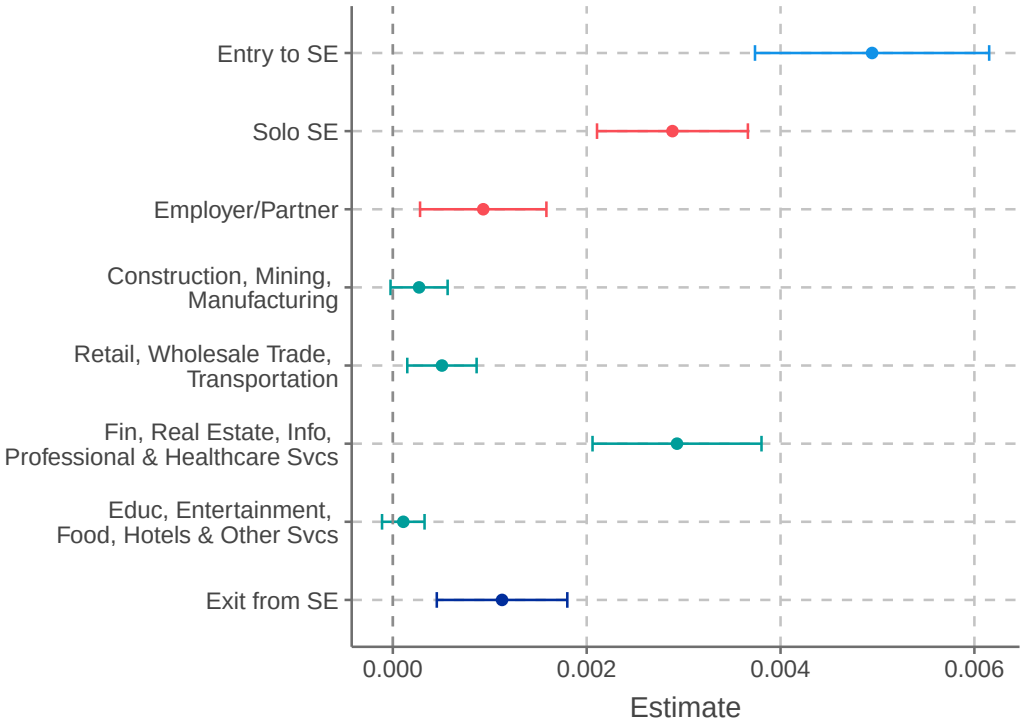
Figure 9 shows the average yearly effect of the flat tax reform over 2004-2008 on entries to self-employment and solo self-employment status 7 years after the entry, and sector of business activity 7 years after the entry using specification (14). Full regression results are presented in Table C.4 in Appendix C.4. The majority, almost 60%, of the taxpayers who shifted to self-employment during this time due to the reform were solo self-employed in the long run.[37] Just under 20% of additional self-employed taxpayers were employers or

[37]The percentages are calculated as the ratios of estimated coefficients representing the average effects of the 2004 flat tax reform for different outcome variables relative to the coefficient estimated for the entry rate. Specifically, 60% is calculated as 0.0029/0.0049. The numerator is the coefficient from specification (14), where the outcome variable is entry into self-employment and solo self-employment status seven years post-entry (column 2 of Table C.4). The denominator is the coefficient from specification (14), where the outcome variable is entry into self-employment (column 1 of Table C.4).

joint owners 7 years after transition, while the rest left self-employment. Furthermore, the share of solo-self-employed taxpayers among new entries to self-employment induced by the reform is higher than the proportion of solo-self-employed taxpayers among entries that occurred prior to the reform. Among taxpayers who entered self-employment in 2003, 39% were solo self-employed and 30% were employers or joint owners 7 years after transition.

Sector of business activity. Figure 9 also shows the average yearly effect of the flat tax reform by sector of business activity 7 years after the entry using specification (14). Full regression results are presented in Table C.5 in Appendix C.4. Nearly 60% of the taxpayers who shifted to self-employment in this period due to the reform were in high-skilled service industries, specifically: finance, real estate, information, professional and healthcare services. There were also statistically significant but quantitatively smaller increases in traditional industries such as retail, wholesale trade, transportation, construction, mining, and manufacturing. These results suggest that the reform predominantly facilitated solo self-employment in industries with a substantial human capital component. As identified by Smith et al. (2019), single-establishment firms in professional or health services have become dominant among top earners in the United States. Our analysis confirms their hypothesis that tax incentives to become self-employed concentrated in the upper part of the income distribution may particularly attract such high-skilled professionals, potentially leading to a recharacterization of labor income as capital income.

Figure 9: Impact of the flat tax on the average yearly entry rate to self-employment by hiring status and sector of the business activity 7 years after the entry



Note: The figure illustrates the effect of the 2004 reform (β_1) on entries into self-employment, hiring status seven years after entry, and sector of business activity seven years after entry, based on specification (14). Entries into self-employment in year t are decomposed according to the hiring status in year $t+7$: Solo self-employed (Solo SE), Employer/Partner, or outside of self-employment (Exit from SE). Alternatively, they can be decomposed by the business sector in year $t+7$. The treatment group is defined as the 99th and 100th percentiles of the 2000 income distribution and the control group is defined as the 97th and 98th percentiles. Sample: balanced panel from 2000 to 2014 of employees in 2000.

8 Robustness Checks

This section presents the results of various robustness checks, in which we modify the treatment status and sample definitions. Figure 10 shows the difference-in-differences coefficients over time for different specifications. Table D.1 in the Appendix provides the estimated average yearly effects and elasticity calculations for these different specifications.

Ranking taxpayers using income in 2002. In this specification, treatment and control groups are defined based on the income distribution in 2002 instead of 2000. Taxpayers in the baseline estimation sample are ranked according to their taxable income in 2002. Individuals in the top two percentiles in 2002 are assigned to the treatment group, while those in the next two percentiles are assigned to the control group. This assignment better reflects the difference in tax incentives directly before the reform. The results of this specification are in column (1) of Table D.1, entitled "Reranking". The estimated impact on net transitions is higher than in the baseline, but the semi-elasticity remains at the similar level.

Defining treatment and control group using cross-sectional variation in tax incentives. Joint filing generates varying tax incentives across the income distribution in a given year. This allows us to establish a treatment and control group that is not influenced solely by an individual's position in the income distribution. When filing jointly with a lower-earning spouse, an individual might fall into a lower income tax bracket compared to a taxpayer with similar income filing with a higher income spouse. This source of variation was used by Kopczuk (2023) to identify intensive margin responses of the flat tax reform and by Zawisza (2017) to identify extensive margin responses of the 2009 reform. In the baseline estimation sample, we define the treatment group as taxpayers facing one of the higher income brackets in 2003 and the control group as taxpayers who are in the lowest income bracket after incorporating spousal income. The sample is restricted to taxpayers filing with a spouse in 2003. The results of this specification are in column (4) of Table D.1, entitled "Redefining treatment". The impact on net transitions is lower in the sample of taxpayers filing jointly, which is supported by our heterogeneity analysis.

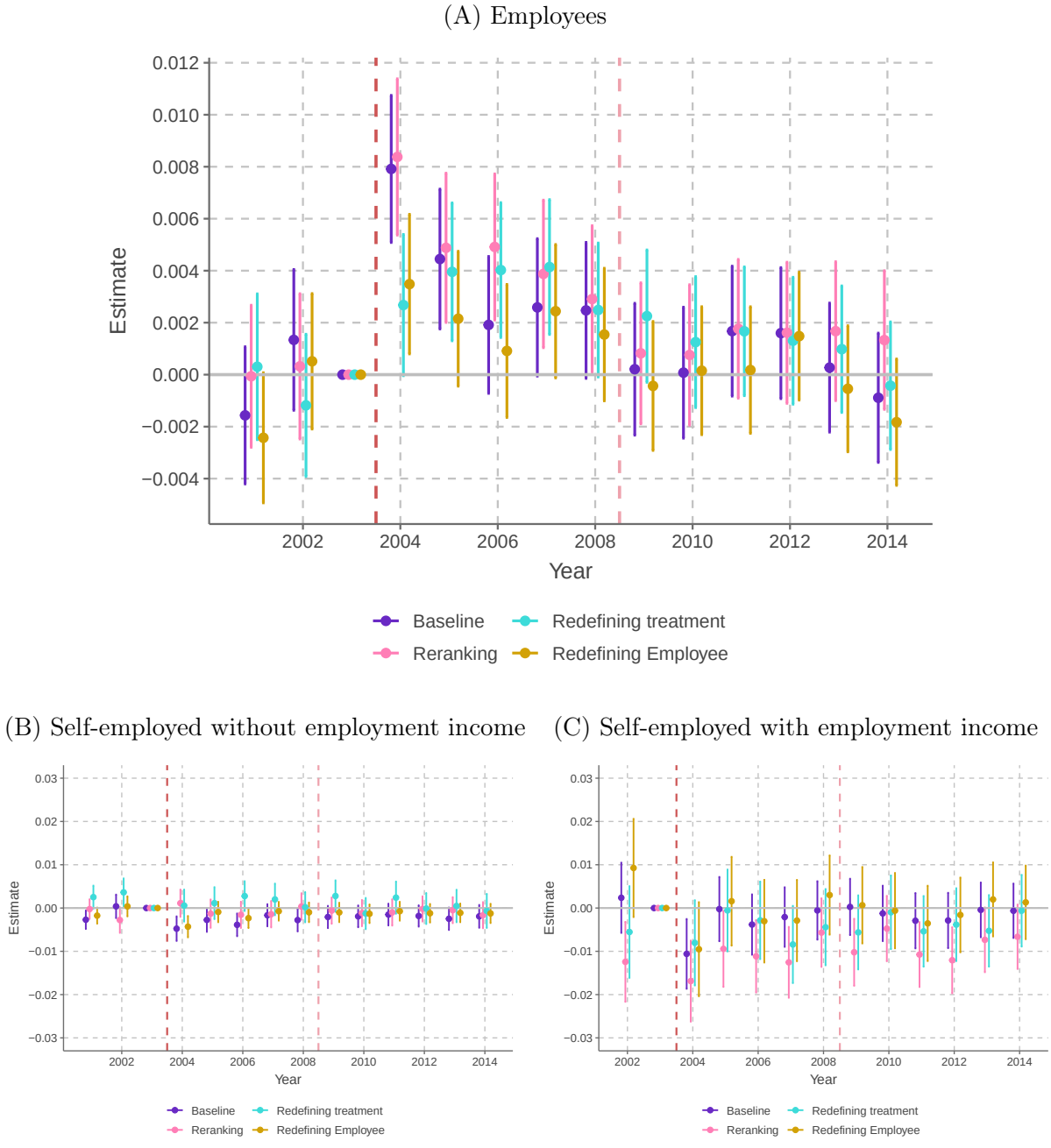
Changing the definition of an employee. The baseline specification defines the employees as taxpayers who earn the majority of their income from employment contracts or contracts of mandate that share some features of employment contracts. Here, we examine a sample where employees earn the majority of income from employment

contracts only. Employees who mainly earn income from employment contracts may have lower flexibility in changing employment forms than those employed under civil law contracts. The results of this specification are in column (5) of Table D.1 entitled "Re-defining Employee". As an employment contract is the least flexible form of employment, the semi-elasticity in this specification is lower than in the baseline specification.

Repeated cross-section estimation. We estimate the effects on transitions using the repeated cross-section approach outlined in Saez et al. (2012). In this approach, we compare the changes in transition behaviors of two cross-sections of employees: one before and one after the 2004 reform. We also conduct placebo tests. The sample definitions, exact specifications, and results are presented in Appendix D.1. This analysis is most comparable to the analysis of entries into self-employment and self-employment status. The results, which use different sample definitions and estimation methods, are broadly in line with our baseline results. We estimate an increase of 0.5 percentage points in the probability of switching to self-employment within a year among employees in the top two percentiles, compared to the 2002-2003 transitions. This estimate is close to the overall average effect of the reform on one-year entries into self-employment obtained in the balanced panel analysis (see Table C.4 in the Appendix). This analysis also indicates that over 50% of the taxpayers who shifted to self-employment due to the reform were solo self-employed in the long run. Over 20% of additional self-employed individuals became employers or joint owners seven years after transition. None of the placebo estimates showed statistical significance, confirming the stability of transition rates outside the reform years.

Overall, the results do not vary substantially across these different specifications of the samples and treatment status. The average effect of the 2004 reform on yearly transition rates from employment to self-employment varies between 0.003 and 0.005 and the implied semi-elasticity varies between 5 and 8 across different specifications. The semi-elasticity is lower for joint filers and employees with a standard contract as opposed to a more flexible employment form.

