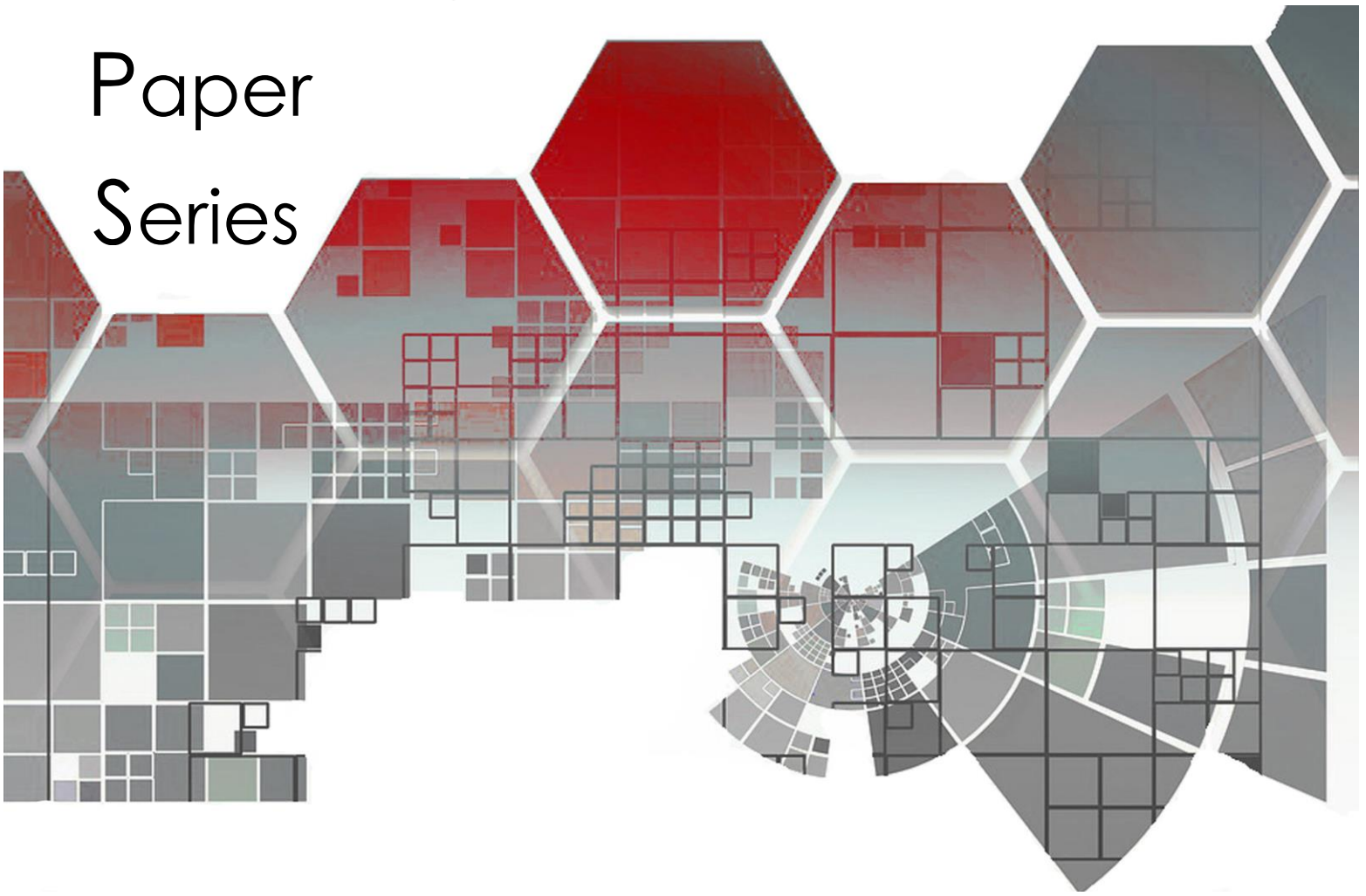
Ministerstwo Finansów

No 43-2024

MF Working Paper Series



Justyna Klejdysz, Tomasz Zawisza

Taxation and Business Entry: Evidence from the Polish Self-Employment “Flat” Tax

Taxation and Business Entry: Evidence from the Polish Self-Employment "Flat" Tax

Justyna Klejdysz, Tom Zawisza*

December 3, 2024

Abstract

How does the tax treatment of entrepreneurial activity affect the decision to start a business? We study this question in the context of a major tax reform in Poland that introduced a flat tax for business owners, leaving the taxation of employees unchanged. Using a difference-in-differences framework and data on the universe of Polish taxpayers, we find that a 1 percentage point increase in the tax differential at the top of the income distribution leads to a 1.4% increase in the share of self-employed five years after the reform. The increase is primarily driven by transitions from employment to self-employment, in particular solo self-employment (self-employment without dependent workers). Moreover, the transitions occur in industries with a high human-capital component. Altogether, we find that high-income taxpayers respond strongly to the increased attractiveness of self-employment by starting a business, that such behavior shows considerable persistence, that it accumulates over time, and much of it is likely to reflect income reclassification rather than genuine entrepreneurial activity.

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

Acknowledgements: We thank Andreas Peichl, Paweł Bukowski, Paweł Chrostek, Paweł Doligalski, Emanuel Hansen, Jonas Löbbing, Michał Myck, and Marek Skawiński for helpful comments. We also appreciate the feedback and discussions from the participants at the 79th and 80th Annual Congress of the IIPF, the ZEW Public Finance Conference, the PhD Public Economics Workshop at the University of Munich, as well as the seminar participants at the ifo Institute, the Institute for Fiscal Studies, the UCL School of Slavonic and East European Studies (SSEES), and the Ministry of Finance of the Republic of Poland. The views expressed are those of the authors and do not necessarily reflect those of the Ministry of Finance of the Republic of Poland. Any remaining errors are solely the responsibility of the authors.

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

1 Introduction

The entrepreneurial activity of business owners is essential for economic growth and employment creation. Policymakers often prioritize supporting small business owners as a key means of fostering entrepreneurship. In many countries, business income is subject to lower tax rates than income from employment (Milanez and Bratta, 2019), justified by positive spillovers from entrepreneurship, as well as the greater difficulty of taxing small business income compared to employment income.[1]

However, regardless of their economic justification, differences in the tax treatment of employment and business income 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). Self-employment is a form of business ownership that may be especially susceptible to tax arbitrage, as it is comparatively easier to establish than other business forms. Measuring the extent of switching behavior between employment and business ownership, and self-employment in particular, is crucial for several tax policy questions, such as understanding the distortions created by preferential tax treatment for small businesses and determining the optimal tax rate differential between employment and self-employment. Moreover, distinguishing whether switching behavior reflects genuine entrepreneurial activity or income reclassification is important for assessing whether favorable tax policies effectively promote entrepreneurship. Despite the potential importance of these questions, the empirical evidence is still limited.

Our 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 initiating genuinely entrepreneurial activity or the reclassification of existing activity.[2] Leveraging a large reform in Poland in 2004, we examine the 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 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

[1] Empirical evidence suggests that the elasticities of taxable income are greater for the self-employed than for 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).

[2] We define income self-employment as unincorporated owner-managed businesses, such as sole proprietorships and partnerships. In most countries, income from such businesses 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 the double taxation of corporate income.

could only file under the progressive schedule, the reform created a large difference in the average tax burden between employees and the self-employed.[3] A 2009 tax reform flattened the progressive schedule by reducing the top marginal tax rates, thus reducing the tax differential and providing a unique setting to analyze whether taxpayers switched back to employment after a partial reversal of the original reform.

For our empirical strategy, we adopt a difference-in-differences approach. We exploit the panel structure of our data, which consists of the entire population of taxpayers for the period 2000-2014. We analyze separately patterns of transitions into self-employment of those employed at the beginning of our period, as well transitions into employment of those self-employed at the beginning of our period. From these, we infer the change in the share of self-employed in response to the reforms. To identify reform effects on tansitions, 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. Crucially, in addition to the immediate impact of the reforms, our approach enables us to estimate the long-term impacts of the 2004 reform and convert our estimates to elasticities.

We find a significant increase in the share of the self-employed in the top two percentiles of the income distribution as a result of the 2004 reform. Five years after the reform, the share of the self-employed increased by 1.8 percentage points (3.6%). Converting our estimates into a semi-elasticity, we obtain 1.4, implying that a 1 pp. increase in the tax differential at the top of the income distribution increases the share of self-employed by 1.4% after 5 years. The majority of the increase in the share of the self-employed is driven by a higher rate of transitions from employment to self-employment. These transitions account for 55% of the total increase of 1.8 percentage points, whereas reduced transitions out of self-employment into employment account for 45% of the response. The 2004 reform created a persistent increase in the rate of transitions from employment to self-employment, which accumulated over time. Thus, our semi-elasticity of 1.4 after five years is more than twice as large as the semi-elasticity in the first year following the reform, which we estimate at 0.58. Additionally, we observe a temporary decrease in entries into self-employment among high-income employees following the 2009 reform, with no corresponding increase in entries from self-employment to employment. This pattern suggests a degree of persistence in business entry – having transitioned into self-employment, individuals become less responsive to changes in incentives favoring employment.

[3] Kopczuk (2023) analyzes the intensive-margin responses to this reform and documents a large increase in reported self-employment income among business owners who already owned businesses prior to the reform. This paper focuses instead on the change in the flows between employment and self-employment (the extensive margin). The final part of our analysis estimates the deadweight loss associated with the 2004 reform, comparing the extensive and intensive margin responses and extending Kopczuk's estimates by adding the extensive margin.

To investigate whether responses to the reform were driven by tax avoidance (i.e. income reclassification) or real business activity, we analyze the nature of self-employment several years after entry of those responding to the reform, focusing on hiring behavior and sector of business activity. We estimate that 60% of the taxpayers who shifted to self-employment due to the 2004 reform were solo self-employed 7 years after the transition. The solo self-employed are defined as those self-employed who are not hiring workers and are not partners in partnerships. Remaining solo self-employed for several years suggests a job with a smaller entrepreneurial component and a higher likelihood of a continuing dependent employment relationship.[4] Only around 20% of the additional self-employed were employers or joint owners, while the remaining 20% left self-employment altogether. The share of the solo-self-employed among new entries to self-employment induced by the 2004 reform is higher than the proportion of the solo-self-employed among entries prior to the reform, confirming that the reform encouraged solo-self-employment. Next, we show that the majority of new entries into self-employment occurred in high-skilled service industries with a high human-capital element: finance, real estate, information, and professional services. This also points to income reclassification of previous economic activity instead of real entrepreneurial activity as the main channel behind the observed increase in self-employment (Smith et al., 2019).

Our paper contributes to three key strands of literature. First, we contribute to the literature on tax policy and its influence on business entry by analyzing an economy-wide and salient reform that resulted in a large change in tax incentives to switch from employment to self-employment. We demonstrate that these tax differentials have sizeable and persistent effects on the decision to switch to self-employment. However, a substantial share of these decisions do not result in businesses hiring workers and are concentrated in human capital intensive sectors. Cullen and Gordon (2007) show theoretically that taxes change the trade-off between business and wage income and can affect entrepreneurial activity. Some studies exploited natural experiments to study how taxation affects the self-employment rates or new business entry (Fossen and Steiner, 2009; Aghion et al., 2017; Zawisza, 2017; Bosch and de Boer, 2019; DeBacker et al., 2019; Tazhitdinova, 2020).[5] These, however, have tended to focus on smaller, more limited, or short-lived

[4]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).

[5]Additionally, some studies that do not exploit natural experiments have examined the relationship between taxation and self-employment and provide mixed evidence. For example, Bruce (2000); Parker (2003) find no association between net earnings differentials and self-employment, and Wen and Gordon (2014) find a positive association with self-employment. Bruce (2000) finds a positive association between the difference in the average tax differential (between self-employment and employment) and self-employment

reforms, often finding smaller or no effects of preferential tax regimes on the probability of switching from paid employment or starting a new business. While Tazhitdinova (2020) finds increased business entries in the UK following changes in tax incentives to incorporate, data limitations prevent an analysis of whether these entrants were previously employees.[6] Prior research has rarely analyzed the nature of self-employment after the transition from employment. An exception is DeBacker et al. (2019), who find that the pass-through income tax exclusion in Kansas led to a quantitatively small increase in tax avoidance through income recharacterization. However, they do not examine the magnitude of the overall increase in new business entry relative to the size of the tax incentive to switch. Furthermore, the reform in Kansas was reversed quickly such that authors can only study its short-term impacts.

Second, we contribute to the literature on income shifting across tax bases. Prior research has largely focused on how tax incentives shape the choice of organizational form among business owners, particularly in relation to incorporation decisions (Goolsbee, 2004; Romanov, 2006; De Mooij and Nicodème, 2008; Tazhitdinova, 2020; Smith and Miller, 2023). The impact of differential taxation between employment and business activity is less well understood. Some papers have studied the allocation of income across tax bases, focusing on how high-income individuals or owner-managers of businesses shift income between their wage income and capital income in response to reforms (Gordon and Slemrod, 2000; Pirttilä and Selin, 2011; Kleven and Waseem, 2013; Kleven and Schultz, 2014; Devereux et al., 2014; Harju and Matikka, 2016; Alstadsæter and Jacob, 2016). However, the primary focus of these studies has been on intensive-margin shifting responses, conditional on reporting nonzero income in both tax bases.

