Taxation, Entrepreneurship and Self-Employment: Evidence from a Regression Discontinuity Design

by

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Abstract

This paper uses a unique data set from the United Kingdom to investigate the effect of taxation upon entrepreneurship and self-employment. Arbitrary income thresholds chosen by the government at which the marginal personal rate of income taxation change are exploited using a regression discontinuity design to estimate an average treatment effect of taxation on both entrepreneurship and self-employment. Our results show that higher marginal tax rates raise the likelihood of self-employment at the top end of the income distribution but lower the probability of entry at the lower end. Taxation does not appear to affect whether an individual declares themselves to be an entrepreneur and only affects self-employment among non-entrepreneurs.

Keywords: Entry, self-employment, taxation, entrepreneurship, regression discontinutiy

JEL Codes: H2, H3, D2, L2, J2

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1. Introduction

The high budget deficits and large public debts accumulated as part of the reaction to the global financial crisis have constrained the fiscal response to the current recession and led to calls by policy makers for the private sector to lead the recovery. In the United Kingdom this has centred upon stimulating entrepreneurship through deregulation of entry barriers to foster the creation of new firms. Evidence in support of the view that entering firms affect productivity growth is relatively plentiful with between 15% and 25% of aggregate productivity growth arising through this channel.[1] Often these entrants embody new ideas, technologies, products and processes and leading some to prosper and grow while others are rejected by consumers and exit. This paper studies the effect of one particular important public policy instrument, income taxation, in creating entrepreneurs and new firms.

In studying the effect of taxation we build on a small branch of the policy literature that has considered the effects of tax policy reforms on either the probability of being self-employed or the rate of entry by incorporated firms. Key references here include Gentry and Hubbard (2000), Carrol et al. (1998), Papke (1991), Cullen and Gordon (2007), Djankov et al. (2010) and Da Rin et al. (2010, 2011). Those studies that have examined the effects of income taxation on the decision to be self-employed using (mostly US) micro data include Gentry and Hubbard (2000), Carrol et al. (1998), Papke (1991) and Cullen and Gordon (2007), whereas Djankov et al. (2010) use cross-country, and Da Rin et al. (2011) cross-country and industry data to study the effects of corporate taxation on the entry decision of incorporated firms. Despite differences in the type of data used, a general conclusion emerges across these papers that entry choices are affected by income taxation, with the most consistent evidence for an effect from corporate taxation and, supportive of the model presented in Cullen and Gordon (2007), in a non-linear way.

We contribute to this literature by focusing on the question of whether income taxation affects the probability of a person entering self-employment or declaring themselves to have entrepreneurial ambition using data drawn from the British Household Panel Survey. In modelling the effects of taxation on entry through self-employment we exploit sharp changes in the marginal rate of personal income taxation at different government-defined income thresholds using a regression discontinuity approach. As laid out in Lee (2008), individual's imprecise control of the assignment variable in this context means that local linear regressions in the neighbourhood of the cutoff points

[1] See for example, Disney et al. (2003), Foster et al. (2001) and Scarpetta et al. (2002) for evidence from the UK, US and OECD countries respectively.

(income thresholds) generates a randomised experiment from which we gain a causal, average treatment effect estimate of taxation upon self-employment and entrepreneurship.

Our empirical evidence strongly suggests that self-employment is affected by tax policy, but that the sign of the effect differs according to the point in the income distribution. We find that assignment to the treatment group (that paying a 40% marginal rate compared to 22%) around the upper income threshold raises the probability that an individual will be self-employed by approximately 20% in the next period. However, taxation is only found to affect those people who do not identify themselves to be entrepreneurs, suggesting that income taxation alters the relative returns to employment versus self-employment and that is only among those on the margin of self-employment for whom income taxation alters their incentives. At the lower end of the income distribution we find the opposite result: treatment lowers the probability of self-employment by 10% where again this is only found to affect non-entrepreneurs.[2] This evidence provides a strong motivation for further theoretical analysis of the causes in asymmetries and we describe some mechanisms in the paper, where these include differences in the risk-preferences of individuals in the standard risk-versus-return model (Gentry and Hubbard, 2000) or in the presence of sunk costs to creating a new business (Hopenhayn, 1992).