Figure 10: Robustness checks: net transitions to employment and net transitions to self-employment



Note: The figure shows the results of different robustness checks. The dynamic difference-in-difference estimates are based on the specification (13). "Baseline": the treatment and control group is defined using income rank in 2000, "Reranking": the treatment and control group is defined using income rank in 2002. "Redefining treatment": the treatment and control group is defined using cross-sectional variation in incentives generated by joint filing. 'Redefining Employee": employees earn the majority of income from employment contracts.

9 Interpretation and Policy Implications

We use our estimates to calculate the deadweight loss (DWL) of the 2004 reform, corresponding to the parameter dB_2 in section A, separately from the mechanical effect of the tax changes on revenue and intensive margin responses. Our DWL calculations focus on the top two percentiles of the income distribution, where the 2004 changes in self-employment incentives were concentrated.

Our approach to calculating the extensive margin response is as follows. For each permille of the income distribution, we calculate the predicted change in the probability of filing as self-employed based on our switching parameter estimates and the predicted change in the tax differential between employment and self-employment. For the reform effect parameter, we use our preferred estimates of the percentage point response of 0.7, based on the effects of the reform in both directions of flows after 5 years. We assume that the responsiveness of taxpayers to a change in the tax differential between employment and self-employment, measured in percentage points, is the same across the income distribution. We then derive the predicted loss of tax revenue as a result of shifting to the self-employment tax base. The predicted change in tax revenue for taxpayers in each income permille is calculated as the predicted difference in the average tax rate multiplied by pre-reform income.[38] We restrict our attention to changes in revenue relative to the 2004 baseline in the no reform scenario.

In addition, we calculate the intensive margin effect of the reform using the baseline estimate obtained by Kopczuk (2023). To calculate the intensive margin response, we inflate the pre-reform (2003) gross income from self-employment of those who switched to the flat tax by 0.391 log points, or 48%. We then use the microsimulation model to calculate the revenue effects, including the intensive margin response.[39] We also calculate the mechanical effect of the reform in the absence of behavioral responses.

The results of this exercise, summarised in Table 5, suggest that although the extensive-margin response had a considerable impact on the deadweight losses associated with the

[38]The implicit simplifying assumption is that gross income remains the same regardless of the employment form. Since the majority of the response involves transitions from employment to self-employment, we empirically verify that the percentage change in gross income for those who switch to self-employment is similar to that of those who remain self-employed. However, this comparison does not account for the selection problem. See Appendix B.3 for further discussion. For our deadweight loss calculations we ignore employers' social security contributions.

[39]This model calculates the revenue effect for self-employed who switched to the flat tax and their spouses. It considers changes in joint filing status, deductions, and tax credits resulting from the shift to a new tax regime, under the assumption that these provisions would remain constant in the absence of the flat tax.

2004, they were smaller than those associated with the intensive-margin response. Our calculations also show that the response of the intensive-margin was around five times larger than that of the extensive margin. The predicted reduction in tax revenue resulting from individuals switching from employment to self-employment is 309 mln PLN, which corresponds to a 2.4% reduction in total tax revenue in 2003 for the top two percentiles. The combined mechanical and intensive margin response in the top two percentiles of the income distribution was a 3.5% reduction in tax revenue. The total revenue effect of the reform, which was concentrated at the top of the income distribution, is estimated to be a 5.8% reduction in tax revenue. In terms of the revenue impacts of the reform, the intensive-margin response was more than offset by the mechanical reduction in tax revenue. As a result, the extensive-margin response makes a non-trivial contribution to the total revenue effect of the reform – in the absence of an extensive-margin response, the negative revenue effect would have been around 40% smaller.

Table 5: Calculations of DWL of reform (in millions of PLN).

Percentile:	99	100	Total
1. Mechanical effect	-91	-1 890	-1 981
2. Intensive margin response	247	1 283	1 531
3. Extensive margin response	-23	-286	-309
4. Total revenue effect (1.+ 2. + 3.)	133	-892	-759
5. Tax revenue in 2003	3 276	9 704	12 981
as % of mechanical effect			
6. Intensive margin response (2./1.)	-270.9%	-67.9%	-77.3%
7. Extensive margin response (3./1.)	25.3%	15.1%	15.6%
as % of total tax in 2003			
8. Mechanical effect (1./5.)	-2.8%	-19.5%	-15.3%
9. Intensive margin response (2./5.)	7.5%	13.2%	11.8%
10. Extensive margin response (3./5.)	-0.7%	-2.9%	-2.4%
11. Total revenue effect (4./5.)	4.1%	-9.2%	-5.8%

Note: This table shows the mechanical tax revenue implications, intensive margin response and extensive margin response of the 2004 reform in top two percentiles of the income distribution of employees and self-employed. Row 1. shows the microsimulated effect of the reform absent any behavioral response, using 2003 data from tax forms. Row 2. shows the intensive margin response coming from self-employed increasing self-employment income in response to reduction in the marginal tax rate. Row 3. shows the extensive margin response coming from an increased probability of switching from employment to self-employment and a decreased probability of switching from self-employment to employment. Row 5. shows the total pre-reform tax revenue in the top two percentiles in the population of employees and self-employed.

10 Conclusion

In many countries self-employment is treated more favorably in the tax system than employment. One objective is to foster entrepreneurship, investment, and job creation. However, these beneficial tax rules also create incentives for workers to sell their labor under self-employment.

This study leverages a significant tax reduction for business owners in Poland in 2004 and its partial reversal in 2009 to explore how high-income employees respond to changes in the average tax rate in the self-employment tax base relative to the employment tax base. We focus on switching responses. Our findings highlight a pronounced response for the top income earners. In addition, the analysis distinguishes between transitions into solo self-employment and transitions into self-employment with employees or co-owners. The reform increased transitions to businesses hiring workers. However, a substantial share of the response comes from increased flows from employment to long-term solo-self employment and to high-skilled service industries. This suggests that a number of individuals who transitioned to self-employment after the 2004 reform did not establish businesses that subsequently hired additional workers. The transitions could be due to the reclassification of previous activity as self-employment or self-employment activity that remained on a small scale or was highly human capital intensive.

These results have important implications for the optimal design of the income tax. We demonstrate that tax differentials lead to significant long-term changes in the fraction of taxpayers choosing self-employment, especially long-term solo self-employment. In the face of such switching responses, widening tax differentials between the employment and self-employment tax bases contributes directly to the deadweight loss of taxation. Additionally, switching to self-employment often means less protection against labor market risk and lower social benefits, such as pensions. This generates future revenue costs if individuals do not adequately self-insure, which is not accounted for in our analysis. In addition to revenue losses, such responses raise equity concerns. They undermine the progressivity of the tax system and violate the rules of horizontal equity, i.e. that taxpayers with similar income and performing similar activities may face different level of taxation. As Boeri et al. (2020) recommend: "policymakers should reduce the incentives to hide what are de facto dependent employment positions under self-employment".

Our evaluation focuses on the Polish flat tax reform, making the findings sensitive to the country-specific institutional and regulatory context, such as the legal definitions of

self-employment, historical levels of self-employment, and effectiveness of tax audits. Constraints on taking advantage of the flat tax—specifically, regulations preventing taxpayers from offering the same services to their former employers within the same or preceding tax year—might have tempered the reform's immediate impact. Nevertheless, companies often sought ways around these restrictions despite attempts to limit switching. Without such regulations, the responses would likely be even stronger than those we estimate.

Our study has some limitations. Firstly, the reduced-form effect of the reform can be attenuated, because the control group defined based on the income distribution prior to the reform gets gradually more exposed to the treatment as the income in this group increases over time. Secondly, the lack of data prevents us from distinguishing between solo self-employed working for multiple contractors versus those working for a single contractor, the latter of which would more accurately indicate dependent employment status. Third, our conclusions and elasticity estimates are limited to high-income earners, and the estimated parameters may differ for low-wage workers who can be contracted out by employers to circumvent minimum wage and employment protection legislation. Despite these challenges, our analysis offers new insights into the extensive margin effects of the flat tax reform and, more generally, to tax arbitrage between employment and self-employment.

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Employment to Self-Employment Transitions in Response to Differential Taxation

MAIN APPENDIX

Justyna Klejdysz and Tom Zawisza

Appendix A. Deadweight loss of tax reform

We consider the consequences of a reform that reduces the self-employment tax rate by a small amount $d\tau_S$ above a certain threshold $\bar{b}$. We assume there is no change in the marginal tax rate on employment income, τ_E, as in the 2004 reform. For simplicity, we abstract from the two higher tax brackets under the progressive schedule and consider only a single higher marginal tax rate in the higher tax bracket before the reform. In general, such a reform will have three effects: (1) a mechanical effect, (2) an intensive-margin behavioral effect and (3) an extensive-margin behavioral effect. We discuss these in turn.

The first effect, the mechanical effect, is a reduction in tax revenue from the self-employed as a result of taxpayers with self-employment income facing a lower tax rate. The total size of this effect is:

$$dM = \int_{\Theta} \left[(1 - G_\theta(\widetilde{\phi}))(b(\theta) - \bar{b}) \right] dF\theta \times d\tau_S \tag{A.1}$$

The term captures the decrease in tax revenue from all taxpayers with self-employment income above the threshold $\bar{b}$, absent any behavioral response.

The second effect, the intensive-margin behavioral effect, induces taxpayers in the self-employment tax base to increase their reported income. Specifically, the change $d\tau_S$ will induce self-employed taxpayers of type θ to increase the level of reported income by $\frac{\partial b(\theta)}{\partial \tau_S} d\tau_S$. Using the definition of the intensive-margin elasticity of taxable income in equation (5), this can be expressed as:

$$\frac{\partial b(\theta)}{\partial \tau_S} d\tau_S = \frac{b(\theta)}{(1 - \tau_S)} \varepsilon_S(\theta) d\tau_S \tag{A.2}$$

where $\varepsilon_S(\theta) = \frac{1-\tau_S}{b(\theta)} \frac{\partial b(\theta)}{\partial (1-\tau_S)}$ is the elasticity for an individual of type θ. Integrating over all the productivity types, the total amount of tax revenue gained through the intensive-margin response is:

$$dB_1 = \left(\frac{\tau_S}{1 - \tau_S} \right) \int_{\Theta} \left[(G_\theta(\widetilde{\phi}))(b(\theta) - \bar{b}) \varepsilon_S(\theta) \right] dF\theta \times d\tau_S \tag{A.3}$$

where we integrate only those types θ who have earnings $b(\theta) > \bar{b}$.

The third effect, the extensive margin response, which is the focus of this paper, can be summarised as follows. For a taxpayer of type θ above the threshold $\bar{b}$, the reform will lower the threshold of fixed costs at which it is optimal for them to switch from employment to self-employment. This will induce a fraction of individuals to switch from employment to self-employment. Specifically, the threshold at which individuals are indifferent between the two tax forms will change by:

$$\frac{\partial \widetilde{\phi}_\theta}{\partial \tau_S} d\tau_S = - \frac{\partial \left(v^S(\theta) - v^E(\theta) \right)}{\partial (1 - \tau_S)} d\tau_S = (b(\theta) - \bar{b}) d\tau_S. \tag{A.4}$$

where the second inequality comes from substituting equation (8) for the indirect utilities. In this specification, the change in the cost parameter at which it becomes optimal to switch is increasing in the total amount of tax savings from switching to self-employment.[40]

If we assume the variable-cost specification of the costs of switching, this becomes:

$$\frac{\partial \widetilde{\phi}_\theta}{\partial \tau_S} d\tau_S = \frac{(b(\theta) - \bar{b}) d\tau_S}{b(\theta)} - \widetilde{\phi}_\theta \frac{\varepsilon_S(\theta)}{(1-\tau_S)} d\tau_S \tag{A.5}$$

The first term is just the change in the total tax liability of individual θ under self-employment divided by the individual's income under self-employment, which is the change in the average tax rate under self-employment as a result of the tax reform. In other words, the change in the cost parameter at which it becomes optimal to switch to self-employment is increasing in the change in the average tax rate. The second term captures the fact that the tax reform results in self-employed individuals reporting more self-employment income after the tax reduction. Since self-employment costs are proportional to income, they increase as a result for any given taxpayer as long as the elasticity $\varepsilon_S(\theta)$ is above zero.