Thirdly, this paper contributes to the literature on the growing importance of business income at the top of the income distribution by shedding light on the extent to which this may be driven by tax considerations. 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 tax schedule and may exacerbate inequality (Rubolino and Waldenström, 2020; Förster et al., 2014). Furthermore, there is an 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 and has suggested the business share may be partly driven by reclassification (Smith et al., 2019, 2022; Delestre et al., 2024). There has also been debate about the nature and extent of business income in driving income

[6] 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 contractor" work more attractive than regular wage employment. To what extent this form of income shifting happens in practice remains an open empirical question."

inequality in Poland (Bukowski and Novokmet, 2021; Brzeziński et al., 2022; Bukowski et al., 2023).

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 activity in Poland are sole proprietorships, companies (limited liability companies and joint stock companies), and partnerships (which can be civil law, unlimited, professional, limited, and limited joint stock partnerships).[7] Sole proprietorships and partnerships are pass-through forms that are not taxed at the entity level. Instead, the profit of an entity is distributed to its owners. Partners in partnerships can be individuals or legal persons.[8] Individuals conducting non-agricultural business activity are subject to personal income taxation under a progressive tax schedule but with the option to choose a flat tax since 2004.[9] Companies are subject to corporate income taxation. The corporate income tax (CIT) rate was 28% in 2002, 27% in 2003, and was reduced to 19% in 2004, where it remained subsequently.[10]

Definition of self-employment. We use the same definition of self-employment as that found in the Polish tax system, which defines a self-employed person as an individual

[7]In Polish: 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).

[8]Professional partnerships may only have natural persons as partners. Natural persons generally have unlimited liability, except in limited partnerships, where liability may be restricted.

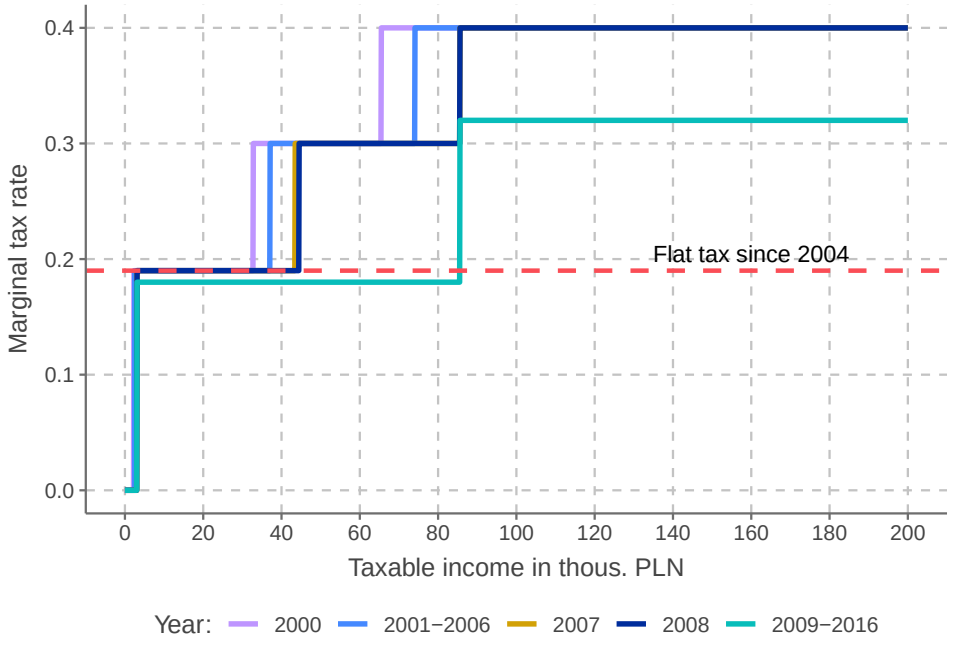
[9]Two additional methods of taxing businesses are "tax card" (*karta podatkowa*) and lump-sum tax on registered revenues (*ryczałt od przychodów ewidencjonowanych*). The tax card is a fixed amount set by local authorities, while the lump-sum tax is a proportional rate on revenue from specific business activities, with rates varying by business type. Neither method permits business expense deductions. These simplified schedules are intended for small businesses in traditional services or manufacturing and are excluded from this analysis.

[10]The CIT rate was equalized with the personal flat tax rate in 2004. However, this did not equalize the tax treatment between the flat tax and CIT, since for incorporated businesses, business income is subject to double taxation.

conducting non-agricultural business activity. This includes sole proprietors and partners in partnerships (if the partners are individuals, and not legal persons). Such firms are effectively pass-through entities, whereby income passes through to the business owner and is subject to personal income taxation.

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 covered by our sample, 2000–2016. It shows a progressive income tax schedule 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 2001 and 2006, while the tax-free amounts were 518 PLN in 2002 and 530 PLN in 2003–2006 (1 PLN $\approx$ 0.25 USD as of 2003). Between 2009 and 2018 there were two tax brackets with marginal tax rates at 18% and 32%. The progressive tax schedule allowed for joint taxation with a spouse.

Figure 1: Personal income tax schedule, 2000–2016



Social security contributions (SSCs) include payments for health, pension, disability, sickness and work accident insurance. The calculation bases for SSCs vary between employees and the self-employed. For employees, the contribution base is the gross salary. The total SSCs on earnings under an employment contract are shared between the employer and the 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 SSCs of the self-employed are lump-sum payments.[11]

Flat tax regime. Starting January 1, 2004, taxpayers engaged in non-agricultural business activities and subject to personal income taxation, i.e. the self-employed, 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.[12] However, 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 simultaneously proposals to encourage entrepreneurship by reducing taxes for the self-employed. On 9 June 2003, following the referendum on EU accession, the then 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.[13] The decision to adopt a flat tax appears to have been influenced by political and economic factors. Proponents argued

[11]The base rate for self-employed individuals is 60% of the projected 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 total 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%.

[12]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 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.

[13]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.

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 the upper limit of this bracket, and abolishing the middle bracket. The top marginal tax rate was reduced from 40% to 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. There were other more minor changes in the tax system that increased the attractiveness of the progressive schedule or employment around this time, namely 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 that 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 extensive-margin decision on whether to report income as employment income or self-employment income, as well as an intensive-margin decision on how much income to declare in a given tax base.

3.1 Model

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

$$\begin{aligned} u(c,l,b;\theta,\theta_S) &= c - \mathbf{1}\{b=0, l>0\} \times \psi^E(l/\theta) \\ &\quad -\mathbf{1}\{b>0, l=0\} \times \left(\psi^S(b/(\theta^S)) + \Phi(b;\phi)\right) \end{aligned} \tag{1}$$

where c is consumption, b is the amount of self-employment income declared, l is the amount of labor income declared, and $\mathbf{1}\{b=0, l>0\}$, as well as $\mathbf{1}\{b>0, l=0\}$, are dummy variables equal to 1 if, respectively, any positive employment or self-employment income is declared. We 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 assume that costs of being in self-employment $\Phi(b;\phi)$ are proportional to the level of self-employment income:

$$\Phi(b;\phi) = \phi \times b, \tag{2}$$

The cost parameter ϕ is taken from a distribution that may depend on the employment productivity parameter θ. The cumulative density function of the fixed costs is denoted $G_\theta(.)$, with marginal density $g_\theta(.)$. 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, e.g. if a tax reform reduces the marginal rate on business income above a threshold of $\bar{b}$. 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 the 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:

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

and

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

[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.

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:

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

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 productivity paramter 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 of individuals reporting self-employment income as a result of a 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, five years after the 2004 reform, and 9 years after the 2009 reform. We restrict attention to 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, business revenue, and costs, as well as 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 definition

Main sample. Our main sample includes taxpayers whose combined employment and self-employment income constitute the majority of their gross income in a given year. Individuals declaring only employment income but with unusually high costs or abnormally low SSCs and health contributions relative to gross income are excluded.[15] In this sample, *employees* are taxpayers who do not report any self-employment income, while the *self-employed* report positive self-employment revenue.[16] The *estimation sample*, detailed in section 6, is a balanced panel of taxpayers who are in the main sample of employees or the self-employed in each year from 2000 to 2014.

Key variable definitions

Income concepts. Employment income includes gross income from employment contracts and commissions.[17] 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,

[15] This exclusion mainly captures erroneous entries, as well taxpayers whose income is largely exempt from SSCs and health contributions, such as uniformed services or employees with a high share of sickness benefits.

[16] 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.

[17] For more flexible arrangements, some opt for a commission in addition to or instead of an employment contract. Commissions are typically issued for specific tasks or projects and function independently of 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 commission (*Umowa zlecenie*) corresponds to *Działalność wykonywana osobiście, o której mowa w art. 13 ustawy.*

pensions, civil law agreements, taxable benefits). It is income before deducting SSCs 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 gross income net of SSCs and other deductions. Unless stated otherwise, taxable income refers to individual taxable income before adjustments for joint filing (dividing the combined income of spouses).

Tax incentive variables. The *tax differential*, our main measure of incentives to adopt self-employment, is the difference in the average tax rate between employment and self-employment. In the paper, we usually evaluate the tax differential among taxpayers within the same income percentile. A positive differential implies higher taxes under employment. The *average tax rate (ATR)* is the sum of individual tax liability, social security contributions paid by an employee or a self-employed (deductible part), and health insurance contributions divided by gross income. The average tax rate does not include contributions paid by an employer.[18].

Income rank, the variable we use to assign individuals to our treatment and control groups in our baseline specification, is a taxpayer's rank in taxable income within the main sample of employees and the 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, our main outcome variable 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 person 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 $t+d$. We mostly focus on transitions within a 1-year horizon, but we focus on longer horizons in the robustness checks.

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

[18]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.

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 using the main 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 SSCs. The reform reduced the tax burden in the self-employment tax base by lowering the PIT rate for self-employment income. The flat rate schedule had a 19% marginal tax rate, which was lower compared to the top two brackets in the progressive schedule: 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). As expected, we observe a significant increase in the average tax rate differential for the top two percentiles after 2004. 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, and confirms that the sharpest changes occurred in 2004 and 2009.

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.[21] We provide additional evidence on re-ranking effects showing that the rise in upward mobility

[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.

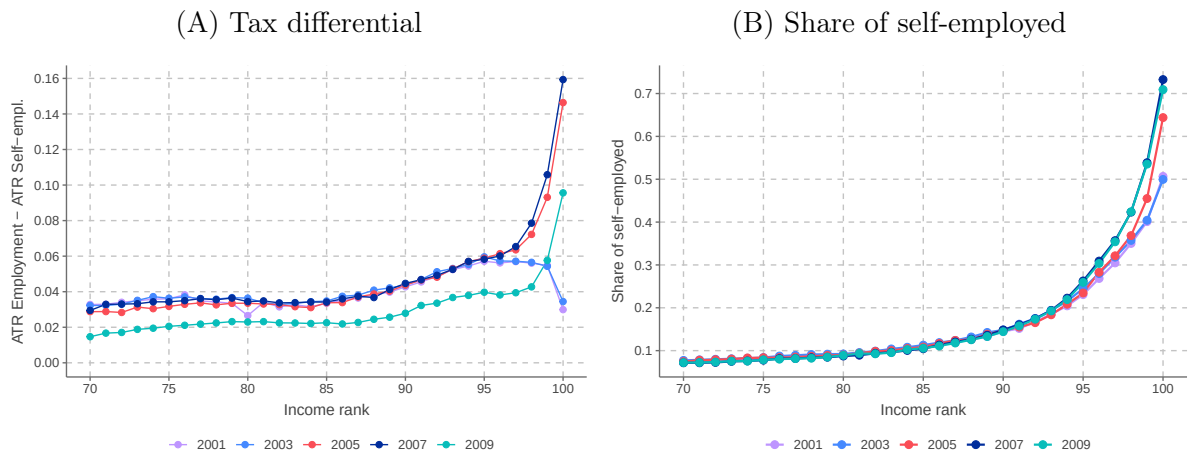
[20] The tax differential in the top 1% is also influenced by the fact that the self-employed declared substantially higher average income than employees in the top 1%, especially post-reform (this is not the case for lower percentile groups where income is capped). The average taxable income in the 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.

[21] Bukowski 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 income for the top 1%.