This pattern of results for marginal personal income tax rates does not fit with the predictions of the risk versus return model of entrepreneurship in Cullen and Gordon (2007), even where this to allow for asymmetric responses to taxation. In that model increases in tax rates at high income levels would usually be expected to decrease entrepreneurship. Our findings also compete with the empirical evidence of Gentry and Hubbard (2000), who find that less progressive personal income tax systems spur entry due to risk taking and the relatively higher expected payoff offered by entrepreneurship. Our findings are not without precedent however, they are in-line with the time-series evidence for the US in Blau (1987), Parker (1996) for the UK and the cross country-industry study in Kneller and McGowan (2011) as well as the theoretical model on entrepreneurship found in Asoni and Sanadaji (2009). The latter is of particular interest as it emphasises the dynamic nature of entrepreneurship and a role for the irreversibility of investment. In their paper potential entrepreneurs differ from actual entrepreneurs in that they receive in each period a new business idea, such that there is an option value of waiting. Increased taxation reduces this option value by disproportionately taxing the most successful ideas, thereby encouraging the entry of new firms.

[2] The treatment group in this case pays a marginal rate of income tax of 10% compared to the 0% rate paid by the control group.

The rest of the paper is organised as follows. In section 2 we discuss the existing theoretical and empirical evidence of the relationship between tax policy and the decision to become an entrepreneur. Section 3 details the data sources and tax data, while Section 4 describes empirical methodology we adopt in the paper. Section 5 reports and interprets the results from our empirical strategy, while Section 6 draws some conclusions from the study.

2. Existing Literature

As Cullen and Gordon (2007) and others have noted the theoretical relationship between entrepreneurship entry decisions and tax policy quickly becomes complex, such that the exact relationship becomes an empirical matter (Da Rin et al., 2011). Most of the theoretical models on this topic typically assume that the decision to create a firm by an entrepreneur is a discrete choice and affected by tax rates as potential entrepreneurs compare the after-tax returns to employment versus entrepreneurship. Entrepreneurship income is usually modelled as involving greater variability than employment income, such that it is a standard trade-off between risk and return.[3] The returns to entrepreneurship will be affected by the different tax variables, according to whether the entrepreneurs' income is subject to personal income taxation or corporate taxation, the tax rate on employment income, and the entrepreneur's attitude towards risk (Kihlstrom and Laffont, 1979).

In general, higher corporate taxation in these models is associated with lower returns to entrepreneurship, making employment relatively more attractive. The effects of this tax change on the total stock of enterprises may be mitigated to the extent that it encourages some entrepreneurs to switch to a form of business, such as self-employment, that is subject to income taxation. For personal income taxation the relationship with the total stock of enterprises is complicated further by the combination of the uncertainty of income as an entrepreneur and the greater complexity of the tax schedule usually assumed for personal income taxation. The effects of income tax changes now depend on which specific marginal tax rate (at which level of income) is altered, as well as the value of any tax thresholds, and the returns to employment relative to the two states of entrepreneurship. Assuming a neutral attitude towards risk, a change in the tax rate applied to the unsuccessful entrepreneurial state in general would be expected to encourage entrepreneurship,[4]

[3] There is considerable empirical evidence to support this claim (see for example Holtz-Eatkin, Rosen and Weathers, 2000).

[4] While all of wage income that falls in the tax bracket where the tax change occurs is taxed at the new higher rate, for the self-employed entrepreneur this happens only with the probability that the entrepreneur is successful and receives the higher income state.

those at mean income levels have an ambiguous effect[5], while those applied to successful entrepreneurial outcomes are generally thought to discourage entrepreneurship.[6] Again further ambiguity is introduced if entrepreneurs can alter between different business forms and therefore whether they are subject to income versus corporate taxation and by changes to the assumed attitude towards risk. This extension is made by Cullen and Gordon (2007).

As shown by Asoni and Sanandaji (2009), the relationship between entry and the progressivity of taxation are sensitive to assumptions about timing in these models. Asoni and Sanandaji (2009) consider a dynamic setting in which the start-up decision requires commitment by the entrepreneur. As in the literature of irreversible investment under uncertainty (Dixit and Pindyck, 1994) the timing of entry takes on some importance. As existing entrepreneurs are assumed not to receive new business ideas, there is an option value of waiting. Progressive taxes reduce this option value by disproportionately taxing the most successful firms. In their model progressive taxes can increase entry into self-employment, the opposite prediction to Gentry and Hubbard (2000).