From equations (A.4) and (A.5) expression, it follows that the change in the threshold is proportional to either (i) the change in the total quantity of tax that the individual would pay or (ii) the change in the average tax rate if they were in the self-employment tax base, depending on assumptions about the nature of switching costs. In guiding our empirical specification, we believe the model of variable costs may be closer to a true model of behavior, such that it is reductions in the average tax rate rather than absolute tax gains that matter for switching behavior.[41]

The density of individuals of type θ who are induced to switch as a consequence of the reform is given by $g_\theta\left(\widetilde{\phi}\right) \times \left(\frac{\partial \widetilde{\phi}_\theta}{\partial \tau_S} d\tau_S\right)$. This is the change in the probability that individuals of type θ reporting self-employment, i.e. the fraction switching from the employment to the self-employment form. For each individual in employment who switches to the self-employment tax base, the net loss in tax revenue will be equal to $\Delta T(b(\theta)) = T^E(l(\theta)) - \tau_S(b(\theta) - \bar{b})$.[42] Hence, for type θ, the amount of revenue lost on the extensive margin is the density of individuals induced to switch, multiplied by the difference in total tax amounts between the tax bases across which they are switching: $g_\theta\left(\widetilde{\phi}\right)\left(\frac{\partial \widetilde{\phi}_\theta}{\partial \tau_S}\right) \Delta T(\theta) \times d\tau_S$. The total reduction in tax revenue due to the extensive-margin behavioral response is then equal to

$$dB_2 \;=\; -\int_\Theta \left[g_\theta\left(\widetilde{\phi}\right)\left(\frac{\partial \widetilde{\phi}_\theta}{\partial \tau_S}\right) \Delta T(\theta) \right] dF\theta \times d\tau_S. \tag{A.6}$$

[40] Since taxation under employment remains constant, the term $(b(\theta) - \bar{b}) d\tau_S$ captures the total amount of tax savings in self-employment relative to employment as a result of the reform.

[41] This has been the approach of most papers in the literature on tax arbitrage through incorporation, such as Tazhitdinova (2020).

[42] Assuming that taxable income does not change after transition, this term becomes $\Delta T(b(\theta)) = (\tau_E - \tau_S)(b(\theta) - \bar{b})$. This will be our approach in this paper.

The extensive-margin response is, therefore, a function of the increase in the probability of filing in self-employment, which we further know from equation (*A*.5) is proportional to the change in tax rate savings in self-employment.

The total effect of the tax reform on government tax revenue is just the sum of the three effects:

$$\Delta R = dM + dB_1 + dB_2. \tag{A.7}$$

Many studies have focused on the intensive-margin responses to tax reforms, dB_1. For example, Kopczuk (2023) estimates the intensive margin reaction to the reform studied here. In this paper, our focus is on estimating the magnitude of the extensive margin behavioral response in dB_2, and, in particular, identifying the key behavioral parameter $g_\theta\left(\widetilde{\phi}\right) \times \left(\frac{\partial \widetilde{\phi}_\theta}{\partial \tau_S} d\tau_S\right)$, measuring the change in the probability of filing self-employment in response to a percentage point change in tax saving in self-employment. This corresponds to the key behavioral parameters for the estimation that we highlight in equations (9) and (10) in Section 3.

Appendix B. Additional descriptive statistics

B.1 Tax differential

The sample of employees and self-employed is the main sample that we construct based on the administrative tax records. This sample is then used to construct the balanced panel of employees and self-employed in our main analysis.

Sample of employees and self-employed includes taxpayers whose combined employment and self-employment income constitutes the majority of their gross income in a given year. Employees are defined as those who earn the majority (at least 50%) of their gross income from employment and do not declare any self-employment income. Self-employed individuals earn the majority of their income from self-employment or from employment while also declaring self-employment revenue.

Figure B.1 shows the ranking of tax thresholds (see Figure 1) in the taxable income distribution in the sample of employees and self-employed.

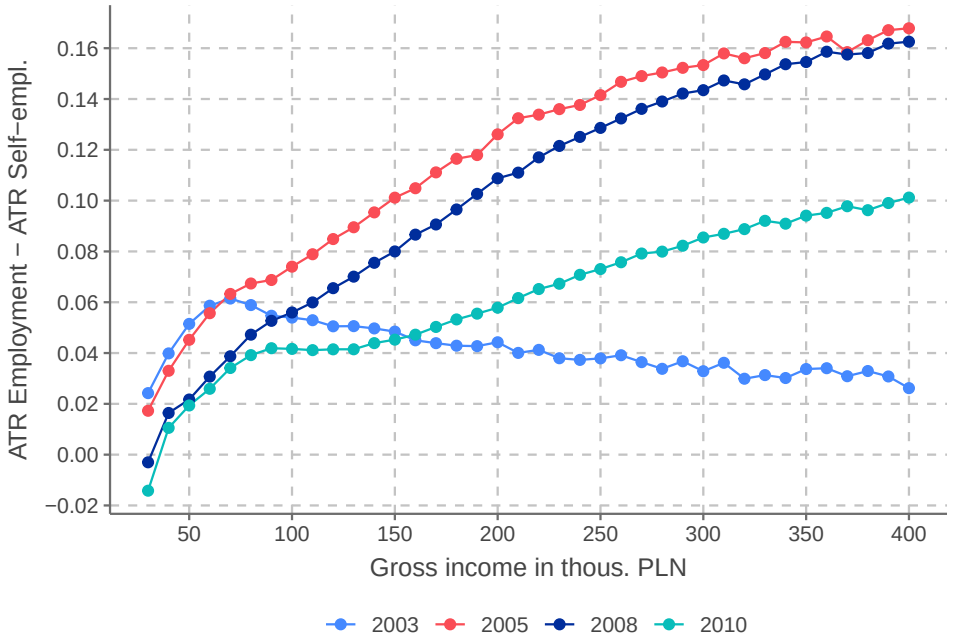
Table B.1: Rank of tax thresholds in the individual taxable income distribution

Year	30% tax threshold	32% tax threshold	40% tax threshold
2000	89.1	-	97.5
2001	90.0	-	97.7
2002	89.3	-	97.5
2003	88.7	-	97.3
2004	87.5	-	96.9
2005	86.3	-	96.5
2006	84.9	-	96.0
2007	86.7	-	96.3
2008	83.2	-	95.3
2009	-	94.9	-
2010	-	94.5	-
2011	-	94.0	-
2012	-	93.6	-
2013	-	93.2	-
2014	-	92.8	-
2015	-	92.3	-
2016	-	91.8	-
2017	-	90.9	-
2018	-	89.7	-

Note: The table shows the position of tax thresholds in the individual taxable income distribution in the sample of employees and self-employed. Taxpayers with income rank higher than the threshold's rank may face different marginal tax rates than implied by the progressive tax threshold, i.e. due to filing under the flat tax schedule or joint filing under the progressive schedule.

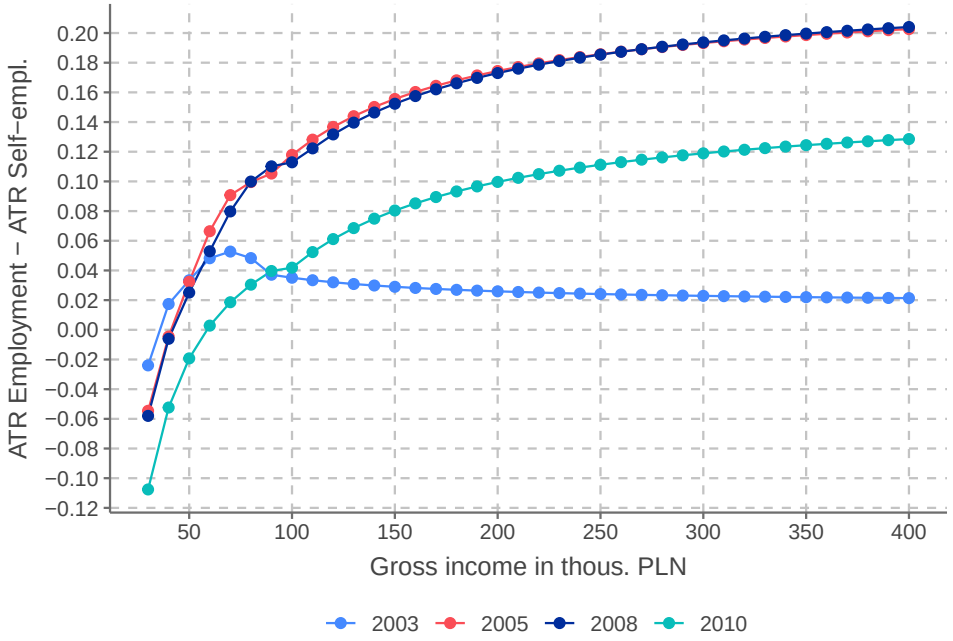
Figure B.1 shows the tax differential (the difference in ATR between employees and self-employed). Figure B.2 shows the tax differential calculated for a theoretical taxpayer with specific characteristics.

Figure B.1: Tax differential by gross income



Note: The figure shows the difference in the average tax rate (ATR) between employees and self-employed within the same gross income interval in different years. ATR includes tax liability, health insurance contribution, and social security contributions paid by an employee or self-employed, relative to gross income. Sample: employees and self-employed.

Figure B.2: Theoretical tax differential for a single filer without children



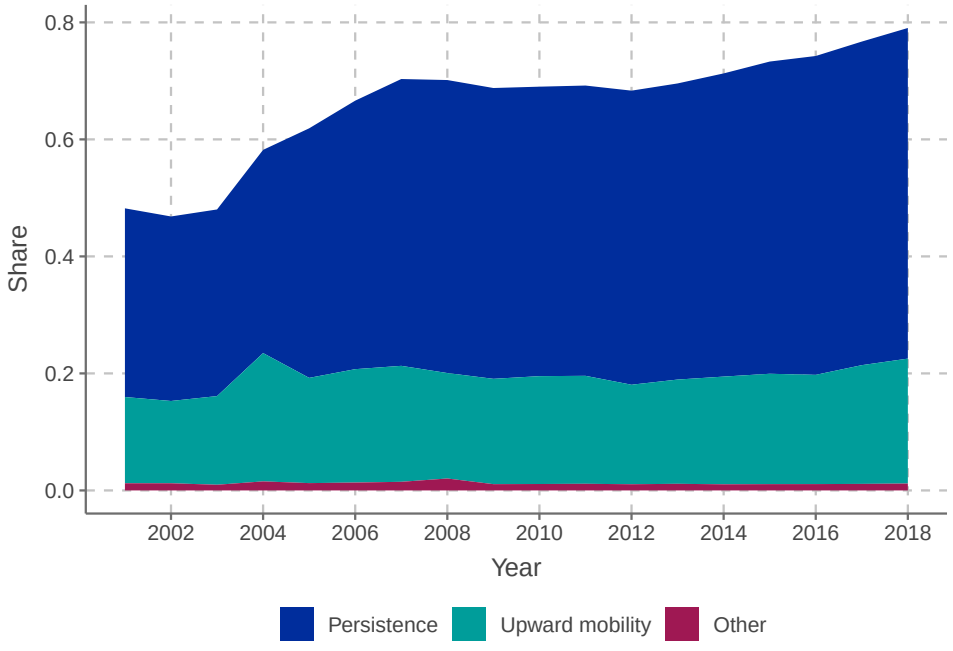
Note: The figure shows the theoretical difference in average tax rate between an employee and self-employed with the same gross income in different years. The calculation is performed under the assumption of earning the same monthly gross income for 12 months, single filing, no extra deductions or tax credits. The ATR includes tax liability, health insurance contribution, and social security contributions paid by an employee or self-employed, relative to gross income.

B.2 Mobility of taxpayers in top income groups

To understand the drivers behind rising shares of self-employment (see Figure 3B), we analyze how individuals entered the top 1 percentile as self-employed from one year to the next. Individuals can enter top 1 in year t through various pathways: remaining in the same percentile as self-employed from year $t-1$ to year t, climbing into top 1 from a lower percentile as self-employed, switching from being an employee in year $t-1$ to self-employment in year t, or transitioning into self-employment in year t from other income sources.

Our decomposition in Figure B.3 shows that the majority of the increase in self-employment within the top percentile of the income distribution between 2003 and 2004 came from the upward mobility of self-employed within a single year. The persistence in self-employment surged between 2004 and 2005. Together, the increase in upward mobility of self-employed individuals and persistence from the previous year explain almost the whole increase in the share of self-employed between 2003 and 2005 in the top percentile. While transitions from employment to self-employment also contributed to the increase in self-employment shares in the top 1% after the reform, their impact was less pronounced than the changes in the mobility of self-employed individuals across the income distribution. Figure B.4 shows a detailed decomposition of the share of self-employed.

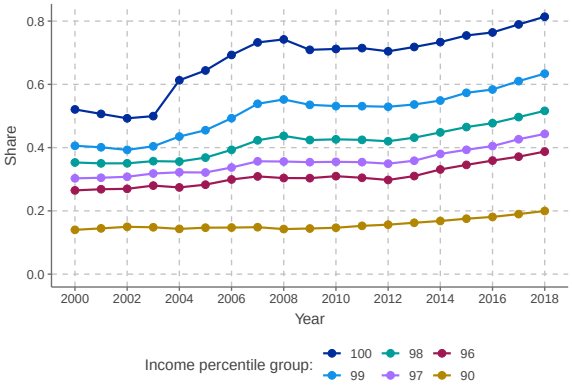
Figure B.3: Decomposition of the share of self-employed in top one percentile of the income distribution 2001–2018.