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. It can be seen that the rise in transitions in 2004 is persistent, i.e. it is not a short-term, one-time reaction to the change in tax differentials. However, using income rank one year before transition is not our preferred approach to classifying individuals' exposure to the reform, as rank is in itself influenced individuals' intensive-margin responses to reforms. For instance, individuals only appear as transitioning in Figure 4 if a taxpayer was in one of the top percentiles after transition into self-employment. This is less likely post-reform due to the re-ranking effects among the self-employed. As is explained in more detail in the next section, to ensure our classification is not affected by re-ranking, in our main empirical strategy we rank taxpayers according to taxable income well before the reform in 2000, with the rank fixed in the following years.[22]

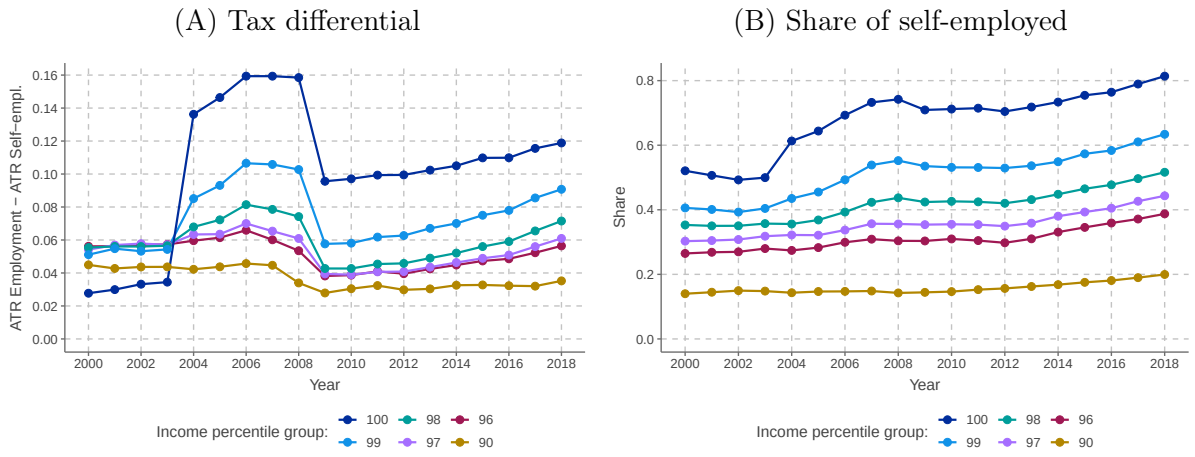
Figure 2: Tax differential and share of self-employed by income rank



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 a 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 main sample of employees and the self-employed each year, with income rankings determined within this sample annually.

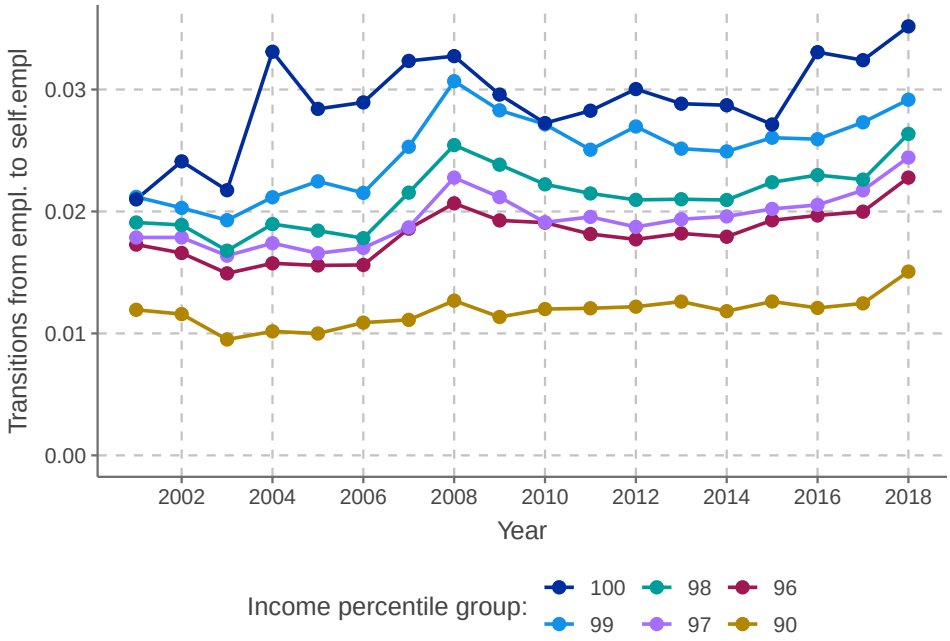
[22]Nonetheless, for completeness we present results which assign individuals to treatment and control groups using income rank one year before transitions in Appendix D.1. We refer to this approach as the 'repeated cross-sections' approach.

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



Note: Panel A shows the difference in the 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 in different percentiles of the income distribution in each year. This analysis is based on the main sample of employees and the self-employed 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 main sample of employees and the self-employed each year, with income rankings determined within this sample annually.

6 Empirical strategy

Informed by our model in Section 3, 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.[23]

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 $t+s$:

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

Above, $Pr(trans_{it+s}^{E \to S})$ denotes the net transitions from employment to self-employment, $Pr(trans_{it+s}^{S \to E})$ denotes the net transitions from self-employment to employment, E_t denotes employment at time t and S_t denotes self-employment at time t.[24] 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 around the 2004 introduction of the flat tax and the 2009 reform. In Appendix C.2 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.

[23] 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.

[24] *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 $t+s$.

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 between employment and self-employment, 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.[25] We exclude observations with income rank larger than 99.95 in 2000 to ensure that the results are not driven by extreme cases.[26]

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.[27] 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 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 in the top four deciles of the income distribution. 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. The self-employed without any employment income constitute 29% and

[25]The share of self-employed increases with income rank resulting in important compositional differences across percentiles. Consequently, changes in the baseline share of self-employed affect the transition patterns. Furthermore, the two groups of the 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.

[26]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.

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

their share increases with income rank. Prior to the reform, taxpayers in the control group were mostly subject 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 with a spouse. In the treatment group, the share of taxpayers facing the middle and the top marginal tax rate was 40% and 60%, respectively.[28] Taxpayers move across the percentiles of the income distribution over time, but they are assigned to the treatment and control percentiles only once. In the sample of employees, almost 80% of the taxpayers in the top two percentiles in 2000 stayed in the top two percentiles by 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 at around 27%.

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.

[28]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.

6.2 Estimating reform impacts

Our identification strategy relies on comparing differences over time in the outcome variable for the treatment and control groups. 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 become 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 reforms on transitions between employment and self-employment using the 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 long-run change in the share of self-employed between 2003 and 2008 we sum the of coefficients β_s for s between 2004 and 2008.[29]

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. To investigate the relative contribution of these components 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.

[29] 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 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.

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

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

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 a dummy variable that takes the following form in the different specifications: a dummy for being male, for age being equal to or less than 40, for being a single filer, and a series of dummies for different percentiles of the income distribution.

Solo self-employment and sector of business activity. We use transitions into solo self-employment and into sectors with a high human-capital component as proxies for income-reclassification responses. Focusing on the sub-panel 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 $t+7$. An individual can be solo self-employed, can employ other workers, or be a joint owner of an enterprise (a partner). We will focus on the distinction between the self-employed, who are sole owners and do not hire employees, and the self-employed with employees or co-owners. We refer to the first group as the 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.[30]

[30] 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.

To identify the effect of the reform on solo self-employment seven years after transition we use the specifications (13) and (14), but with outcome variables capturing hiring behavior. Our primary outcome variable is whether an employee entered self-employment in year t ($\mathbb{1}[\Delta y_{it} = 1]$) and was solo self-employed in year t+7. A complementary 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.[31] 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 (and similarly for the 2009 reform). 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.[32] As will be seen in Section 7, 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 EU enlargement had a different impact on the top two percentiles of the income distribution compared to the next two percentiles. Several factors mitigate this concern. First, the EU integration process had been underway for several years before formal accession, suggesting that any effects on self-employment or reported business income would have been gradual rather than abrupt. Additionally, the top 1% income share increased only in Poland in 2004, unlike in other Central-Eastern European countries that joined the EU that year (see Figure B.7 in Appendix B), making the flat tax reform a more plausible explanation. Lastly, our robustness checks use an alternative specification based on cross-sectional variation in joint filing incentives. This strategy does not depend directly on the income rank and is therefore unlikely to be

[31] 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.

[32] We also implement placebo tests in the alternative repeated cross-section specification summarised in Section D.1, by defining a reform date prior to the actual reform year.

correlated with any potential impacts of EU integration concentrated at the top of the income distribution.[33]

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 in the left-hand panels, alongside difference-in-differences estimates based on equation (13) in the right-hand panels.

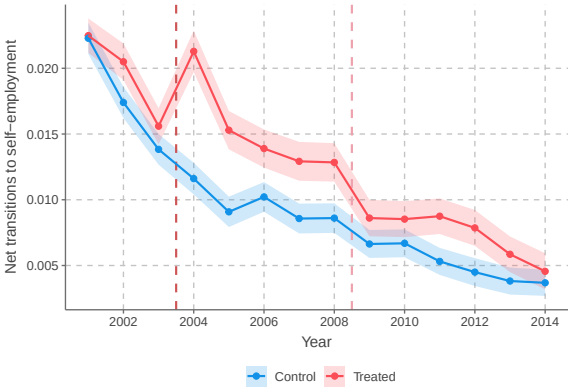
Panels 5A and 5B show net transitions to self-employment starting with the population of employees in 2000. The observed downward trend in net transitions stems from our panel being initially composed only of employees in 2000, leading to zero exits from self-employment in 2001. Over time, exits from self-employment increased, creating a downward trend in net transition rates. Pre-reform trends appear parallel for the three pre-reform years available in the data. 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, the elimination of the 30% middle band and an adjustment of the top tax threshold, all of 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.

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.

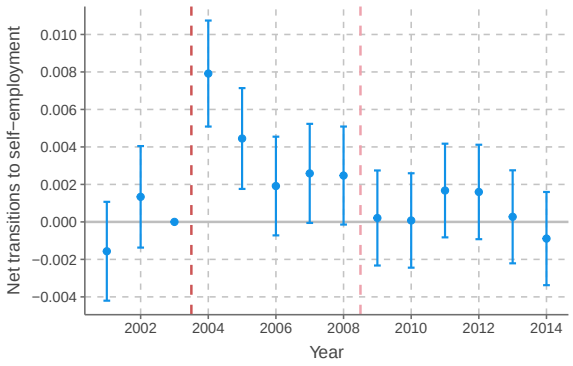
[33]There was also a reduction in the CIT rate in 2004. However, a limited liability structure is subject to dual taxation via both CIT and capital income tax. As discussed by Kopczuk (2023), the reduction in the CIT rate was rather expected to decrease business income subject to personal income taxation,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

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

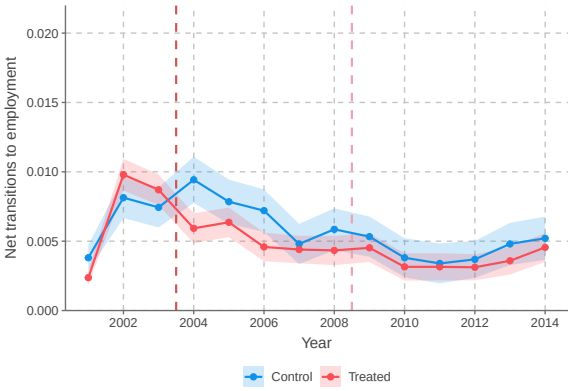
(A) Net transitions to self-employment (previously employees)



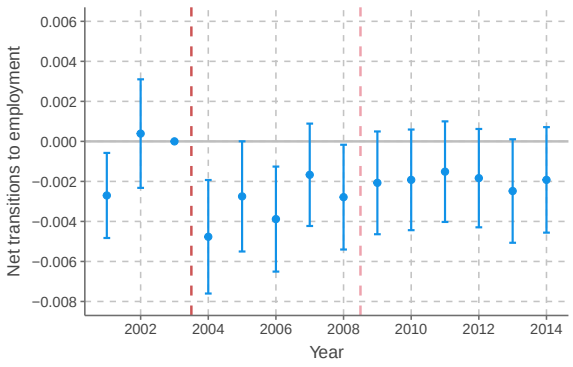
(B) Net transitions to self-employment (previously employees)



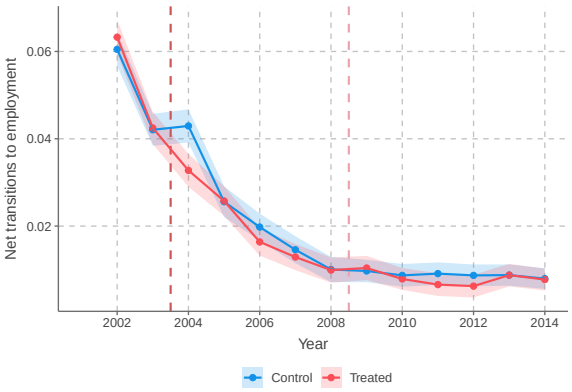
(C) Net transitions to employment (previously self-employed without employment income)



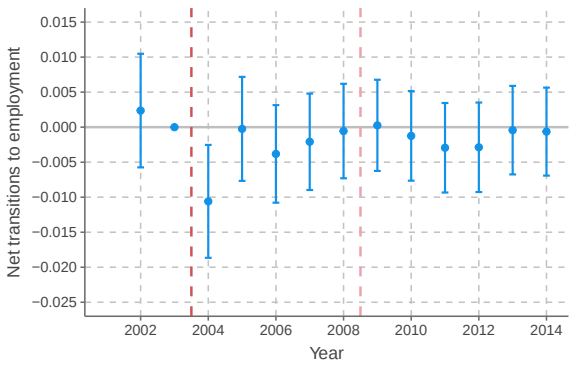
(D) Net transitions to employment (previously self-employed without employment income)