Most previous empirical research on taxes and self-employment has focused on the effects of taxation on self-employment using US data (Long, 1982; Gordon, 1998). A general observation of the results from this literature would be that the relationship with corporate taxation has tended to be more robust than for income and payroll taxation. This sensitivity for income and payroll taxation is of course consistent with the theoretical models on this issue, where the particular tax rate that is changed can matter. Gentry and Hubbard (2000) for example, model the probability of becoming self-employed (which they use as a proxy for entrepreneurship) as a function of tax progressivity in the US. They find strong evidence that greater progressivity of the tax rate, captured as the marginal tax rate faced when entrepreneurship is unsuccessful compared to successful, is associated with a lower probability of choosing self-employment. In contrast, Blau (1987) finds that higher marginal tax rates in the upper income brackets of the personal income tax have a positive effect on the decision to be self-employed and that the opposite is true in lower income brackets using aggregate U.S. time-series data to examine the changes in self-employment between 1948 and 1982. Here, as tax rates become more progressive self-employment becomes less, not more, popular. Again an implicit assumption made in all these papers is that tax changes on the decision to become self-employed is equal and opposite to any effect on the decision to leave self-employment.

[5] Assuming this tax rate is applied to employment income.
[6] They affect the returns to income in the successful entrepreneurial state in these models.

Using data on specific marginal tax rates Cullen and Gordon (2007) find that the proportion choosing to become entrepreneurs in the US is increasing in personal income taxation, because it affects loss sharing with governments, and decreasing in corporate taxation. These results for income taxation are in contrast with those found for Canada by Stabile (2004), where increases in taxation were associated with an increase in taxation on employees. Gurley-Calvez and Bruce (2008) is a rare example of a study that considers the effects of taxation on the decision to close a firm, or specifically the duration of entrepreneurial activity. They find that greater entrepreneurial taxes shorten spells of entrepreneurial activity, whereas an increase in wage taxation lengthens them.

As mentioned above the results for corporate taxation have tended to be more robust. Carroll et al. (1998) examine the effects of changes in taxation on the investment decision of sole-proprietors (their measure of entrepreneurs) between 1985 and 1988 in the US. They find that a change in the user cost of capital, which includes the effects of taxation, significantly reduces the probability of capital investment. Supportive evidence can also be found in Papke (1991) who examines the effects of taxation on the number of new firms created within a given US state and 3-digit manufacturing industry (of which there are 5) between 1975 and 1982. The effective tax rate on capital is negative and significant in two industries and insignificant in another. Its effect is positive in the remaining two, being statistically significant in both of these. They show that taxes affect the incentive for entrepreneurship because of the progressivity of the tax system (success taxes), the option to incorporate and due to risk sharing with the government. The most comprehensive coverage of different forms of taxation can be found in Bruce and Mohsin (2006). Using a time series approach on the percentage of individuals that are self-employed from 1950 to 2000 they find a significant co-integrating relationship with the corporate income tax rate, but not the top personal income tax rate, capital gains tax rate or the payroll tax rate.

More recently the studies by Da Rin et al. (2011) and Djankov et al. (2010) have examined the effects of corporate taxation in a cross-country setting. Da Rin, Di Giamcomo and Sembenelli (forthcoming) examine whether corporate income taxation causes entrepreneurship by inducing entry through the incorporation of new companies. Using industry-level data on the rate of entry in 17 European countries from 1997 to 2004 they uncover a significant non-linear relationship that is robust to the use of instrumental variables to correct for any endogeneity bias. In their preferred specification they find that a reduction of the corporate tax rate from the median (30.04%) to the first quartile (27.57%) implies a 0.88 percentage point increase in the entry rate, whereas for the same sized reduction from the third quartile (33.44) to the median, entry increases by 0.27 percentage points.

The approach taken by Djankov et al. (2010) uses survey-based information to build the tax burden of a 'standard' company with similar characteristics across all countries (the company produces and sells flower pots). They find that this measure of the tax burden is significantly negatively correlated with the rate of entry in a cross-section of developed and developing countries, as well as other performance measures such as aggregate investment and FDI. For a measure of the top personal income tax rate they can find no significant relationship with rates of entrepreneurship however.

3. Data Description and Summary

The data on entrepreneurship and self-employment used in this paper are drawn from the British Household Panel Survey (BHPS). This is an annual survey conducted in the United Kingdom with the central aim of being to collect nationally representative longitudinal micro data on persons and households.[7] Households are sampled according to a stratified random cluster drawn from the population of British household postal addresses.[8] A rather stable set of core questions is asked every year covering the most essential areas such as health, education, labour market and socio-economic outcomes. Households are re-interviewed annually and at present waves of data are available to researchers since 1991.