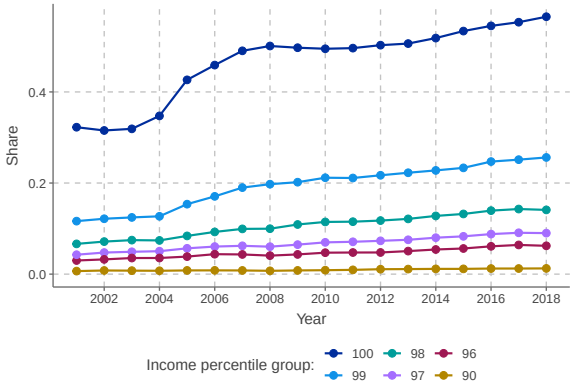
Note: The figure presents the composition of self-employed individuals in the top 1% of income distribution in the sample of employees and self-employed in each year (t) from 2001 to 2018, categorized by their position in the income distribution in the preceding year ($t-1$). "Persistence" denotes the number of self-employed individuals in year t who were self-employed in year $t-1$ and remained within the top 1 from year $t-1$ to year t, as a fraction of the total number of self-employed in the top 1%in year t. "Upward mobility" refers to the proportion of self-employed individuals in year t who were self-employed in year $t-1$ and moved into the top 1 in year t, relative to the total number of self-employed in the top 1%in year t. The "Other" category includes all other pathways leading to self-employment in the top 1%in year t, specifically transitions from other income sources to self-employment. This analysis is based on the sample of employees and self-employed individuals each year, with income rankings determined within this sample annually.

Figure B.4: Decomposition of the self-employment shares

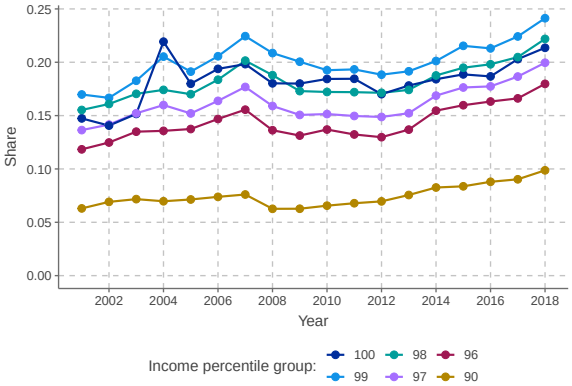
(A) Share SE



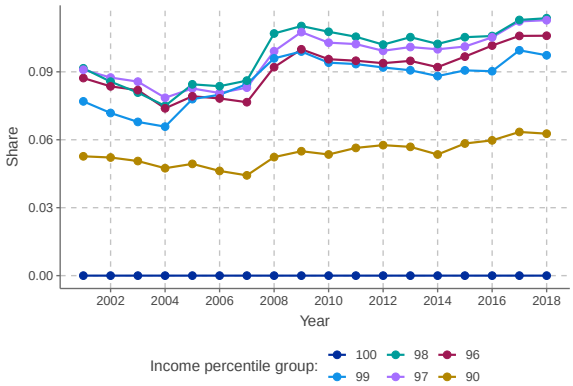
(B) Persistence in SE



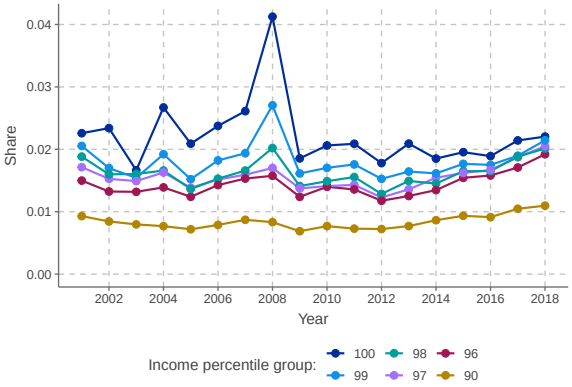
(C) Upward mobility in SE



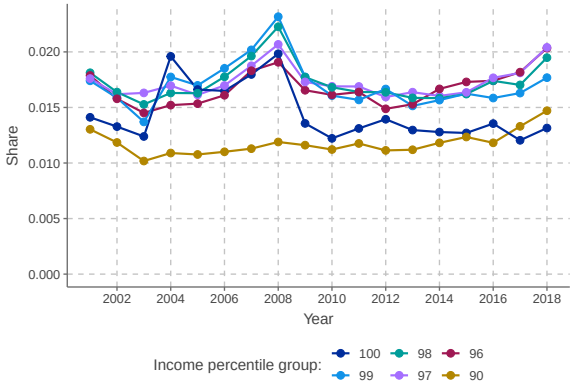
(D) Downward mobility in SE



(E) Entry from outside of employment



(F) Entry from employment



Note: he figure presents the composition of self-employed individuals in the given percentile of income distribution in the sample of employees and self-employed in each year (t) from 2001 to 2018, categorized by their position in the income distribution in the preceding year ($t-1$). "Persistence" denotes the number of self-employed individuals in year t who were self-employed in year $t-1$ and remained within the given percentile from year $t-1$ to year t, as a fraction of the total self-employed in that percentile in year t. "Upward mobility" refers to the proportion of self-employed individuals in year t who were self-employed in year $t-1$ and moved into the given percentile in year t from a lower percentile, relative to the total number of self-employed in that percentile in year t. "Downward mobility" refers to the proportion of self-employed individuals in year t who were self-employed in year $t-1$ and moved into the given percentile in year t from a higher percentile. "Entry from outside of employment" refers to the proportion of self-employed individuals in year t who were neither employees or self-employed in year $t-1$ and were self-employed in the given percentile in year t. Entry from employment" refers to the proportion of self-employed individuals in year t who were employees in year $t-1$ and were self-employed in the given percentile in year t. This analysis is based on the sample of employees and self-employed individuals each year, with income rankings determined within this sample annually

B.3 Income after transition

This section examines the income changes experienced by taxpayers transitioning between employment and self-employment, and how these changes influence elasticity and deadweight loss calculations.

The tax differential between employment and self-employment for a given taxpayer depends on the potential income in the alternative sector. The difference in earnings between employment and self-employment is observed only for those who switch sectors. In this paper, we do not estimate earnings in the alternative sector for every taxpayer in our sample.[43] Selection into self-employment is influenced by factors not captured in our tax data, such as education, occupation, or years of experience. Consequently, we rely on the observed income changes post-transition for our analysis.

Elasticity calculations. We measure the change in the tax differential, defined as the difference between the average tax rate (ATR) of employees and the ATR of the self-employed, within subpopulations. For example, we calculate the ATR of employees minus the ATR of self-employed individuals who switched from employment to self-employment. Our analysis focuses on how the ATR difference changes over time and in comparison to the control group. Since the tax treatment of employees did not change significantly around the 2004 reform, the change in the tax differential represents the change in ATR on income under self-employment before and after the reform. The reduction in ATR on self-employment income implies an increase in net income under self-employment.

It is also likely that self-employment income was underreported pre-reform. In that case, the observed change in the tax differential is lower than it would be absent the reporting response. Additionally, we compute the difference in the tax differential between the treatment and control groups. If the downward bias in the tax differential is larger in the treatment group, our elasticity estimates are overestimated. If the biases are similar, treatment-control comparisons help mitigate this bias.

Deadweight loss calculations: To calculate revenue implications, we assume that a taxpayer's gross income in the alternative sector would be the same as in the current sector. Figure B.5 illustrates the percentage change in gross income of switchers minus the percentage change in gross income of stayers over two years, representing the additional income growth after switching.

Panel A shows the additional income growth for individuals transitioning from employment to self-employment. For example, the 2002-2004 line indicates the percentage change in gross income for those who switched to self-employment (employed in 2002, self-employed in 2003 and 2004) minus the percentage change in gross income for those who remained employed. Pre-reform transitions show similar income growth for switchers and stayers in the 90th-96th percentiles of the pre-transition income distribution but lower growth for the top percentiles. Post-reform, income growth of switchers aligns with stayers in the top percentiles. This can be explained by an increase in reported income by the self-employed (due to increased effort, more hours worked, or decreased avoidance) and the selection of high-ability employees into self-employment post-reform. Overall,

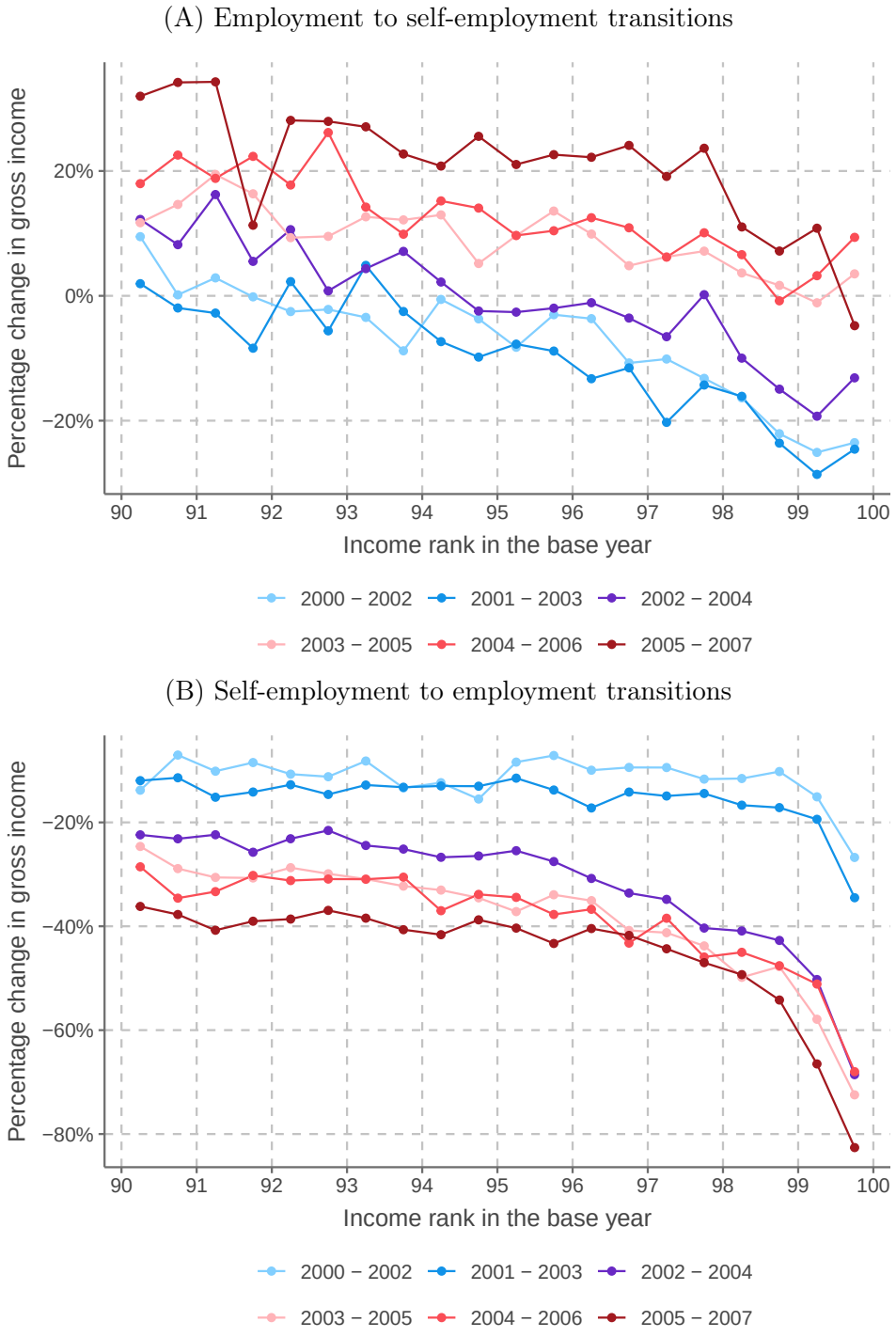
[43] See Manso (2016) and Dillon and Stanton (2017). for a discussion on returns to entrepreneurship

income after transitioning from employment to self-employment remains similar for top income earners after two years.

The panel shows the additional income growth for taxpayers switching from self-employment to employment. We generally observe a 10% lower income growth after the transition, with this drop increasing post-reform. This additional decrease may be due to increased reporting under self-employment or changes in the selection into employment. Transitions to self-employment in 2003 (income change between 2002 and 2004) provide additional insights. These pre-reform transitions, unlikely influenced by the tax differential, show a decrease in income growth post-reform for switchers, suggesting increased reporting among the self-employed rather than changes in selection into employment post-reform.