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



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

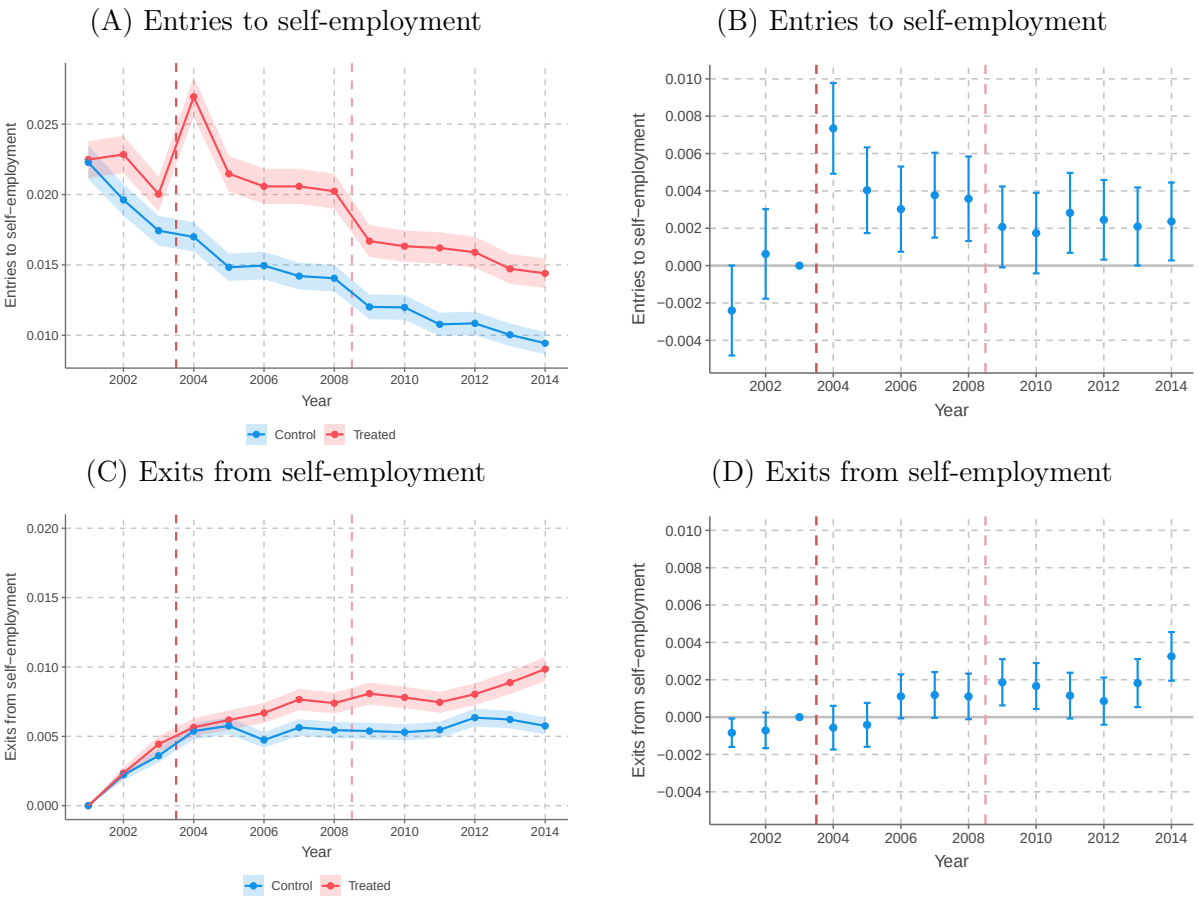


Note: Net transitions to self-employment in year t are defined as the share of self-employed in year t less the share of self-employed in year $t-1$, calculated within the treatment and control group separately. Net transitions to employment in year t are defined as the share of employees in year t less 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 (panels A and B), balanced panel from 2000 to 2014 of the self-employed with no employment income in 2000 (panels C and D) balanced panel from 2000 to 2014 of the self-employed with employment income in 2000 and 2001 (panels E and F).

To explore in more detail the change in net transitions, we decompose the net transitions in Figure 5A into entries from employment to self-employment and returns to employment of those who previously transitioned out of it. Figures 6A and 6B show the entries to self-employment and Figures 6C and 6D show the exits from self-employment to employment.[34] The magnitude of the observed changes in net transitions around both reforms show they were primarily driven by entries into self-employment rather than exits. 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. 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. 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.

[34]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.

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



Note: Entries to self-employment in year t are defined as the share of taxpayers in the population who declared self-employment income in year t and did not declare self-employment income in year $t-1$. Exits from self-employment are defined as 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.

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, specifically by 0.0034 or 87%, in the period 2009–2014. Table C.1 in the Appendix reports separately 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.

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 focusing on gender (column (2)), age (column (3)) and position in the income distribution (column (4) and (5)).

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 tended to experience a larger change in the tax differential in 2004 and 2009. 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.[35] The larger response among single filers is likely because the flat tax schedule, lacking provisions for joint filing, tends to be less advantageous for

[35]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).

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.[36] Table C.1 reports the results of heterogeneity analysis for transitions from self-employment to employment.

Figure 7 shows that a particularly strong response is observed at the very top of the income distribution. 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.[37] 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 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.[38]

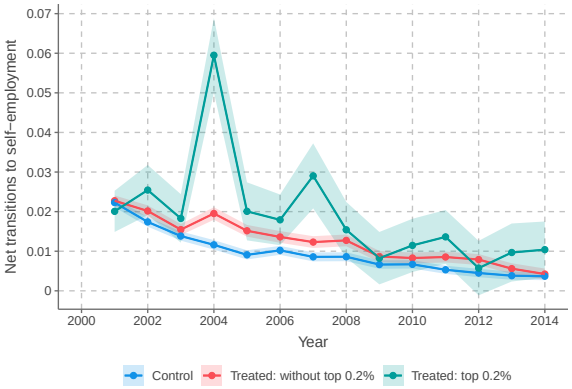
[36]For top 1, the differential increased by 6.2 pp., for the next percentile in the treatment group, by 3.6 pp. between 2003 and 2008.

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

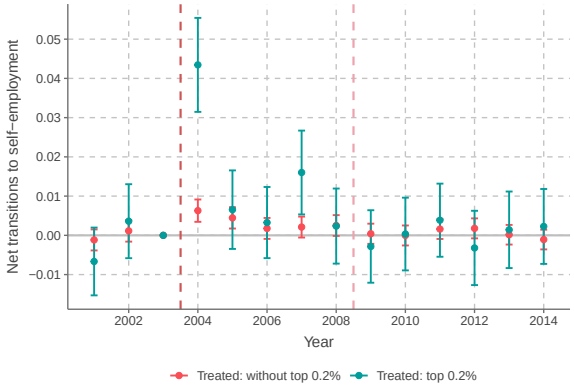
[38]Among the highest income 0.2% of taxpayers who switched to self-employment between 2004 and 2006, 38% remained solo self-employed in 2014, and 39% were employers or joint-owners. The remaining share returned from self-employment to employment.

Figure 7: Heterogeneous effects by income level

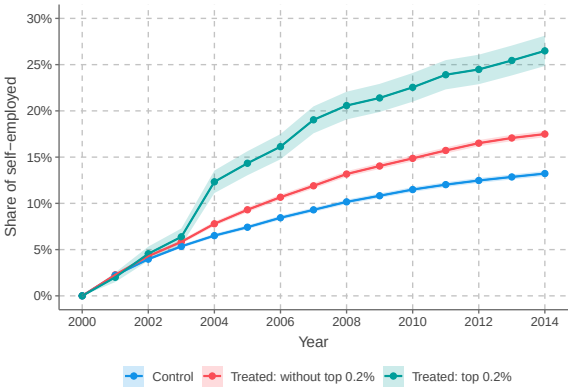
(A) Net transitions from employment to self-employment



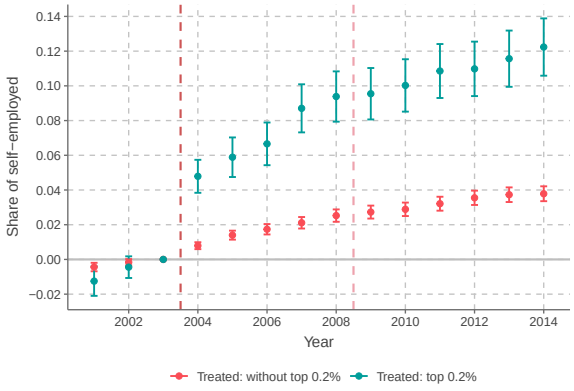
(B) Net transitions from self-employment to employment



(C) Share of self-employed



(D) Share of self-employed



Note: Net transitions from employment to self-employment in year t are defined as 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 estimates from 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 the self-employed. The average tax rates are computed within each subpopulation. For example, in the population of employees we calculate it as the average tax rate of employees less the average tax rate of the 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 is mostly driven by the change in the ATR on income under self-employment before and after the flat tax reform. We transform the estimates into a 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 the cumulative effect on transitions from the observed share of the self-employed in 2008.

Table 3 shows step-by-step the calculation of the elasticity for the subpopulations of employees and the self-employed in 2000, separately. In the population of employees in 2000, the share of the self-employed increased by 1.9 pp. (row 2.) over the 5 years post-reform, or 17% (row 4.) relative to the counterfactual of no reform (row 3.). The increase in the tax differential between 2003 and 2008 in the treatment group was 2.1 pp. (row 7.) higher than the increase in the tax differential in the control group.[39] In sum, a 1 pp. increase in the tax differential increases the share of employees in self-employment by 0.9 pp. over 5 years, for the population of employees. The semi-elasticity implies that a 1 pp. increase in tax differential increases the share of self-employed by 7.9% in the population of employees.

Table 4 uses equation (11) to combine the responses estimated for the populations of employees and self-employed to calculate the responsiveness of the share of taxpayers in self-employment to tax incentives. We estimate the cumulative effect of the reform on the share of self-employed to be 1.8 pp. This effect is derived from the average treatment effect on the treated population, which is 99-100 percentiles of the income distribution in 2000. Dividing by the change in the tax incentive, we find that a 1 pp. increase in tax differential increases the share of self-employed by 0.7 pp. or 1.4% in 5 years, where the latter represents the estimated semi-elasticity parameter. Net transitions from employment to self-employment contributed most to the increase in self-employment: they account

[39] 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.

for 55% of the total 1.8 percentage point increase, while reduced net transitions from self-employment to employment contribute the remaining 45%.[40]

For comparison, using cross-country regressions, De Mooij and Nicodème (2008) estimate a 1.02 pp. and Lejour and Massenz (2021) estimate that a 0.32 pp. change in the share using the corporate form is associated with a 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 the self-employed within a given subpopulation. In the population of employees, the difference in ATR is between employees and the self-employed who were previously employees. In the population of the self-employed, the ATR difference is between employees who were previously self-employed and those who remained self-employed. Standard errors are calculated using the delta method.

[40]These contributions were calculated by multiplying the share of each subpopulation by its effect on self-employment, as shown in Table C.3. Specifically, for employees: $0.0193 \times 0.5135/0.0178$, self-employed without employment income: $0.3335 \times 0.0159/0.0178$, and for the self-employed with mixed income: $0.0173 \times 0.1530/0.0178$.