Our sample pools together information across the years 1998 to 2008. This contains the main variables of interest such as annual income and whether a person is self-employed. Further control variables such as age, educational attainment, the region in which a respondent lives and a number of other variables are also taken from the BHPS data set. Since 1998 the BHPS has contained two questions about entrepreneurial aspirations. The precise wording of these are:

"I am going to read out a list of things you may or may not want to happen to your current employment situation. For each one can you please tell me whether you would like this to happen to you in the next twelve months. Would you like to … Start up your own business (a new business)?"

A second question is asked to enquire about unwanted but likely career events:

"(Even though you would not like this to happen) Do you think this will actually happen in the coming twelve months? … Start up your own business (a new business)?"

[7] It is similar to the SOEP for Germany and the PSID for the US.
[8] Technical details are provided in Taylor et al. (2004).

Together we use this information to construct a dummy variable equal to one if a respondent answers 'yes' to either of the two question and zero otherwise. We use this information to identify whether an individual is an entrepreneur or otherwise since it signals whether they are in the process of formulating business ideas. We also measure self-employment using a binary variable equal to one if an individual earns their income through self-employment and zero where their earnings are derived from wage income. In total this provides us with a sample of 84,797 individual-year observations 10.85% of which cover individuals in self-employment and 4.34% relating to entrepreneurship.

[Insert Table 1]

A summary of the main variables of interest is provided in Table 1. Approximately 11% of the observations in our sample relate to individuals who are currently self-employed. The rate of self-employment is fairly stable across our sample ranging between 10.5% and 11.4% in any given year. By contrast the number of people identifying themselves as entrepreneurs is lower with 4.3% of observations belonging to this group.

[Insert Table 2]

Data on marginal personal income tax rates and income thresholds at which these change are drawn from the *OECD Tax database*. Income allowances, marginal personal income tax rates and the income thresholds are presented for each year of the sample in Table 2. Generally the marginal tax rates applied at the different thresholds remain constant during the sample. However, there are two notable changes. First in 1999 the income allowance reduced and the entry-level tax rate, τ^1 fell from 20% to 10%. The middle income tax rate, τ^2, was also reduced by one percentage point in 2000 to 22%. Given that we are primarily interested in the effects of taxation around the point where the 40% rate takes effect, any change in behaviour resulting from these reforms is likely to minimal.[9] However, we also conduct sensitivity checks in which data from the years 1998 and 1999 are excluded from the sample to ensure the consistency of our results.

4. Econometric Strategy

[9] Moreover, since we use a regression discontinuity design these factors will be common to all individuals in the neighbourhood of the upper income threshold meaning that a local linear regression will continue to yield an unbiased treatment effect.

The heart of our research design is to examine whether discontinuities in the marginal rate of personal income taxation at the cutoff are mirrored by discontinuities in other outcomes. Specifically, in the probabilities of self-employment and entrepreneurship. Our analyses are conducted using individual-level data, although within our nonparametric framework we aggregate the individual data into narrowly defined income bins.[10]

We first show in a cross-sectional framework how a RD design approximates a randomised experiment. Suppose that the government sets an income threshold (v^*) where individuals who earn an income of at least v^* pay a marginal income tax rate of t^h and t^l if their income falls below v^* (where $t^h > t^l$). Let $d_i = 1(v_i \geq v^*)$ be an indicator of whether an individual pays the higher tax rate, that is their income is greater than or equal to the income threshold. Suppressing time-related considerations, we can write some outcome y_i (self-employment or entrepreneurship) as

$$y_i = \alpha + d_i\theta + u_i \qquad (1)$$

where θ is the causal effect of higher marginal income tax rates and u_i represents all other determinants of the outcome (with $E(u_i) = 0$).

In general a person's income may be correlated with other individual characteristics (such as educational attainment, age, whether they are a member of a trade union etc) and regional characteristics (demand conditions or the relative affluence of an area may matter affect the income of those in self-employment). If so, a simple regression of y_i on d_i will yield biased estimates of θ. However, as noted by Lee (2008), as long as there is some unpredictable random component of a person's income a regression comprising observations close to the cutoff yields a randomised experiment and unbiased estimates of θ despite non-random selection. In other words, the correlation between assignment to a given tax band and unobserved characteristics can be kept close to zero by focusing on a narrow range of observations around the cutoff. One can therefore identify the causal effect of higher marginal tax rates by comparing individuals whose income barely exceed the threshold (the 'treatment group') with others whose income is just below the cutoff (the

[10] That is, for each income bin (j) we calculate the average outcome within the bin as $Y_j = \sum_j(Y_{ij}w_{ij})/\sum_j(w_{ij})$ where.....