For simplicity, we assume the same income after transition for deadweight loss calculations. The increase in the number of self-employed individuals is primarily due to transitions from employment to self-employment, with a smaller contribution from a decrease in transitions from self-employment to employment. Not fully accounting for income loss after transitioning from self-employment to employment leads to an underestimation of revenue implications.

Figure B.5: Percentage change in gross income of switchers less percentage change in the gross income of stayers over two years



Note: The figure depicts the observed premium from switching from employment to self-employment (panel A) and from self-employment to employment (panel B) over 2 years by position in the income distribution. Only the top four percentiles of the income distribution are shown. The premium over two years is defined as the difference between percentage change in gross income for taxpayers who switch the employment form over two years versus taxpayers who stay in the same employment form over two years, between t and $t+2$. The blue lines show the outcome for pre-reform years: $t \in \{2000, 2001\}$. The red lines show the outcome for post-reform years: $t \in \{2002, 2003, 2004, 2005\}$.

B.4 Balanced panel

Table B.2 shows the summary statistics for each percentile 97-100 separately in the balanced panel of employees and self-employed between 2000 and 2014. Table B.3 shows the summary statistics for the cross-section of employees and self-employed in 2002 (without restricting the sample to taxpayers observed in each year between 2000 and 2014). Figure B.6 shows the persistence of taxpayers in the treatment group (the balanced panel) in the top two percentiles of the income distribution.

Table B.2: Descriptive statistics: estimation sample

	Employees				Self-employed, no empl. inc.				Self-employed, mixed inc.			
	Percentiles				Percentiles				Percentiles			
	97	98	99	100	97	98	99	100	97	98	99	100
Number of taxpayers	30,271	28,646	27,526	21,844	7,535	9,546	12,676	19,383	7,053	7,760	7,930	6,784
Male	68.0%	70.7%	73.9%	80.2%	70.3%	71.3%	72.4%	74.3%	66.4%	67.8%	69.1%	73.5%
2002												
Age	40.9	41.4	41.7	42.2	41.8	42.2	42.8	43.7	42.3	42.9	43.4	43.9
Married	81.3%	81.3%	82.5%	84.4%	87.1%	88.0%	88.6%	89.0%	85.6%	85.8%	86.7%	87.6%
Filing jointly	74.0%	74.3%	75.7%	77.7%	75.7%	76.7%	78.3%	77.3%	76.5%	77.6%	78.4%	76.3%
Gross income	75,584	88,829	112,563	200,754	69,521	79,289	99,292	208,345	69,819	79,486	100,238	189,468
Average tax rate (ATR)	28.7%	29.2%	29.8%	32.2%	26.0%	24.1%	24.7%	28.0%	25.9%	25.8%	26.5%	29.0%
Share in top tax bracket	10.4%	20.1%	36.9%	75.8%	14.4%	20.4%	30.9%	63.0%	9.7%	16.2%	28.6%	62.0%
Share in middle tax bracket	61.3%	62.4%	55.2%	21.1%	40.8%	43.6%	42.9%	24.7%	52.9%	54.9%	52.4%	28.4%
Taxable income	63,214	75,034	97,070	180,096	63,792	73,041	92,318	196,873	59,944	69,212	88,443	172,990
Share in top 2	11.0%	29.2%	66.4%	90.8%	20.7%	29.9%	46.5%	75.8%	13.7%	23.9%	48.5%	77.4%
Share in top 4	58.3%	77.6%	89.0%	95.4%	44.2%	55.8%	68.9%	85.4%	45.2%	60.3%	75.4%	87.6%
2008												
Taxable income, 2008	103,724	120,652	152,604	269,015	171,748	204,324	248,057	508,302	129,488	140,424	179,553	322,326
Share in top 2, 2008	13.7%	22.2%	40.6%	72.7%	33.0%	39.6%	50.3%	73.3%	25.8%	32.8%	43.8%	65.2%
Share in top 4, 2008	46.6%	60.2%	75.5%	87.9%	51.1%	58.1%	68.5%	83.5%	51.2%	59.1%	68.5%	80.1%
2014												
Taxable income, 2014	128,581	147,698	180,402	305,669	178,423	204,973	246,151	462,139	148,630	159,282	194,323	317,335
Share in top 2, 2014	16.8%	24.5%	36.2%	61.9%	25.7%	28.8%	35.5%	55.5%	23.7%	29.0%	35.7%	50.6%
Share in top 4, 2014	43.2%	51.2%	63.8%	78.9%	39.0%	43.4%	50.6%	67.9%	45.4%	50.9%	56.6%	67.5%

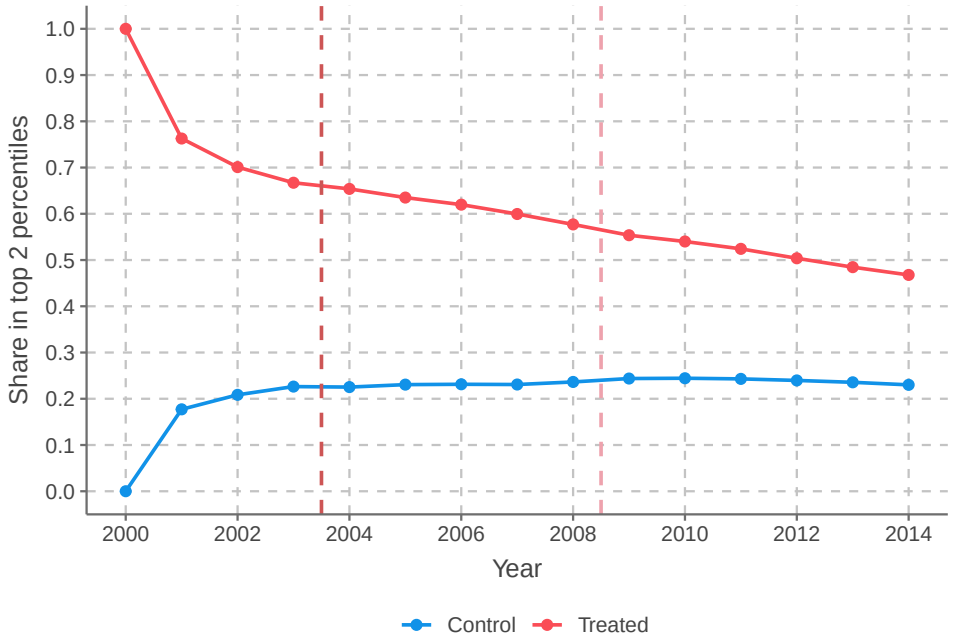
Note: This table presents summary statistics in 2002 (two years before the reform) for a balanced panel of employees and self-employed between 2000 and 2014. The treatment group includes those in the top two percentiles of the income distribution in 2000, and the control group, which includes those in the next two percentiles. We divide the panel into three sub-panes: employees in 2000, self-employed with no employment income in 2000 and self-employed with employment income in 2000 and 2001. The share in the top 1 represents the proportion of taxpayers in the top percentile of the income distribution in a given year. The share in the top 2 (3, 4) represents the proportion of taxpayers in the top two (three, four) percentiles of the income distribution in a given year.

Table B.3: Descriptive statistics: population of employees and self-employed in 2002

	Employees		Self-employed, no empl. inc.		Self-employed, mixed inc.	
	Percentiles		Percentiles		Percentiles	
	97-98	99-100	97-98	99-100	97-98	99-100
Number of taxpayers	147,358	122,391	44,890	71,852	27,402	25,408
Male	65.8%	72.5%	67.9%	71.4%	65.9%	70.1%
Age	45	44	44	44	43	44
Married	79.7%	79.6%	84.9%	86.5%	83.5%	84.2%
Filing jointly	72.2%	72.2%	73.0%	74.7%	74.0%	73.1%
Gross income	81,585	166,152	75,518	232,143	80,123	183,246
Taxable income	68,664	148,138	69,632	219,971	69,088	166,983
Min. of Taxable income	58,826	83,134	58,827	83,135	58,826	83,137
Average tax rate (ATR)	28.3%	31.0%	21.0%	26.7%	25.2%	28.5%
Self-employed	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%
Self-employed with employment income	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
Share in top tax bracket	11.0%	62.0%	13.8%	68.0%	10.6%	61.4%
Share in middle tax bracket	74.1%	38.0%	65.1%	32.0%	74.1%	38.6%
Share in top 1	0.0%	45.5%	0.0%	58.8%	0.0%	46.7%
Share in top 2	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%
Share in top 3	48.4%	100.0%	54.7%	100.0%	50.9%	100.0%
Share in top 4	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: This table presents summary statistics in 2002 (two years before the reform) for a cross-section of employees and self-employed in 2002. We divide the panel into three sub-panels: employees in 2002, self-employed with no employment income in 2002 and self-employed with employment income in 2002. The share in the top 1 represents the proportion of taxpayers in the top percentile of the income distribution in a given year. The share in the top 2 (3, 4) percentiles represents the proportion of taxpayers in the top two (three, four) percentiles of the income distribution in a given year.

Figure B.6: Share of taxpayers in the top two percentiles of the income distribution, balanced panel



Note: The figure shows the persistence of taxpayers in the treatment group (top two percentiles of the income distribution in 2000) to stay in the top two percentiles of the income distribution and the share of taxpayers in the control group (next two percentiles of the income distribution in 2000) to move up to the top two percentiles of the income distribution. Sample: balanced panel of employees and self-employed 2000–2014 (the estimation sample).

Appendix C. Additional results

C.1 Heterogeneity

Table C.1: Baseline effect and heterogeneity analysis: transitions from self-employment to employment

(a) Self-employed without employment income

	Net transitions from self-employment to employment				
	(1)	(2)	(3)	(4)	(5)
Treated × Post 2004	-0.0024***	-0.0023**	-0.0029***	-0.0022***	
	(0.0006)	(0.0011)	(0.0007)	(0.0006)	
Treated × Post 2009	0.0012**	0.0009	0.0014**	0.0013**	
	(0.0005)	(0.0009)	(0.0006)	(0.0006)	
Treated × Post 2004 × Male		-4.91×10^{-5}			
		(0.0013)			
Treated × Post 2009 × Male		0.0005			
		(0.0011)			
Treated × Post 2004 × Age≤ 40			0.0007		
			(0.0013)		
Treated × Post 2009 × Age≤ 40			-0.0005		
			(0.0011)		
Treated × Post 2004 × Single filer				-0.0013	
				(0.0018)	
Treated × Post 2009 × Single filer				-0.0004	
				(0.0015)	
Centile 99 × Post 2004					-0.0012*
					(0.0007)
Centile 100 × Post 2004					-0.0032***
					(0.0007)
Centile 99 × Post 2009					0.0015**
					(0.0006)
Centile 100 × Post 2009					0.0010*
					(0.0006)
Observations	687,960	687,960	687,960	687,960	687,960
Year FE	✓	✓	✓	✓	✓
Treated FE	✓	✓	✓	✓	✓

(b) Self-employed with employment income

	Net transitions from self-employment to employment				
	(1)	(2)	(3)	(4)	(5)
Treated × Post 2004	-0.0046**	-0.0015	-0.0029	-0.0048**	
	(0.0022)	(0.0037)	(0.0027)	(0.0024)	
Treated × Post 2009	0.0022*	0.0029	0.0047***	0.0028**	
	(0.0012)	(0.0021)	(0.0015)	(0.0013)	
Treated × Post 2004 × Male		-0.0039			
		(0.0046)			
Treated × Post 2009 × Male		-0.0010			
		(0.0025)			
Treated × Post 2004 × Age≤ 40			-0.0062		
			(0.0045)		
Treated × Post 2009 × Age≤ 40			-0.0059**		
			(0.0024)		
Treated × Post 2004 × Single filer				0.0013	
				(0.0061)	
Treated × Post 2009 × Single filer				-0.0033	
				(0.0031)	
Centile 99 × Post 2004					-0.0048*
					(0.0026)
Centile 100 × Post 2004					-0.0045
					(0.0028)
Centile 99 × Post 2009					0.0027*
					(0.0014)
Centile 100 × Post 2009					0.0015
					(0.0015)
Observations	383,851	383,851	383,851	383,851	383,851
Year FE	✓	✓	✓	✓	✓
Treated FE	✓	✓	✓	✓	✓

Note: The table reports the effect of the 2004 and 2009 reform on net transitions from self-employment to self-employment based on the specification (14) (column 1) and the triple difference specification (15) (columns 2–5). The treatment group is defined as the 99th and 100th percentiles of the 2000 income distribution and the control group is defined as the 97th and 98th percentiles. Age, single filer status refer to the values of these variables in 2002. Standard errors are in brackets and are clustered at the taxpayer level. Sample: balanced panel from 2000 to 2014 of self-employed without employment income in 2000 (panel A) and balanced panel from 2000 to 2014 of self-employed with employment income in 2000 and 2001 (panel B). * p<0.1, ** p<0.05, *** p<0.01.