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 the 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

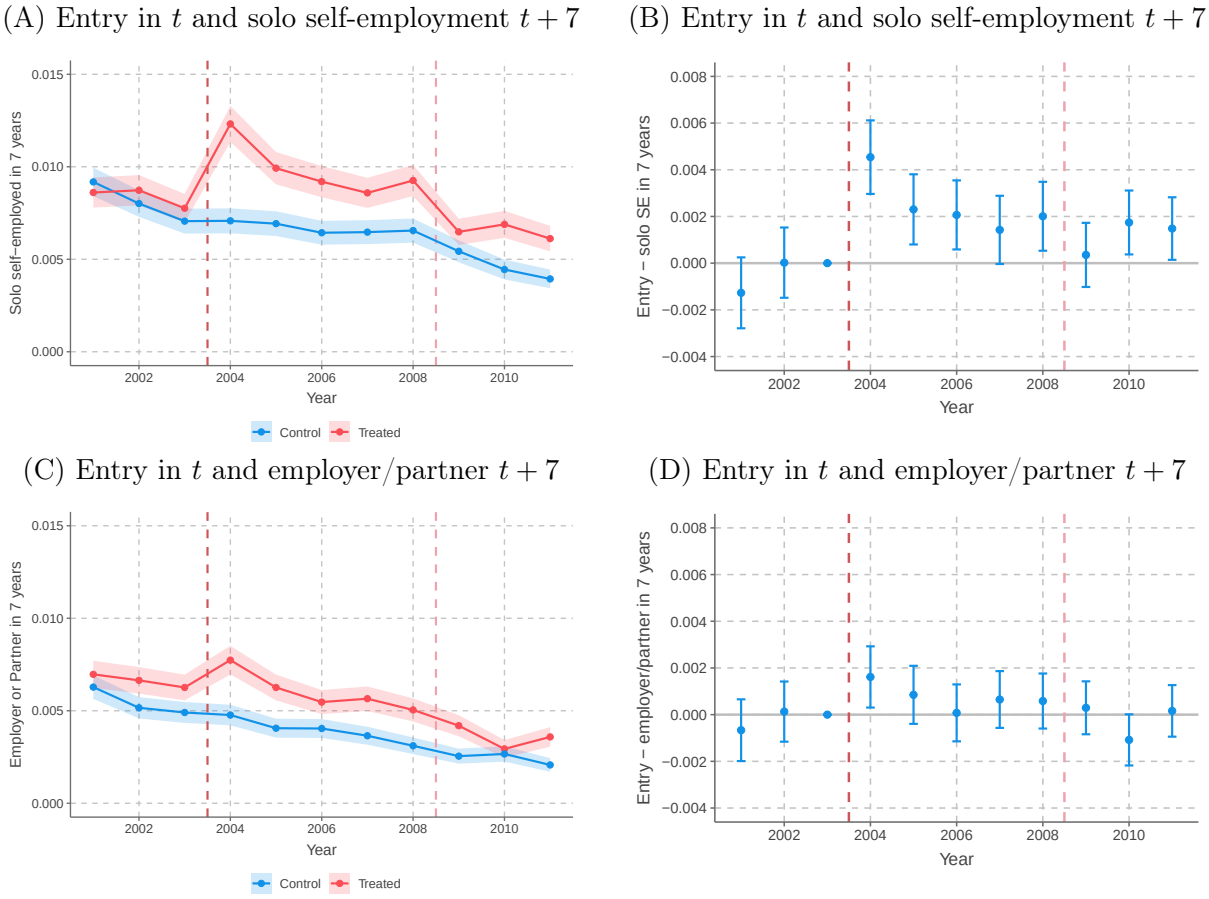
Hiring behavior. To investigate whether those entering self-employment were more likely to become solo self-employed than to hire employees or become partners, we decompose the entries into self-employment observed in Figure 6A by the hiring status seven years from the entry.[41] Specifically, we classify in $t + 7$ an individual entering self-employment in year t as: being solo self-employed, being an employer/partner, or as having exited self-employment and returned to employment.

Figure 8A shows the raw averages of solo self-employment status and employer/partner status seven years after transition to self-employment, while Figure 8B shows difference-in-differences estimates based on equation (13). The estimates are on 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.

The top three coefficient estimates shown in Figure 9 are the average yearly effect of the flat tax reform over 2004-2008 on entries to self-employment, solo self-employment and employer/partnership status 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

[41] 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



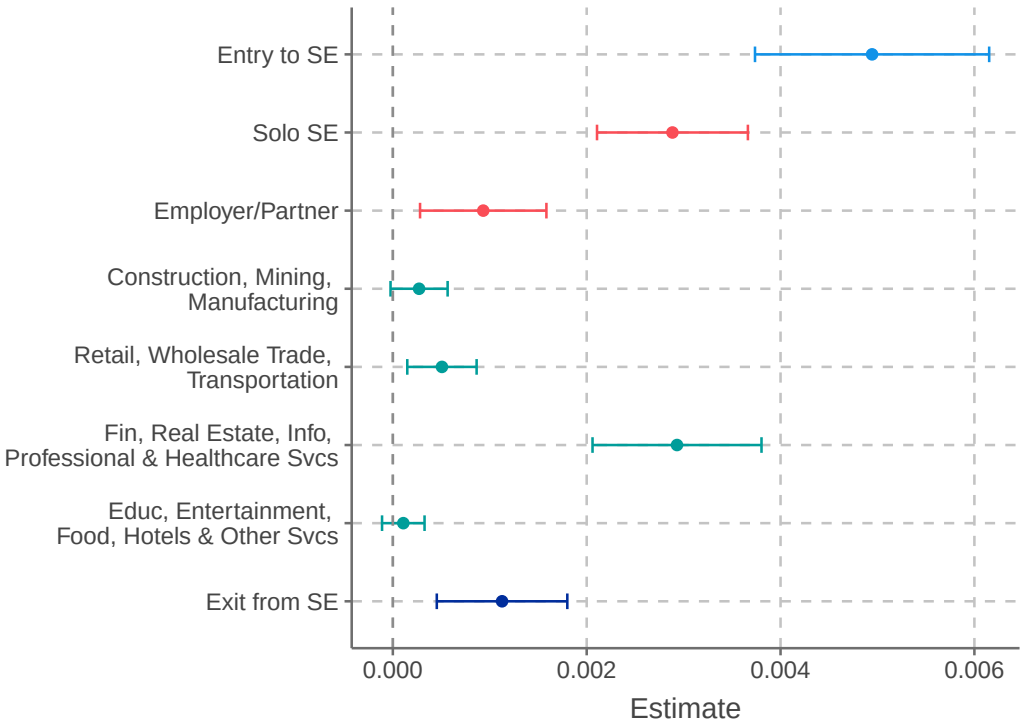
Note: Entries to self-employment in year t and solo self-employment in $t+7$ are defined as the share of taxpayers who declared self-employment income in year t, did not declare self-employment income in year $t-1$ and were solo self-employed in year $t+7$. Entries to self-employment in year t and employer/partner in $t+7$ are defined as 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.

were solo self-employed in the long run.[42] Just under 20% of additional self-employed taxpayers were employers or 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, confirming that the reform increased the overall rate of entries and changed their composition towards more solo self-employment. Among taxpayers who entered self-employment in 2003, 39% were solo self-employed, and 30% were employers or joint owners 7 years after transition.

[42]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 overall 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).

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). Again, 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, consistent with a recharacterization of labor income as capital income by these individuals.

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

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 more closely reflects the difference in tax incentives directly before the reform but defines the treatment and control groups based on a later year than the one used to specify baseline employment and self-employment states. The results of this specification are in column (2) of Table D.1, entitled "Reranking". The estimated impact on net transitions is higher than in the baseline, but the semi-elasticity remains at a similar level.

Defining treatment and control group using cross-sectional variation in tax incentives. Joint filing with spouses 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 determined 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 (3) of Table D.1, entitled "Redefining treatment". The impact on net transitions is very similar in the sample of taxpayers filing jointly to our baseline case, although the semi-elasticity is somewhat smaller.

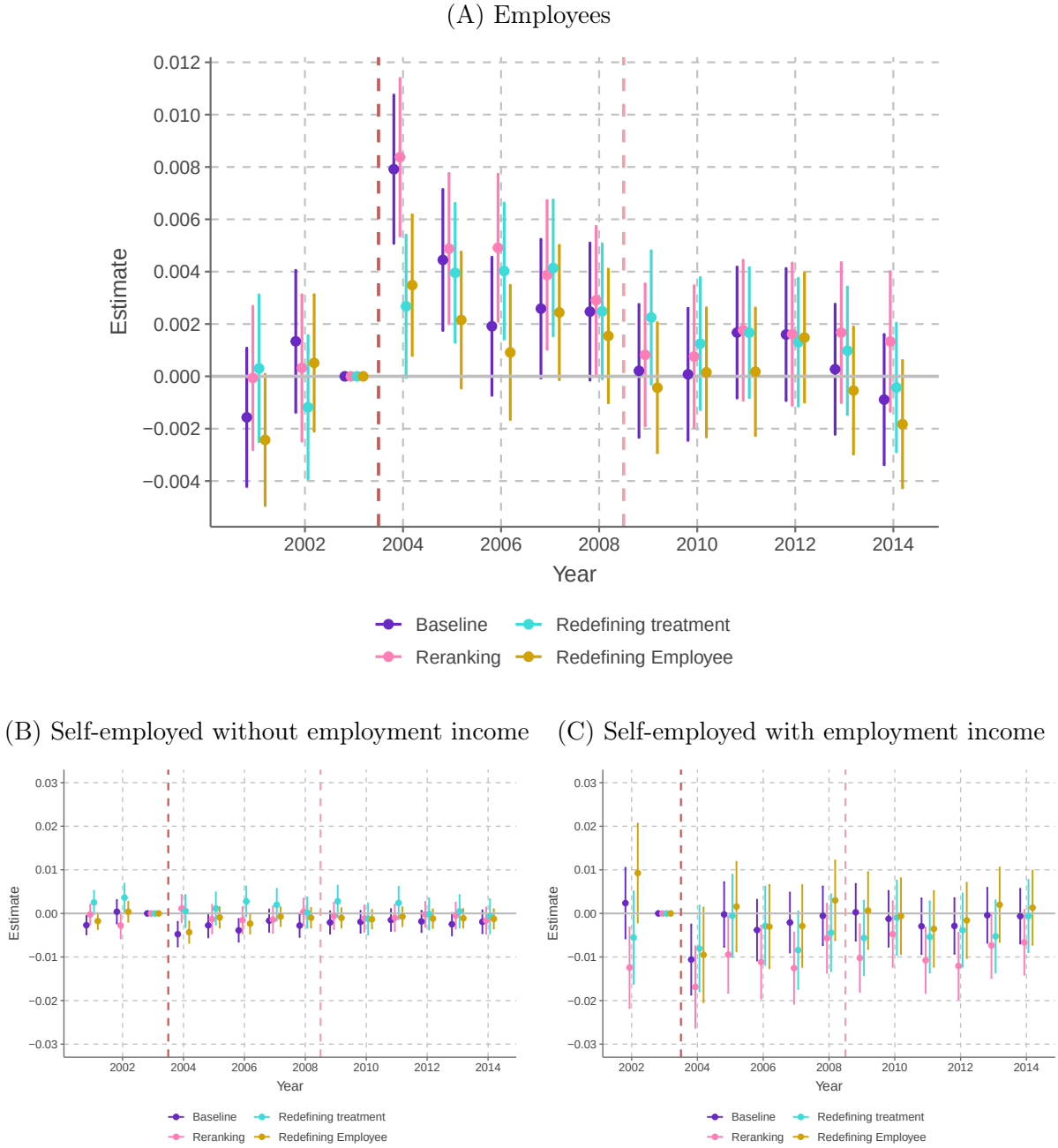
Changing the definition of an employee. The baseline specification defines the employees as taxpayers who earn the majority of their income from employment contracts or commissions that share some features of employment contracts. Here, we examine a sample where employees earn the majority of income from employment contracts only. Employees who mainly earn income from employment contracts may have lower flexibility in changing employment forms than those working for commission under civil law

contracts. The results of this specification are in column (4) 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 somewhat lower than in the baseline specification but remains economically and statistically significant.

Repeated cross-section estimation. As a final robustness check, we estimate the effects on transitions using an adaptation of the repeated cross-section approach outlined in Saez et al. (2012). In this approach, we compare the changes in transition behaviors of pairs of cross-sections of employees: in each case, 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 our baseline analysis of transitions from employment to self-employment. 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 our baseline 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 the baseline and the alternative specifications. Among these, 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. This corresponds to the parameter dB_2 in section A, and is separate 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.[43] 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, his baseline estimate, or 48%. We then use a microsimulation model to calculate the revenue effects, including the intensive margin response.[44] 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 2004 reform, 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

[43]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.

[44]This model calculates the revenue effect for the self-employed who switched to the flat tax and their spouses. It captures 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.

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. 1 PLN $\approx$ 0.25 USD as of 2003.

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. Focusing on switching responses, we find a pronounced response for the top income earners. In addition, to investigate to what extent switches are likely to be driven by income shifting, the analysis distinguishes between transitions into solo self-employment and transitions into self-employment with employees or co-owners, and analyzes transitions by sector. Although the reform increased transitions to businesses hiring workers, a disproportionate share of the response comes from increased flows from employment to long-term solo-self employment and to high-skilled service industries. This is consistent with the majority of transitions being 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 the changes in rates of transition to self-employment in response to 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.[45] In addition to revenue losses, such responses raise equity concerns. They reduce the progressivity of the tax system and undermine horizontal equity, i.e. that taxpayers with similar income and performing similar activities may face different levels of taxation. It raises the question whether, as Boeri et al. (2020) recommend, "policymakers should reduce the incentives to hide what are de facto dependent employment positions under self-employment".

The external validity of our findings is sensitive to the country-specific institutional context, such as the legal definitions of self-employment, historical levels of self-employment, and effectiveness of tax audits. Nonetheless, there are reasons to believe that the magnitude of the elasticities we estimate is attenuated by Poland's regulatory environment. 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 – are likely to have tempered the reform's immediate impact, even

[45]These additional revenue costs lie beyond the scope of our paper and are not accounted for in our analysis.

if companies often sought ways around these restrictions. 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, 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. For such workers, the motivation for selecting self-employment can be very different, and may take the form of being 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, tax arbitrage between employment and self-employment.

References

Aghion, P., U. Akcigit, M. Lequien, and S. Stantcheva (2017). Tax simplicity and heterogeneous learning. National Bureau of Economic Research Working Paper 24086.