C.2 Reform impact on the share of self-employed

Empirical specification. We also investigate the cumulative change in the share of self-employed between 2004 and 2008 (i.e. after the introduction of the flat tax and before the change in the progressive schedule). To do so, we estimate a specification with the probability of self-employment as the outcome variable:

$$y_{it} = \sum_{\substack{s=2001 \\ s \neq 2003}}^{2014} \beta_s \times \mathbb{1}[t = s] \times Treated_i + \delta_t + \alpha_i + \varepsilon_{it} \tag{C.1}$$

where y_{it} represents self-employment status (where $y_{it} = 1$ if the individual is self-employed). This specification also includes individual fixed effects α_i to control for time-constant unobservables that may influence the choice of self-employment. This specification serves to illustrate the impact of the reform on the increase in the share of solo-self-employed long-term and yields almost identical results to the sum of the transition coefficients in our baseline strategy.

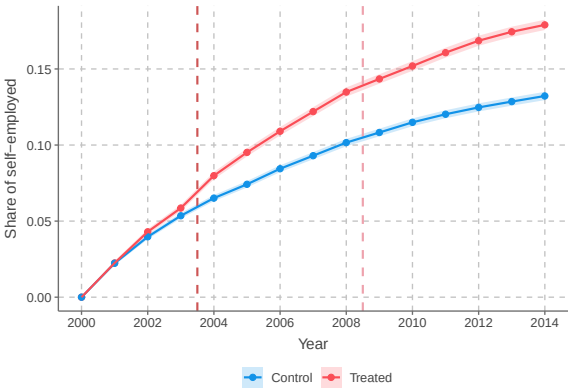
The specifications in equations (13) and (C.1) differ in terms of their underlying assumptions. In the specification (13) using transitions as an outcome variable, we assume that the difference in *transitions* between the treatment and control groups would stay constant after 2004, absent the introduction of the flat tax. This assumption allows for increasing differences in the shares of self-employed in both groups. In the specification (C.1) we assume that the difference in the *shares* of self-employed would have stayed constant absent the reform, and thus, the effect can be overestimated.

Results. Figure C.1 presents the cumulative change in the share of self-employed for both treatment and control groups over time, as well as difference-in-differences estimates of the effect of the reform on the probability of self-employment based on equation (C.1). The estimated coefficients for 2004 and 2008 are presented in Table C.2. Panels C.1A and C.1B show the change in the share of self-employed in the sample of employees in 2000. Up until 2003, the increase in the self-employed share was similar for both groups. However, five years after reform, in 2008, the share of self-employed in the treatment group was 3 pp. (almost 30%) higher than that of the control group.

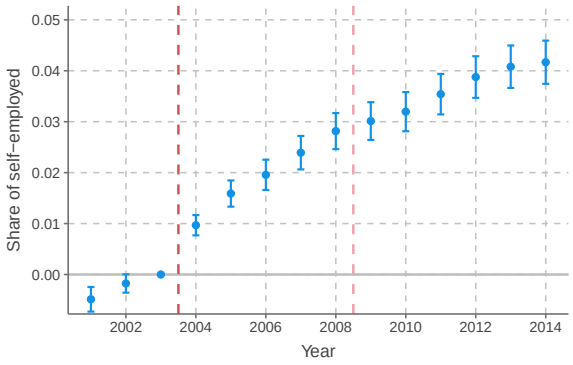
Panels C.1C and C.1D examine the change in the share of self-employed among self-employed individuals in 2000 with no employment income, while panels C.1E and C.1F look at self-employed with mixed income in 2000 and 2001. In the first group, we observe increased persistence in self-employment after the 2004 reform. However, the effect is much smaller compared to the population of employees. In the population of self-employed with mixed income, we did not observe any statistically significant changes in the frequency of resigning from self-employment income following the reform.

Figure C.1: Dynamic effect of the flat tax reform in 2004 on the share of self-employed

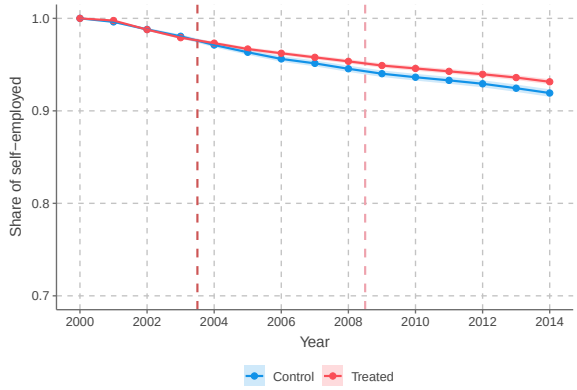
(A) Employees in 2000



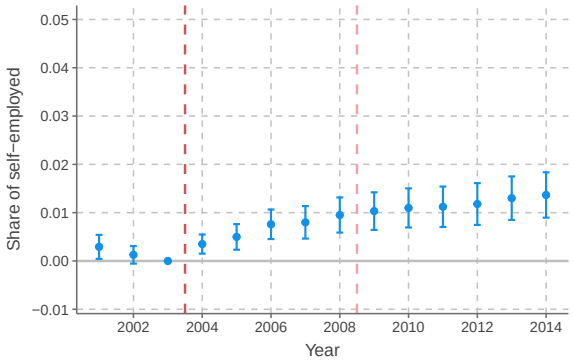
(B) Employees in 2000



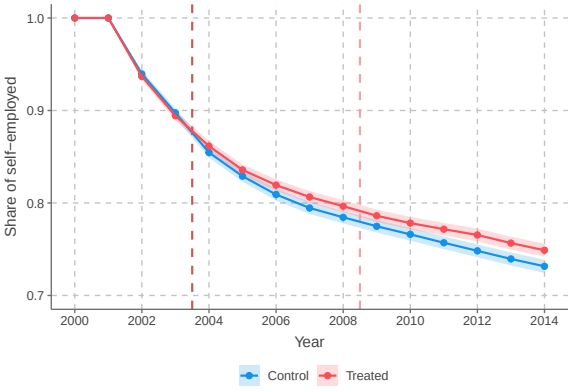
(C) Self-employed without employment income in 2000



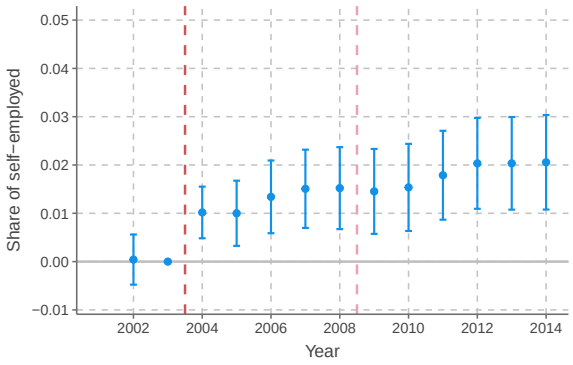
(D) Self-employed without employment income in 2000



(E) Self-employed with employment income in 2000 and 2001



(F) Self-employed with employment income in 2000



Note: The figures show the share of self-employed in each year, calculated within the treatment and control group separately. The dashed vertical lines mark the 2004 flat tax reform (large increase in the tax differential) and the 2009 reform of the progressive schedule (smaller reduction in the tax differential). The figures on the left show sample averages with 95% confidence intervals. Figures on the right show difference-in-differences coefficients with 95% confidence intervals based on specification (C.1). Sample: balanced panel from 2000 to 2014 of employees in 2000 (panel A and B), balanced panel from 2000 to 2014 of self-employed with no employment income in 2000 (panel C and D) balanced panel from 2000 to 2014 of self-employed with employment income in 2000 and 2001 (panel E and F).

Table C.2: Reform impact on the probability of self-employment (SE)

	Employees	Self-employed, no empl. inc.	Self-employed, mixed. inc.
	(1)	(2)	(3)
Treated × I(t = 2004)	0.0097***	0.0035***	0.0102***
	(0.0010)	(0.0010)	(0.0027)
Treated × I(t = 2008)	0.0282***	0.0095***	0.0152***
	(0.0018)	(0.0019)	(0.0043)
Share in SE, 2004, Treated	0.0799	0.9732	0.8615
Share in SE, 2004, Control	0.0651	0.9712	0.8545
Share in SE, 2008, Treated	0.1348	0.9535	0.7965
Share in SE, 2008, Control	0.1016	0.9455	0.7845
Observations	1,516,018	687,960	383,851
Year FE	✓	✓	✓
Taxpayer FE	✓	✓	✓

Note: The table reports the effect of the 2004 and 2009 reform on the probability to be self-employed based on the specification (C.1) in three subpopulations: employees in 2000 (column 1), self-employed with no employment income in 2000 (column 2) and self-employed with employment income in 2000 and 2001 (column 3). Each subpopulation is observed in a balanced panel between 2000 and 2014. The treatment group is defined as the 99th and 100th percentiles of the 2000 income distribution and the control group is defined as the 97th and 98th percentiles. * p<0.1, ** p<0.05, *** p<0.01.

C.3 Elasticity of switching

Table C.3: Elasticity calculations for subpopulations of employees and self-employed

	Employees	Self-employed, no empl. inc.	Self-employed, mixed inc.
2004			
1. Number of taxpayers in the treatment group	49370	32059	14714
2. Weight	0.5135	0.3335	0.1530
3. Observed share in self-employment	0.0799	0.9732	0.8615
4. Cumulative estimated effect (p.p.)	0.0079	0.0048	0.0106
5. Counterfactual share in self-employment (3. - 4.)	0.0720	0.9684	0.8509
6. Change in tax incentive (p.p.)	0.0211	0.0323	0.0264
2008			
1. Number of taxpayers in the treatment group	49370	32059	14714
2. Weight	0.5135	0.3335	0.1530
3. Observed share in self-employment	0.1348	0.9535	0.7965
4. Cumulative estimated effect (p.p.)	0.0193	0.0159	0.0173
5. Counterfactual share in self-employment (3. - 4.)	0.1155	0.9377	0.7792
6. Change in tax incentive (p.p.)	0.0211	0.0323	0.0264

Note: This table shows components for calculating aggregate semi-elasticity in Table 4.

C.4 Impact on self-employment by hiring status and sector

Table C.4: Reform impact on the entries to self-employment and solo self-employment status

	Entries to SE (1)	Solo SE in 7 years (2)	Employer/partner in 7 years (3)	Outside of SE in 7 years (4)
Treated × Post 2004	0.0049***	0.0029***	0.0009***	0.0011***
	(0.0006)	(0.0004)	(0.0003)	(0.0003)
Treated × Post 2009	-0.0021***	-0.0013***	-0.0010***	9.99×10^{-5}
	(0.0005)	(0.0004)	(0.0003)	(0.0003)
Observations	1,191,157	1,191,157	1,191,157	1,191,157
Year FE	✓	✓	✓	✓
Treated FE	✓	✓	✓	✓
Mean outcome pre-reform, Treated	0.0218	0.0084	0.0066	0.0068

Note: The table reports the effect of the 2004 and 2009 reform on entries to self-employment in one year based on specification (14), (column 1). Entries into self-employment are further decomposed according to the self-employment status seven years post-entry as follows: entry into self-employment and solo self-employment status seven years post-entry (column 2), entry into self-employment and employer or joint owner seven years post-entry (column 3), and entry into self-employment and outside of self-employment 7 years after the entry. The treatment group is defined as the 99th and 100th percentiles of the 2000 income distribution and the control group is defined as the 97th and 98th percentiles. Standard errors are in brackets and are clustered at the taxpayer level. Sample: balanced panel from 2000 to 2011 of employees in 2000. * p<0.1, ** p<0.05, *** p<0.01.

Table C.5: Reform impact on the entries to self-employment by sector of business activity

	Construction, mining or manufacturing in 7 years (1)	Retail, wholesale trade or transportation in 7 years (2)	Finance, real estate, information, professional or healthcare services in 7 years (3)	Education, entertainment, food, hotels or other services in 7 years (4)
Treated × Post 2004	0.0003**	0.0005***	0.0029***	0.0001
	(0.0001)	(0.0002)	(0.0004)	(0.0001)
Treated × Post 2009	0.0001	-0.0002	-0.0021***	-9.13×10^{-5}
	(0.0001)	(0.0002)	(0.0004)	(0.0001)
Observations	1,191,157	1,191,157	1,191,157	1,191,157
Year FE	✓	✓	✓	✓
Treated FE	✓	✓	✓	✓
Mean outcome pre-reform, Treated	0.0010	0.0018	0.0113	0.0007

Note: The table reports the effect of the 2004 and 2009 reform on entries to self-employment in one year by sector of business activity seven years after transition based on specification (14). We define four broad categories of business activity. Column (1) shows entry into self-employment and working as self-employed in construction, mining or manufacturing, column (2) shows entry into self-employment and working as self-employed in retail, wholesale trade or transportation, column (3) shows entry into self-employment and working as self-employed in finance, real estate, information, professional or healthcare services, column (4) shows entry into self-employment and working as self-employed in education, entertainment, food, hotels or other services seven years after transition. The treatment group is defined as the 99th and 100th percentiles of the 2000 income distribution and the control group is defined as the 97th and 98th percentiles. Standard errors are in brackets and are clustered at the taxpayer level. Sample: balanced panel from 2000 to 2011 of employees in 2000. * p<0.1, ** p<0.05, *** p<0.01.

Appendix D. Robustness

Table D.1 shows the estimated average yearly effects and elasticity calculations for different specifications described in 8. Figure D.1 shows the difference in the tax incentive to switch between the treatment group and the control group for the population of employees in 2000. The tax incentive to switch is defined as the difference in the ATR between employment and self-employment, specifically, the ATR of employees minus the ATR of self-employed individuals who transitioned from employment. This difference is used to measure the responsiveness of the proportion of individuals in self-employment to changes in the tax differential.

Table D.1: Robustness

(a) Employees: net transitions to self-employment

	Baseline (1)	Reranking (2)	Redefining treatment (3)	Redefining Employee (4)
Treated × Post 2004	0.0039***	0.0049***	0.0037***	0.0027***
	(0.0007)	(0.0007)	(0.0007)	(0.0006)
Treated × Post 2009	-0.0034***	-0.0037***	-0.0023***	-0.0023***
	(0.0005)	(0.0006)	(0.0005)	(0.0005)
Observations	1,516,018	1,198,148	1,736,042	1,301,720
Year FE	✓	✓	✓	✓
Treated FE	✓	✓	✓	✓
Elasticity	0.5877	0.1635	0.1857	0.3697
	(0.1846)	(0.045)	(0.0676)	(0.1968)
Semi-elasticity	7.924	6.916	5.232	5.026
	(2.4893)	(1.9053)	(1.9044)	(2.6761)
Response	0.9150	0.7169	0.4459	0.4596
	(0.2462)	(0.1592)	(0.1349)	(0.2194)

(b) Self-employed without employment income: net transitions to employment

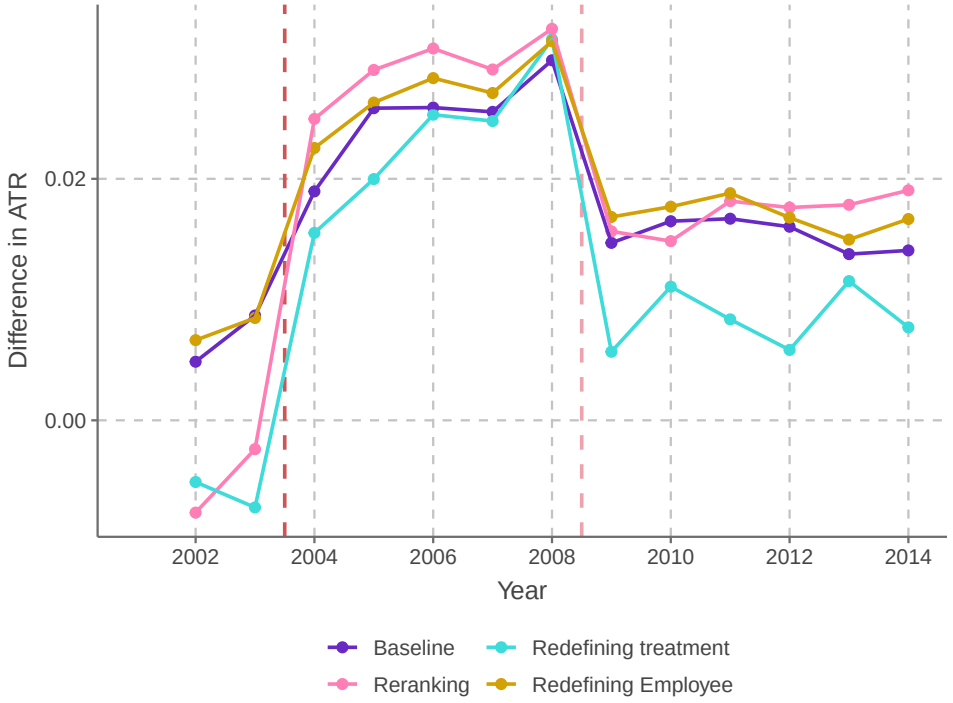
	Baseline (1)	Reranking (2)	Redefining treatment (3)	Redefining Employee (4)
Treated × Post 2004	-0.0024***	0.0004	-0.0007	-0.0014***
	(0.0006)	(0.0007)	(0.0008)	(0.0005)
Treated × Post 2009	0.0012**	-0.0003	-0.0007	0.0008*
	(0.0005)	(0.0006)	(0.0008)	(0.0004)
Observations	687,960	499,772	508,816	701,134
Year FE	✓	✓	✓	✓
Treated FE	✓	✓	✓	✓
Elasticity	0.0136	0.0022	-0.0058	0.0118
	(0.0046)	(0.0045)	(0.0061)	(0.0058)
Semi-elasticity	0.5228	0.0522	-0.0942	0.3159
	(0.1756)	(0.109)	(0.0994)	(0.1549)
Response	0.4902	0.0502	-0.0919	0.3018
	(0.1619)	(0.1046)	(0.0976)	(0.1466)

(c) Self-employed with employment income: net transitions to employment

	Baseline (1)	Reranking (2)	Redefining treatment (3)	Redefining Employee (4)
Treated × Post 2004	-0.0046**	-0.0049*	-0.0021	-0.0068**
	(0.0022)	(0.0025)	(0.0028)	(0.0030)
Treated × Post 2009	0.0022*	0.0025*	0.0012	0.0019
	(0.0012)	(0.0014)	(0.0016)	(0.0016)
Observations	383,851	262,132	346,151	233,909
Year FE	✓	✓	✓	✓
Treated FE	✓	✓	✓	✓
Elasticity	0.0264	0.0579	0.0332	0.0169
	(0.0231)	(0.0193)	(0.0256)	(0.0322)
Semi-elasticity	0.8397	1.784	0.7605	0.5186
	(0.7352)	(0.5946)	(0.5868)	(0.9849)
Response	0.6543	1.366	0.6083	0.3869
	(0.5605)	(0.4246)	(0.4555)	(0.7242)

Note: The table reports the effect of the 2004 and 2009 reform on net transitions based on the specification (14). Column (1) shows the baseline results. Columns (2)–(4) show the results of different robustness checks. "Baseline": the treatment and control group is defined using income rank in 2000, "Reranking": the treatment and control group is defined using income rank in 2002. "Redefining treatment": the treatment and control group is defined using cross-sectional variation in incentives generated by joint filing. 'Redefining Employee": employees earn the majority of income from employment contracts. * p<0.1, ** p<0.05, *** p<0.01.

Figure D.1: Difference in the average tax rate between employment and self-employment and between treatment and control group for each robustness check scenario. Sample of employees in 2000.



Note: The figure shows the difference between tax differential in the treatment group and tax differential in the control group in the sample of employees in 2000. The tax differential is the difference in ATR in percentage points between employees and self-employed who were previously employees. "Baseline": the treatment and control group is defined using income rank in 2000, "Reranking": the treatment and control group is defined using income rank in 2002. "Redefining treatment": the treatment and control group is defined using cross-sectional variation in incentives generated by joint filing. 'Redefining Employee": employees earn the majority of income from employment contracts.

D.1 Repeated cross-section

Empirical specification. An alternative specification is a repeated cross-section approach outlined in Saez et al. (2012). In this approach, we compare the changes in the transition behaviors of two cross-sections of employees, one before and one after the 2004 reform.

Under our repeated cross-section specification, we estimate the following equation:

$$z_{i,t+7} = \beta \times \mathbb{1}\left[t \geq 2004\right] \times \mathit{Treated}_i + \gamma\, \mathit{Treated}_i + \eta \mathbb{1}\left[t \geq 2004\right] + \mathbf{x}'_{it}\boldsymbol{\alpha} + \varepsilon_{it} \qquad \text{(D.1)}$$

where z_{it} represents different outcome variables, specifically: an entry to self-employment in year t and solo self-employment in $t+7$: $(\mathbb{1}\left[\Delta y_{it} = 1 \wedge \mathit{solo}_{t+7} = 1\right])$, an entry to self-employment in year t and being an employer or partner in year $t+7$: $(\mathbb{1}[\Delta y_{it} = 1 \wedge \mathit{solo}_{t+7} = 0 \wedge y_{t+7} = 1])$, an entry to self-employment in year t and being out of self-employment in $t+7$: $(\mathbb{1}\left[\Delta y_{it} = 1 \wedge y_{t+7} = 0\right])$. The variable $\boldsymbol{x}_{it}$ is the log of taxable income in the base year, age, age squared, gender, and marital status. In the base year $t-d$, all taxpayers in the sample are employees. $\Delta y_{it} = y_{it} - y_{it-d}$, where y_{it} denotes self-employment status (where $y_{i,t=}1$ if self-employed). The parameter of interest, β,

represents the reform effect on the share of solo self-employed (or to self-employed with workers/co-owners for the treated taxpayers), i.e., the change in the top two percentiles in the income distribution before transition, compared to the next two percentiles. The share is expressed relative to the number of employees in the pre-transition year $(t-d)$. For example, one estimation sample consists of employees in the top four percentiles in $t \in \{2003, 2004\}$ with $d = 1$. That is, we compare 2002–2003 transitions to 2003–2004 transitions and evaluate solo self-employment status in 2010 and 2011 respectively. We repeat the estimation for different pairs of t and d and we also conduct placebo tests for robustness (for example, comparing 2000–2001 transitions to 2001–2002 transitions and evaluating solo-self-employment status in 2008 and 2009 respectively, treating 2002 as placebo post-reform year).

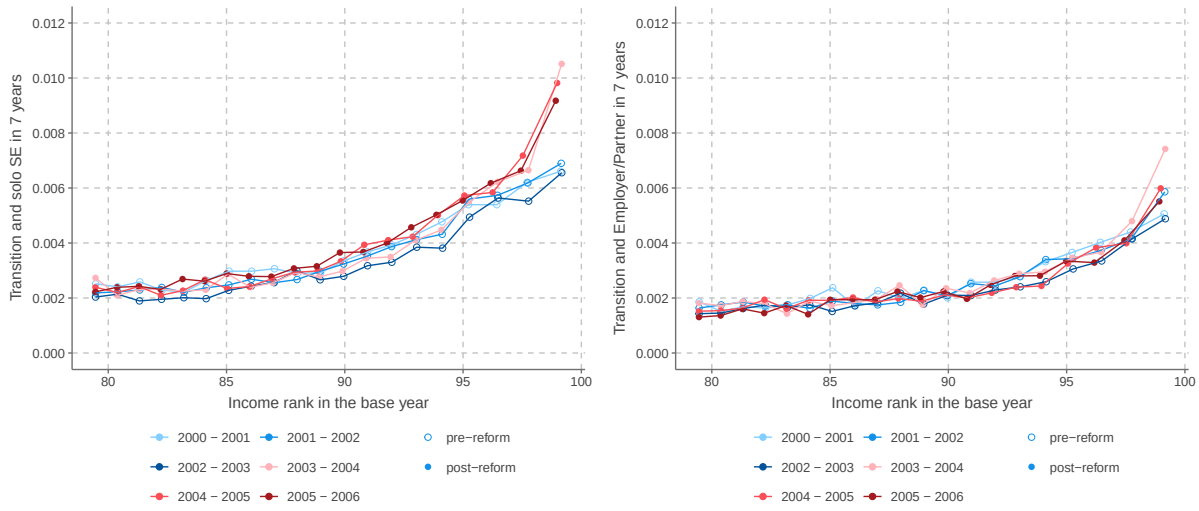
Results. To understand the reform's causal effect on solo self-employment, we adopt the repeated cross-section approach described in equation (D.1). The validity of this approach relies on stability in transitions, absent reform, year-on-year. Figure D.2 provides graphical representation of this estimation strategy. Instead of considering the balanced panel from 2000 to 2014 of employees in 2000 as before, we now turn to a repeated cross-section of employees observed between 2000 and 2005. An employee is assigned to the treatment group if they are in the top two income percentiles, and to the control group if they are in the subsequent two percentiles. The income ranking is assessed annually in the population of employees and self-employed.