Alstadsæter, A. and M. Jacob (2016). Dividend taxes and income shifting. *The Scandinavian Journal of Economics 118*(4), 693–717.

Boeri, T., G. Giupponi, A. B. Krueger, and S. Machin (2020). Solo self-employment and alternative work arrangements: A cross-country perspective on the changing composition of jobs. *Journal of Economic Perspectives 34*(1), 170–95.

Bosch, N. and H.-W. de Boer (2019). Income and occupational choice responses of the self-employed to tax rate changes: Heterogeneity across reforms and income. *Labour Economics 58*, 1–20.

Bruce, D. (2000). Effects of the United States tax system on transitions into self-employment. *Labour economics 7*(5), 545–574.

Brzeziński, M., M. Myck, and M. Najsztub (2022). Sharing the gains of transition: Evaluating changes in income inequality and redistribution in Poland using combined survey and tax return data. *European Journal of Political Economy 73*, 102121.

Bukowski, P., P. Chrostek, F. Novokmet, and M. Skawiński (2023). Income inequality in the 21st century Poland.

Bukowski, P. and F. Novokmet (2021). Between communism and capitalism: long-term inequality in Poland, 1892–2015. *Journal of Economic Growth 26*(2), 187–239.

Cieślik, J. and A. van Stel (2023). Solo self-employment–key policy challenges. *Journal of Economic Surveys*.

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

De Mooij, R. A. and G. Nicodème (2008). Corporate tax policy and incorporation in the EU. *International Tax and Public Finance 15*, 478–498.

DeBacker, J., B. T. Heim, S. P. Ramnath, and J. M. Ross (2019). The impact of state taxes on pass-through businesses: Evidence from the 2012 Kansas income tax reform. *Journal of Public Economics 174*, 53–75.

Delestre, I., W. Kopczuk, H. Miller, and K. Smith (2024). Top income inequality and tax policy. *Oxford Open Economics 3*(Supplement_1), i1086–i1112.

Devereux, M. P., L. Liu, and S. Loretz (2014). The elasticity of corporate taxable income: New evidence from UK tax records. *American Economic Journal: Economic Policy 6*(2), 19–53.

Dillon, E. W. and C. T. Stanton (2017). Self-employment dynamics and the returns to entrepreneurship. National Bureau of Economic Research Working Paper 23168.

Förster, M., A. Llena-Nozal, and V. Nafilyan (2014). Trends in top incomes and their taxation in OECD countries.

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

Goolsbee, A. (2004). The impact of the corporate income tax: evidence from state organizational form data. *Journal of Public Economics 88*(11), 2283–2299.

Gordon, R. and J. Slemrod (2000). Are "real" responses to taxes simply income shifting between corporate and personal tax bases? In J. Slemrod (Ed.), *Does Atlas Shrug? The Economic Consequences of Taxing the Rich*, pp. 240–280. Cambridge: Russell Sage Foundation and Harvard University Press.

Harju, J. and T. Matikka (2016). The elasticity of taxable income and income-shifting: what is "real" and what is not? *International Tax and Public Finance 23*(4), 640–669.

Katz, L. F. and A. B. Krueger (2019). The rise and nature of alternative work arrangements in the United States, 1995–2015. *ILR review 72*(2), 382–416.

Kleven, H. J. and E. A. Schultz (2014). Estimating taxable income responses using Danish tax reforms. *American Economic Journal: Economic Policy 6*(4), 271–301.

Kleven, H. J. and M. Waseem (2013). Using notches to uncover optimization frictions and structural elasticities: Theory and evidence from Pakistan. *The quarterly journal of economics 128*(2), 669–723.

Kopczuk, W. (2023). The Polish business "flat" tax and its effect on reported incomes: a Pareto improving tax reform.

Le Maire, D. and B. Schjerning (2013). Tax bunching, income shifting and self-employment. *Journal of Public Economics 107*, 1–18.

Lejour, A. and G. Massenz (2021). Organizational-form choice and tax incentives: Multi-country evidence. *Finanz-Archiv: Zeitschrift für das Gesamte Finanzwesen 77*(3), 247–286.

Lim, K., A. Miller, M. Risch, and E. Wilking (2019). Independent contractors in the US: New trends from 15 years of administrative tax data.

Manso, G. (2016). Experimentation and the returns to entrepreneurship. *The Review of Financial Studies 29*(9), 2319–2340.

Milanez, A. and B. Bratta (2019). Taxation and the future of work: How tax systems influence choice of employment form. OECD Taxation Working Papers 41, OECD.

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

Pirttilä, J. and H. Selin (2011). Income shifting within a dual income tax system: Evidence from the Finnish tax reform of 1993. *The Scandinavian Journal of Economics 113*(1), 120–144.

Ramsey, F. P. (1927). A contribution to the theory of taxation. *The Economic Journal 37*(145), 47–61.

Romanov, D. (2006). The corporation as a tax shelter: Evidence from recent Israeli tax changes. *Journal of Public Economics 90*(10-11), 1939–1954.

Rubolino, E. and D. Waldenström (2020). Tax progressivity and top incomes evidence from tax reforms. *The Journal of Economic Inequality 18*, 261–289.

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

Saez, E., J. Slemrod, and S. H. Giertz (2012). The elasticity of taxable income with respect to marginal tax rates: A critical review. *Journal of Economic Literature 50*(1), 3–50.

Scheuer, F. (2014). Entrepreneurial taxation with endogenous entry. *American Economic Journal: Economic Policy 6*(2), 126–163.

Smith, K. and H. Miller (2023). It's all about the base: Taxing business owner-managers.

Smith, M., D. Yagan, O. Zidar, and E. Zwick (2019). Capitalists in the Twenty-First Century. *The Quarterly Journal of Economics 134*(4), 1675–1745.

Smith, M., D. Yagan, O. Zidar, and E. Zwick (2022). The rise of pass-throughs and the decline of the labor share. *American Economic Review: Insights 4*(3), 323–40.

Tazhitdinova, A. (2020). Are changes of organizational form costly? Income shifting and business entry responses to taxes. *Journal of Public Economics 186*, 104187.

Wen, J.-F. and D. V. Gordon (2014). An empirical model of tax convexity and self-employment. *Review of Economics and Statistics 96*(3), 471–482.

Wprost (2003). Na zmiany PIT poczekamy...

Zawisza, T. (2017). Intensive and extensive margins of response to taxation: Evidence from the 2009 Polish reform. Working Paper 29, Ministry of Finance in Poland.

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.[46]

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.[47]

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 $\Delta T(b(\theta)) = T^E(l(\theta)) - \tau_S(b(\theta) - \bar{b})$.[48] 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

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

[46] 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.

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

[48] 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 main sample of employees and the self-employed includes taxpayers whose combined employment and self-employment income constitute 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 main sample of employees and the self-employed.

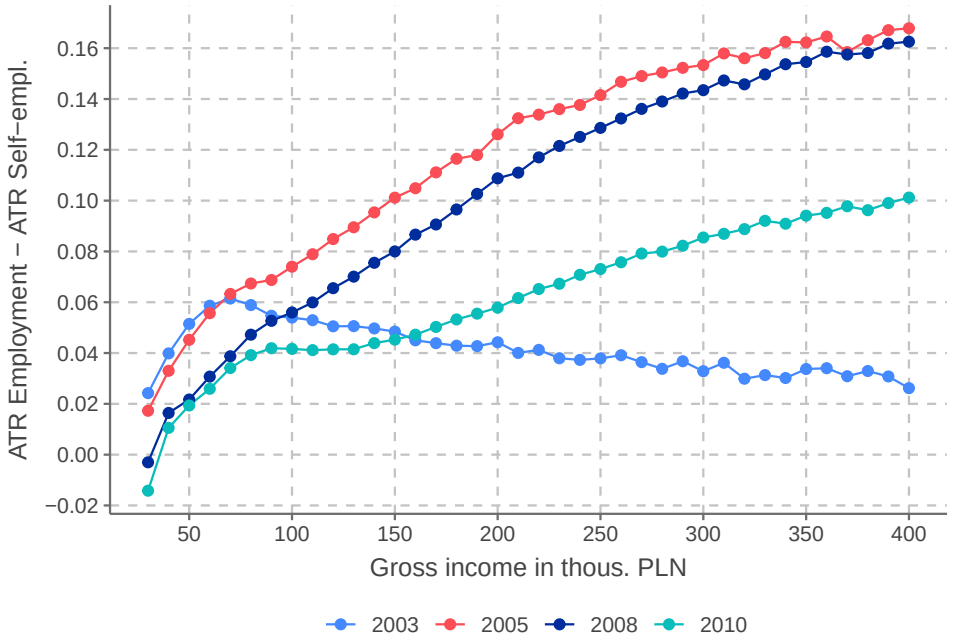
Table B.1: Rank of tax thresholds in the individual taxable income distribution

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 main sample of employees and the 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.

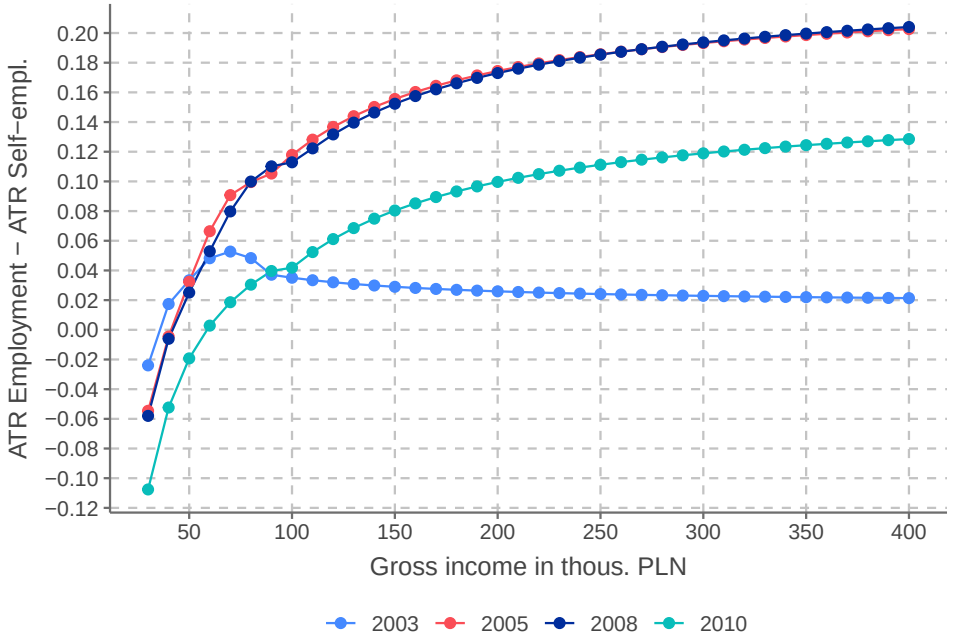
Figure B.1 shows the tax differential (the difference in ATR between employees and self-employed). Figure B.2 shows the tax differential calculated for a theoretical taxpayer with specific characteristics.

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 a self-employed person, relative to gross income. Sample: employees and self-employed.

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



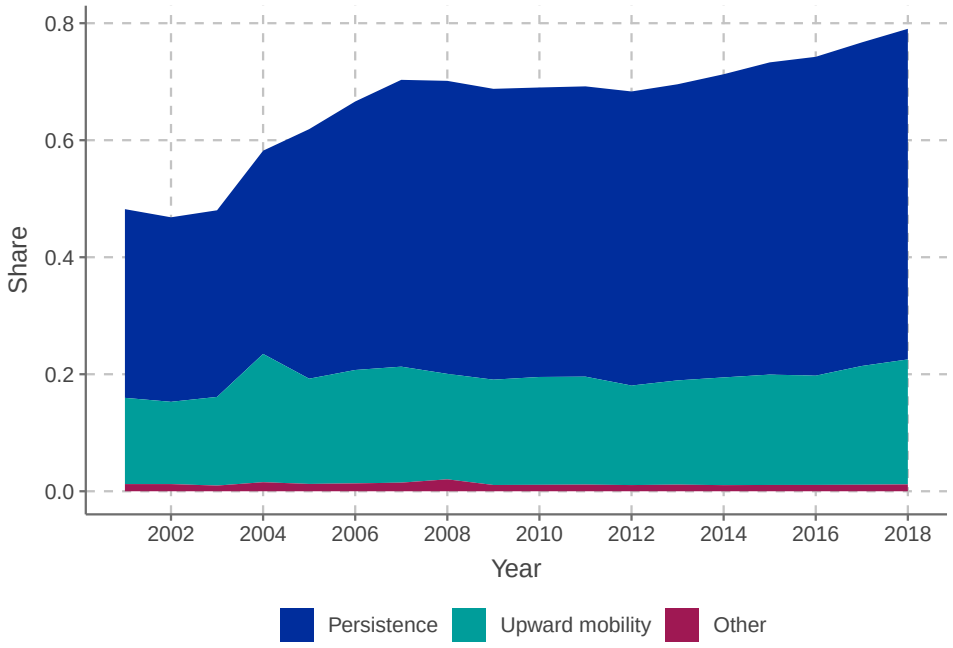
Note: The figure shows the theoretical difference in average tax rate between an employee and self-employed with the same gross income in different years. The calculation is performed under the assumption of earning the same monthly gross income for 12 months, single filing, no extra deductions or tax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

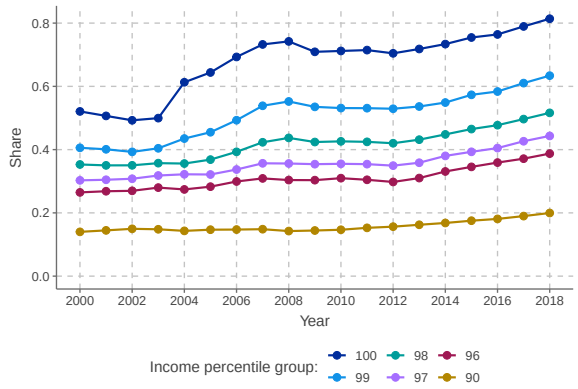
Figure B.3: Decomposition of the share of self-employed in top one percentile of the income distribution 2001–2018.