Our analysis begins by examining the impact of the flat tax reform on transitions from employment to self-employment. Table D.3 presents the reduced-form results. Column (1) presents the results for 2003–2004 transitions. The estimate is 0.005 (standard error: 0.001), meaning that we observe an increase of 0.5 pp. in the probability of switching to self-employment within a year, among employees in the top two percentiles, compared to 2002–2003 transitions. This estimate is close to the overall average effect of the reform on one-year net transitions to self-employment obtained in the balanced panel analysis (see Table 2). When we extend the analysis to cover a three-year period (2003–2006), the average increase in transitions is 1.3 pp. (standard error: 0.001).

Next, we explore the reform's impact on transitions to solo self-employment seven years after the transition. Analyzing the period 2003–2006, we identified an increase of 0.007. This indicates that over half (approximately 50%, calculated as 0.007/0.130) of the taxpayers who shifted to self-employment during this time due to the reform were solo self-employed in the long run. Over 20% of additional self-employed were employers or joint owners 7 years after transitions, while the remainder left self-employment. To validate our empirical strategy, we conducted a battery of placebo tests, the results of which are shown in columns (4)–(6). None of the placebo estimates showed statistical significance, confirming the stability of transition rates outside the reform years.

Figure D.2: Entries to self-employment in one year (by solo self-employment status seven years after transition). Averages in the repeated cross-section.

(A) Entry in t and solo self-employment $t+7$ (B) Entry in t and employer/partner $t+7$



Note: The outcome variable shown in Panel A is the share of employees in year $t-1$ who declared self-employment income in year t and were solo self-employed in year $t+7$. The outcome variable shown in Panel B is the share of employees in year $t-1$ who declared self-employment income in year t, did not declare self-employment income in year $t-1$ and were employers or joint owners in year $t+7$. The blue lines show the outcome for pre-reform years: $t \in \{2001, 2002, 2003\}$. The red lines show the outcome for post-reform years: $t \in \{2004, 2005, 2006\}$. Sample averages with 95% confidence intervals. Sample: cross-section of employees 2000–2005.

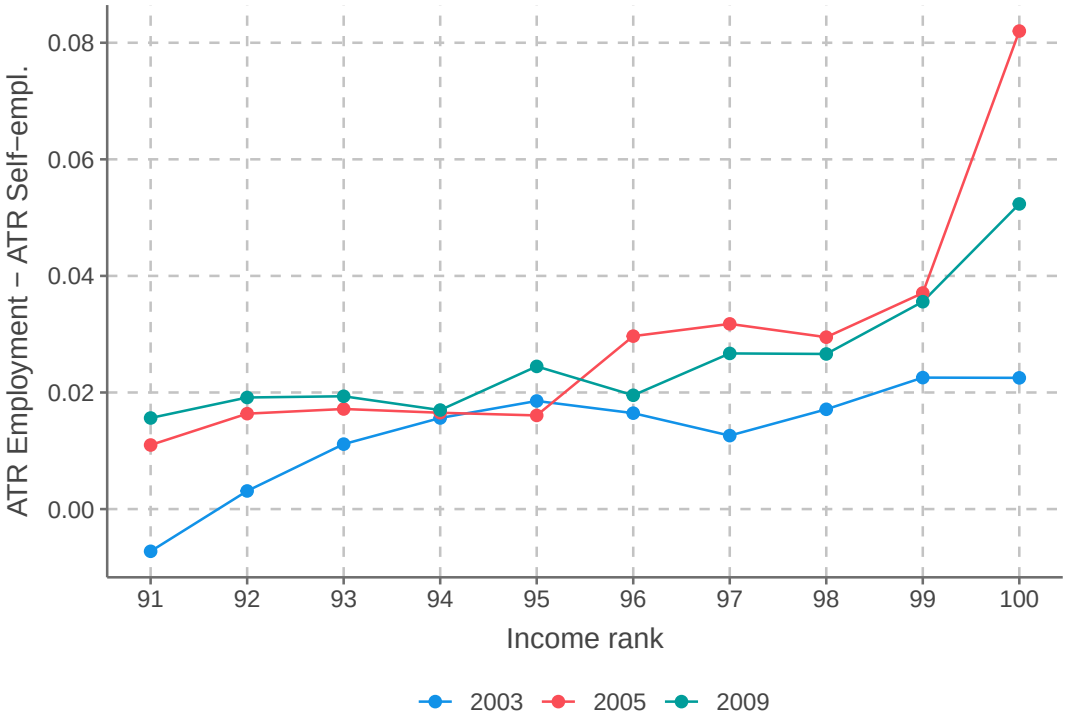
Table D.3: Reduced form results of the reform on transitions to self-employment and self-employment status 7 years after transition (solo self-employment, employer/partner, outside of self-employment). Repeated cross-section approach.

	2003 - 2004	2003 - 2005	2003 - 2006	2001 - 2002 (Placebo)	2001 - 2003 (Placebo)	2002 - 2003 (Placebo)
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: **Employment to self-employment transitions**						
Treated × Post 2004	0.005***	0.009***	0.013***	0.001	0.0005	0.0002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number of observations	493188	473495	459704	504976	481129	497981
Panel B: **Employment to self-employment and solo self-employed in 7 years**						
Treated × Post 2004	0.002***	0.004***	0.007***	−0.00001	0.0004	−0.0002
	(0.0005)	(0.001)	(0.001)	(0.0004)	(0.001)	(0.0004)
Number of observations	493188	473495	459704	504976	481129	497981
Panel C: **Employment to self-employment and employer/partner in 7 years**						
Treated × Post 2004	0.001***	0.002***	0.003***	0.001	0.0002	−0.0002
	(0.0004)	(0.001)	(0.001)	(0.0004)	(0.001)	(0.0004)
Number of observations	493188	473495	459704	504976	481129	497981
Panel D: **Employment to self-employment and outside of self-employment in 7 years**						
Treated × Post 2004	0.001	0.002***	0.003***	0.0004	−0.0001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number of observations	493188	473495	459704	504976	481129	497981
Panel E: **Survival in self-employment in 7 years, conditional on transition**						
Treated × Post 2004	0.023	0.007	0.017	0.0005	0.006	−0.022
	(0.020)	(0.015)	(0.012)	(0.020)	(0.015)	(0.020)
Number of observations	9956	18150	24989	10015	17618	9552

*p<0.1; **p<0.05; ***p<0.01

Note: The table reports reduced form estimates of the effect of the reform on transitions from employment to self-employment and self-employment status several years after transition using specification (D.1). In panel A, we show estimates for the effect on transitions to self-employment. In column (1), we report estimates on transitions between 2003 and 2004, using 2002–2003 transitions as the pre-reform baseline ($t \in \{2003, 2004\}$, $d = 1$). In column (2), we report estimates on transitions between 2003 and 2005, i.e. allowing individuals to transition over a period of 2 years following the reform. The 2001–2003 transitions serve as the pre-reform baseline ($t \in \{2003, 2005\}$, $d = 2$). In column (3), we report estimates on transitions between 2003 and 2006. The 2000–2003 transitions serve as the pre-reform baseline ($t \in \{2003, 2006\}$, $d = 3$). The placebo specification in columns (4), (5), and (6) include, respectively: ($t \in \{2001, 2002\}$, $d = 1$), ($t \in \{2002, 2003\}$, $d = 2$), ($t \in \{2002, 2003\}$, $d = 1$). In the notation $t \in \{t_0, t_1\}$, t_1 denotes post-reform year or placebo post-reform year. Panel (B) reports the effect on the transitions from employment to self-employment and being solo self-employed in 7 years from transition. Panel (C) reports the effect on the transitions from employment to self-employment and being an employer/partner in 7 years from transition. Panel (D) reports the effect on the transitions from employment to self-employment and being outside of self-employment in 7 years from transition. Panel (E) reports the effect on the survival in self-employment, conditional on making a transition to self-employment. Robust standard errors are in parenthesis. * p<0.1, ** p<0.05, *** p<0.01.

Figure D.3: Tax differential (within the population of employees in the base year) - repeated cross section



Note: The figure shows the difference in ATR between employees and self-employed who were previously employees by income rank in the base year. In the base years (2001, 2003 and 2007) all taxpayers in the sample are employees in 2003, 2005, 2009 the taxpayers either stayed in employment or switched to self-employment.

Appendix E. Relationship between transitions and share empirical specifications

Define net transitions between $t-1$ and t as:

$$\begin{aligned} Net\_trans_t^K &= Pr(S_t|E_{t-1};K) \times Pr(E_{t-1}|K) \\ &\quad -Pr(E_t|S_{t-1};K) \times Pr(S_{t-1}|K) \end{aligned} \tag{E.1}$$

where $K \in \{C, T\}$ for the treatment and control group, respectively.

For example, the probability of self-employment in 2004 in the treatment group can be expressed as:

$$\begin{aligned} Pr(S_{2004}|T) &= Pr(S_{2003}|T) + \\ &\quad +Pr(S_{2004}|E_{2003};T) \times Pr(E_{2003}|T) \\ &\quad -Pr(E_{2004}|S_{2003};T) \times Pr(S_{2003}|T) \qquad \text{(E.2)} \\ &= Pr(S_{2003}|T) + Net\_trans_{2004}^T \qquad \text{(E.3)} \end{aligned}$$

Likewise, the probability of self-employment in 2004 in the control group is:

$$\begin{aligned} Pr(S_{2004}|C) &= Pr(S_{2003}|C) + \\ &\quad +Pr(S_{2004}|E_{2003};C) \times Pr(E_{2003}|C) \\ &\quad -Pr(E_{2004}|S_{2003};C) \times Pr(S_{2003}|C) \qquad \text{(E.4)} \\ &= Pr(S_{2003}|C) + Net\_trans_{2004}^C \qquad \text{(E.5)} \end{aligned}$$

The diff-in-diff coefficient at $t = 2008$, dynamic specification, based on levels, with 2003 as a reference year is:

$$\hat{\beta}_{2008}^{levels} = Pr(S_{2008}|T) - Pr(S_{2003}|T) - [Pr(S_{2008}|C) - Pr(S_{2003}|C)] \tag{E.6}$$

The share of individuals self-employed in the treatment and control groups, $Pr(S_{2008}|T)$ and $Pr(S_{2008}|C)$, respectively, can be represented in terms of net transitions as follows:

$$Pr(S_{2008}|T) = Pr(S_{2003}|T) + \sum_{t=2004}^{2008} Net\_trans_t^T \tag{E.7}$$

and

$$Pr(S_{2008}|C) = Pr(S_{2003}|C) + \sum_{t=2004}^{2008} Net\_trans_t^C. \tag{E.8}$$

Using expressions above, we can rewrite equation (E.6) as:

$$\hat{\beta}_{2008}^{levels} = \sum_{t=2004}^{2008} Net\_trans_t^T - \sum_{t=2004}^{2008} Net\_trans_t^C \tag{E.9}$$

We can compare this estimate of long-term 2004 reform effects on the share of self-employed in 2008 to an estimate based on diff-in-diff estimates of the reform effect on transitions.

The diff-in-diff coefficient at t, dynamic specification, based on transitions, with 2003 as reference year is:

$$\hat{\beta}_t^{trans} = Net\_trans_t^T - Net\_trans_{2003}^T - [Net\_trans_t^C - Net\_trans_{2003}^C] \quad \text{(E.10)}$$

Our estimate of the long term effect of the reform is based on summing the diff-in-diff effet of transitions between 2004 and 2008:

$$\begin{aligned} \hat{\beta}_{2008}^{sum} = \sum_{t=2004}^{2008} \hat{\beta}_t^{trans} &= \sum_{t=2004}^{2008} Net\_trans_t^T - \sum_{t=2004}^{2008} Net\_trans_t^C \\ &+ 5 \times [Net\_trans_{2003}^C - Net\_trans_{2003}^T]. \end{aligned} \quad \text{(E.11)}$$

Equations (E.9) and (E.11) together imply:

$$\hat{\beta}_{2008}^{sum} = \hat{\beta}_{2008}^{levels} - 5 \times [Net\_trans_{2003}^T - Net\_trans_{2003}^C] \quad \text{(E.12)}$$

and for any time-period t:

$$\hat{\beta}_t^{sum} = \hat{\beta}_t^{levels} - (t - 2003) \times [Net\_trans_{2003}^T - Net\_trans_{2003}^C]. \quad \text{(E.13)}$$

The differences between the two methods arise because the estimates based on transitions allow for a baseline difference in net transitions between the treatment and control groups. This baseline difference in net transitions adds up over time such that, absent reform, the counterfactual share in self-employment in the treatment group can be different from the share in the control group.

In summary, since the method of estimating long-term effects based on summing reform impact on net transitions allows for baseline differences in net transitions between treatment and control, it can be considered more robust. It is therefore our preferred method. Nonetheless, in practice there are only small differences in predicted shares in the time horizon under consideration.