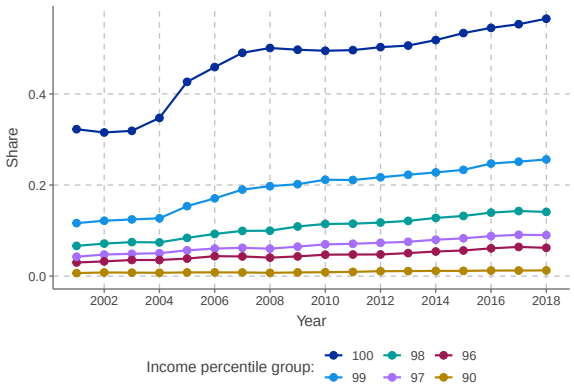
Note: The figure presents the composition of self-employed individuals in the top 1% of income distribution in the main sample of employees and the self-employed in each year (t) from 2001 to 2018, categorized by their position in the income distribution in the preceding year ($t-1$). "Persistence" denotes 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 main sample of employees and the self-employed each year, with income rankings determined within this sample annually.

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

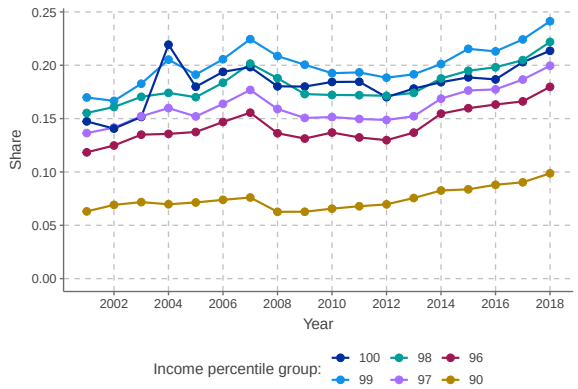
(A) Share SE



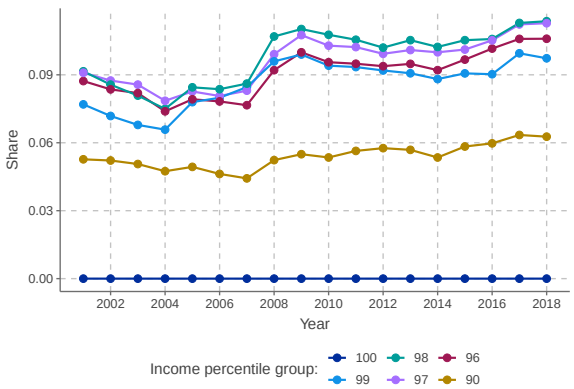
(B) Persistence in SE



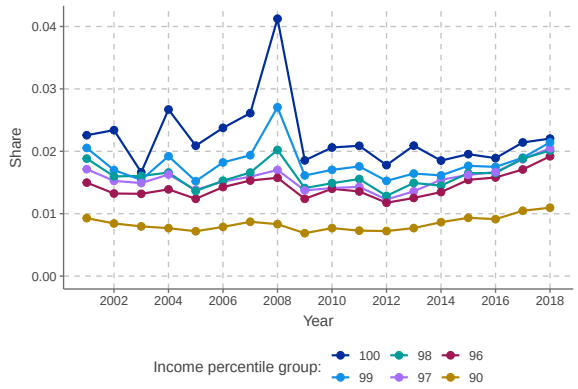
(C) Upward mobility in SE



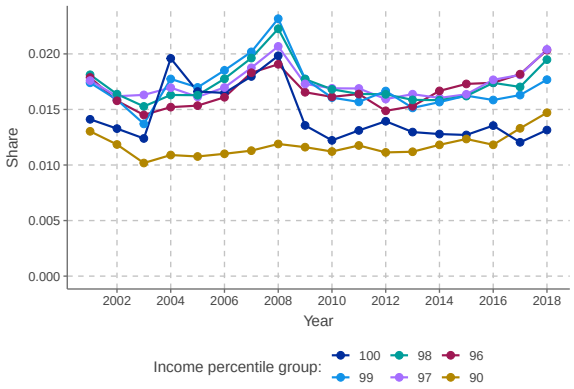
(D) Downward mobility in SE



(E) Entry from outside of employment



(F) Entry from employment



Note: The figure presents the composition of self-employed individuals in the given percentile of income distribution in the main sample of employees and the 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 main sample of employees and the self-employed 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.[49] 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 the 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,

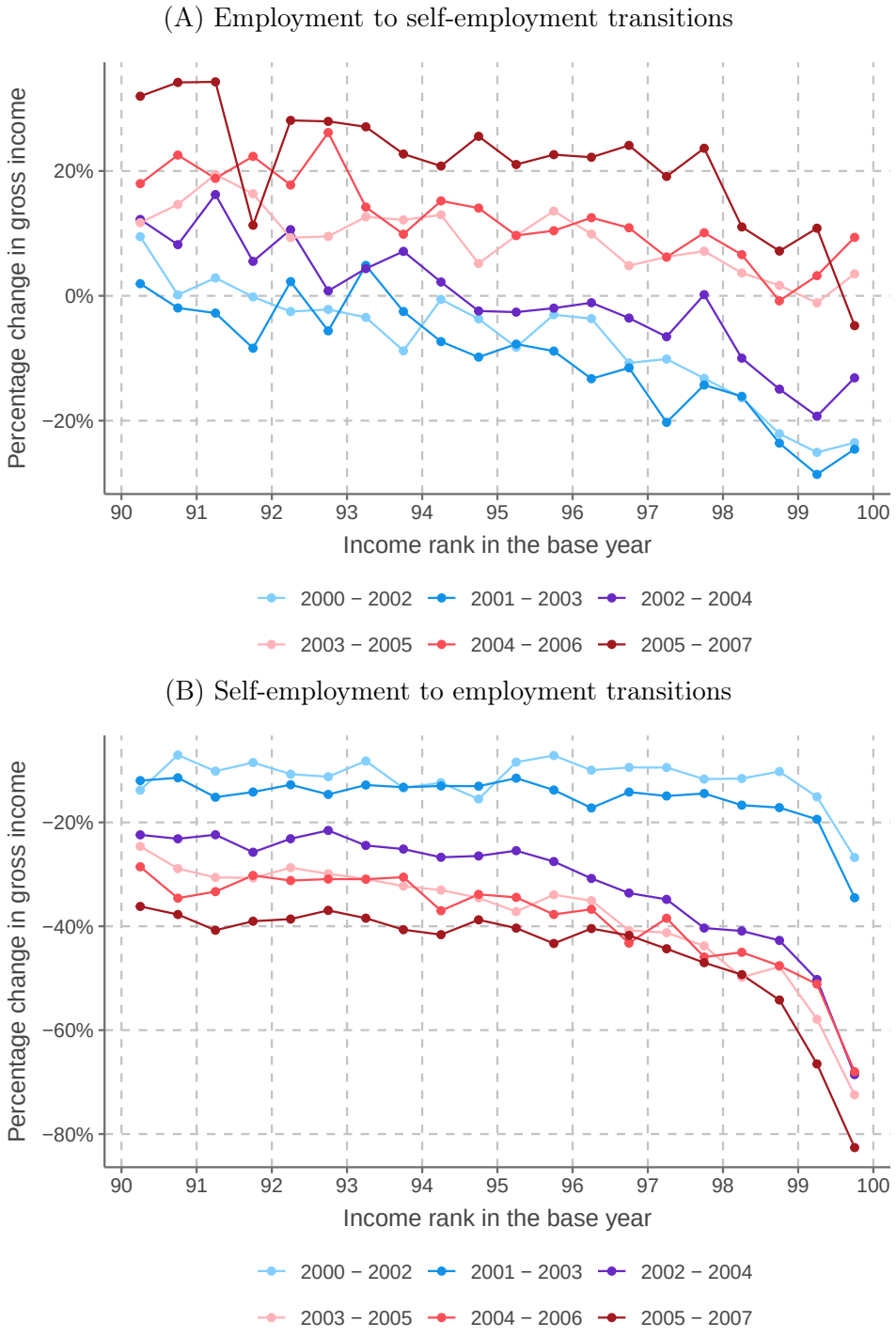
[49] See Manso (2016) and Dillon and Stanton (2017). for a discussion on returns to entrepreneurship

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%

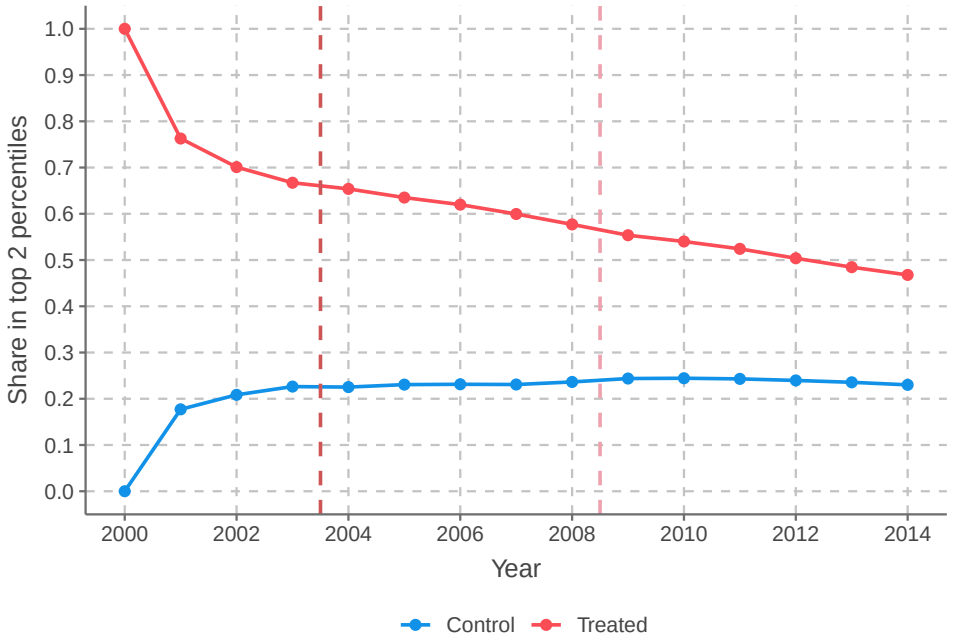
Note: This table presents summary statistics in 2002 (two years before the reform) for a balanced panel of employees and self-employed between 2000 and 2014. The treatment group includes those in the top two percentiles of the income distribution in 2000, and the control group, which includes those in 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.

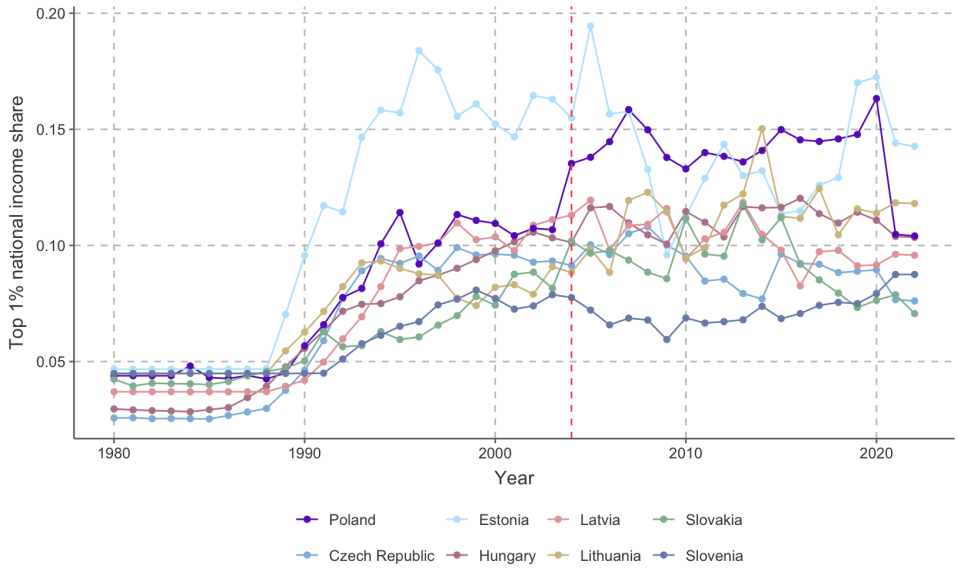
Figure B.6: Share of taxpayers in the top two percentiles of the income distribution, balanced panel



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).

B.5 Top 1% income shares

Figure B.7: Top 1% national income share in Central-Eastern European countries that joined European Union in 2004



Note: Source: World Inequality Database.

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.

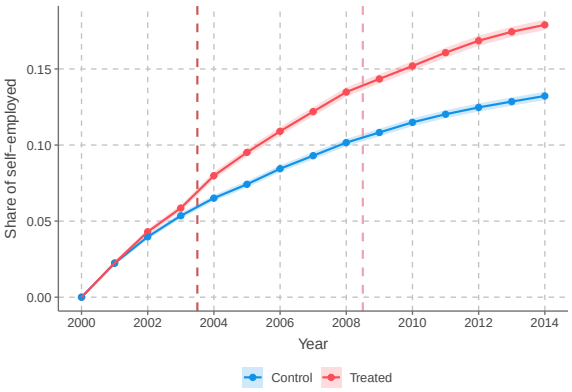
The specifications in equations (13) and (C.1) differ in terms of their underlying assumptions. In the specification (13) using transitions as an outcome variable, we assume that the difference in *transitions* between the treatment and control groups would stay constant after 2004, absent the introduction 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.

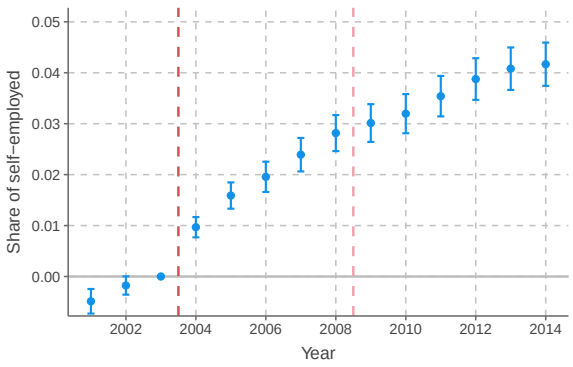
Panels C.1C and C.1D examine the change in the share of self-employed among self-employed individuals in 2000 with no employment income, while panels C.1E and C.1F look at self-employed with mixed income in 2000 and 2001. In the first group, we observe increased persistence in self-employment after the 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

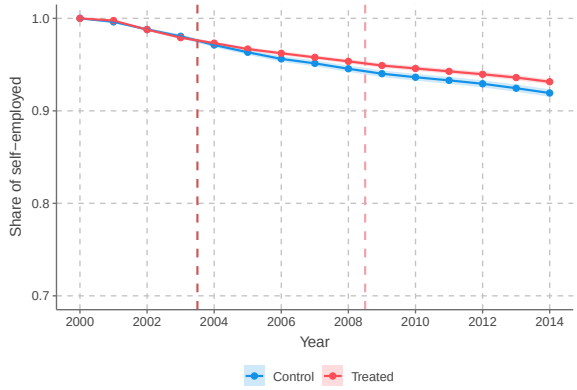
(A) Employees in 2000



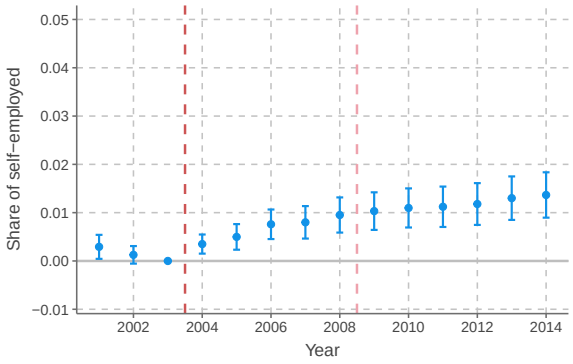
(B) Employees in 2000



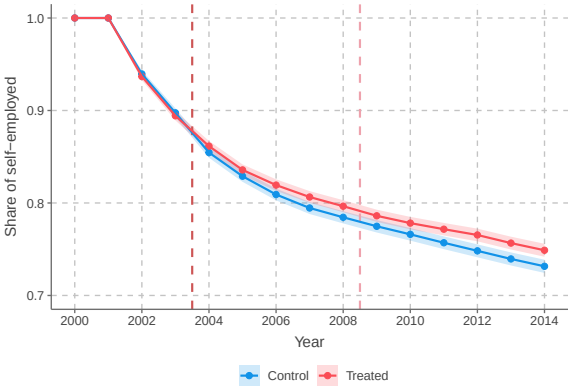
(C) Self-employed without employment income in 2000



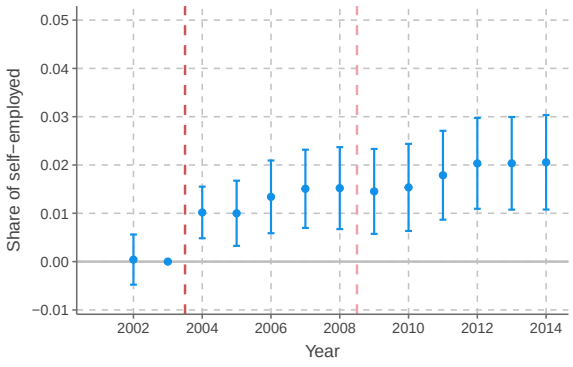
(D) Self-employed without employment income in 2000



(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 become 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

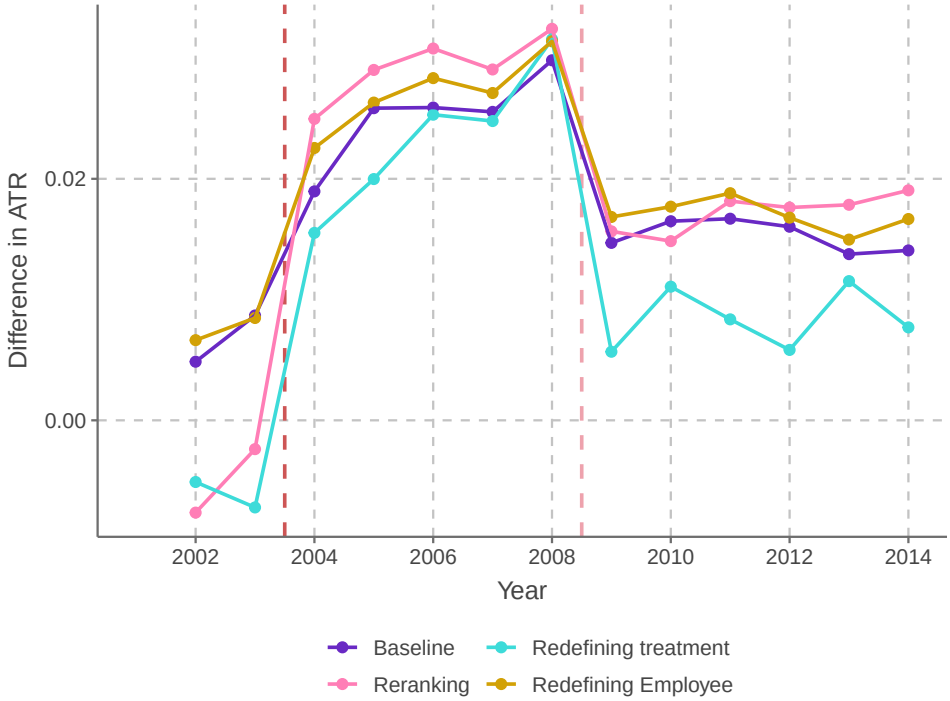
	Baseline (1)	Reranking (2)	Redefining treatment (3)	Redefining Employee (4)
Treated × Post 2004	-0.0024***	0.0004	-0.0007	-0.0014***
	(0.0006)	(0.0007)	(0.0008)	(0.0005)
Treated × Post 2009	0.0012**	-0.0003	-0.0007	0.0008*
	(0.0005)	(0.0006)	(0.0008)	(0.0004)
Observations	687,960	499,772	508,816	701,134
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).

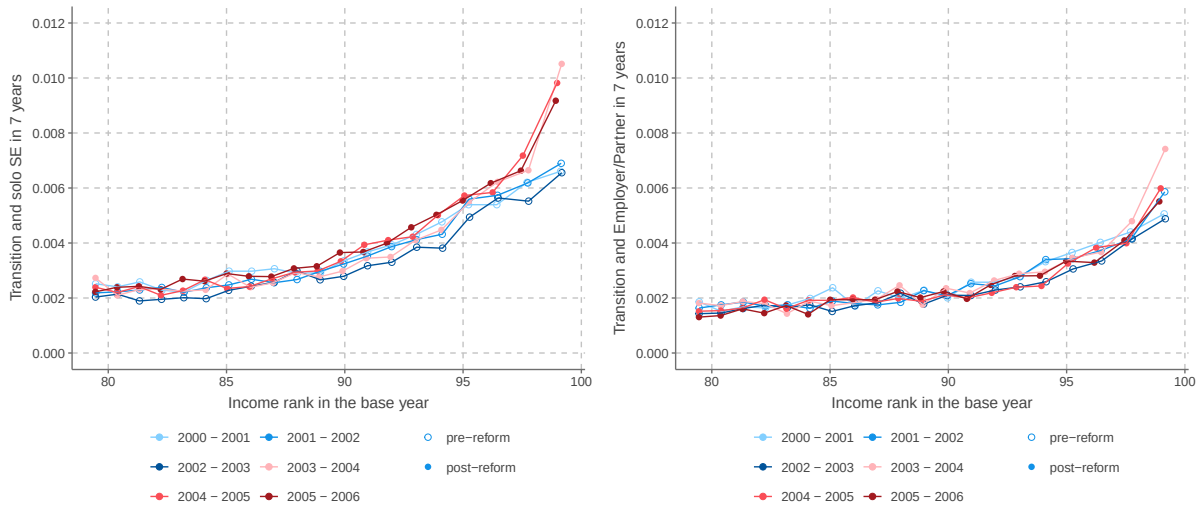
Results. To understand the reform's causal effect on solo self-employment, we adopt the repeated cross-section approach described in equation (D.1). The validity of this approach relies on stability in transitions, absent reform, year-on-year. Figure D.2 provides graphical representation of this estimation 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.

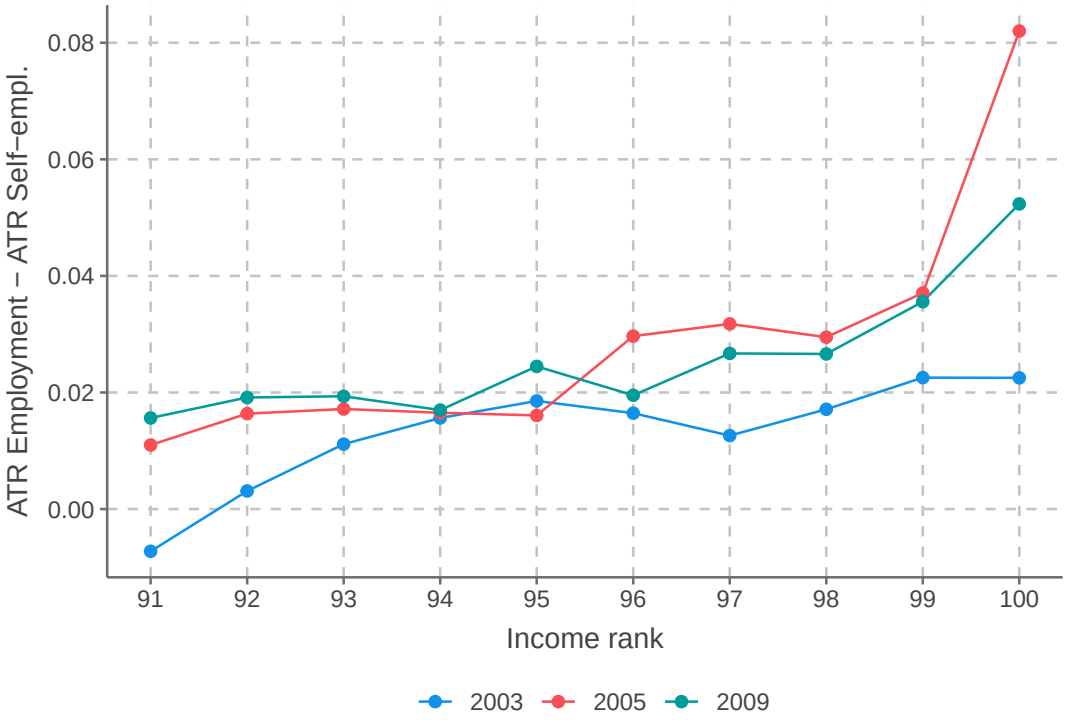
Table D.3: Reduced form results of the reform on transitions to self-employment and self-employment status 7 years after transition (solo self-employment, employer/partner, outside of self-employment). Repeated cross-section approach.

	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:

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

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

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

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.