'control group') since assignment to treatment is essentially random.[11] For example, those earning wage income accept the highest wage contract offered by a firm since they are optimising agents. Whether they are part of the treatment or control group therefore depends on the decision of the firm regarding the wage paid ruling out strategic behaviour by the individual. For those in self-employment their earnings are a function of demand for the good or service they provide which they cannot accurately forecast (we discuss the potential for misreporting of income later). In both cases whether the person receives the treatment is exogenous which results in random assignment close to the cutoff.

As noted by Imbens and Lemieux (2008), there is no value of v_i at which we observe both treatment and control observations. Unlike full covariate matching strategies, which are based on treatment-control comparisons conditional on covariate values where there is some overlap, the validity of RD designs hinges on our willingness to extrapolate across covariate values, at least in the neighbourhood of the discontinuity. As outlined in Lee (2008) and Angrist and Pischke (2009) this means that we are assuming that individuals who lie close to the cutoff point draw their characteristics from the same probability density function. Owing to the random component of their income within this narrow window due say to unpredictable fluctuations in demand (in the case of self-employed) or the number of hours of overtime worked (for those in employment), the likelihood that a given individual receives the treatment or otherwise is essentially random. Consequently a local linear regression in a narrow window around the cutoff yields an average treatment effect of taxation. However, it is worth noting that the ATE in the RD case differs slightly from that in a randomised control trial since we are comparing individuals who are different distances away from the cutoff rather than assigning the same treatment to everyone within the group (Lee and Lemieux, 2010)

As previously commented on by Imbens and Lemieux (2008) practitioners of RD designs are frequently confronted by a trade-off between efficiency and precision. On the one hand a wider window around the cutoff increases the efficiency of the estimates but comes at the price of less precision in the estimates of the treatment effect since the researcher is forced to extrapolate over a wider group of individuals. In our main parametric estimates of the effect of taxation we pool the data across the years 1998-2007 but focus on a narrow window around the income threshold that

[11] A more extensive discussion of how a RD design conforms to a randomised experiment when individuals have imprecise control over the assignment variable in the neighbourhood of the cutoff point can be found in Lee (2008) and Angrist and Pischke (2009).

uses data on individuals with an income within £500 either side of the cutoff.[12] Other studies that use panel data in a RD context are Lee (2008), Lemieux and Miligan (2008).

[Insert Figure 1]

Often with RD designs we are concerned about the possibility of strategic behaviour that may push observational units above or below whatever cutoff is used for the assignment of treatment (McCrary, 2008). In the context of this paper individuals may under-report their income to avoid paying the higher tax rate on that fraction of their income that exceeds the threshold. Using individual tax return micro data from 1960 to 2004 Saez (2010) finds no evidence that US tax payers cluster around the income threshold at which the top marginal rate of income taxation takes effect (equivalent to the point at which the 40% rate takes effect in our data). However, density plots of the assignment variable (income) in Figure 1 around the cutoff point provide no evidence that clustering occurs in our data (McCrary (2008) proposes this as a test of strategic behaviour in RD designs). We are therefore confident that the effect of taxation on self-employment is not biased by strategic behaviour. Moreover, it is not obvious why strategic behaviour would occur with respect to whether an individual declares themselves to be an entrepreneur.

5. Results

We begin by pooling the data across the sample and deflating income and income thresholds into real 2010 values to ensure consistency in the distance a person's income lies from the cutoff. Figure 2 provides a graphical analysis of the impact of taxation on self-employment. It plots the estimated probability of an individual being employed in time t+1 as a function of income in time t. The horizontal axis measures an individual's income minus the cutoff level of income. Each point is an average of the indicator variable (self-employment) for each bin midpoint and being in self-employment in t+1 for each interval which is £100 wide. To the left of the cutoff individuals pay the lower marginal income tax rate; to the right they pay the higher rate (40%).

The plot displays a considerable degree of noise which is unsurprising given the relatively narrow binwidth we use. However, as is apparent from the figure, the local polynomial regressions display a striking discontinuous jump at the cutoff (0 point). Individuals whose income barely exceeds the income threshold in the current period are much more likely to be self-employed in the next period.

[12] Incomes are deflated into 2010 prices to ensure comparability across years.

The causal effect is approximately 0.04 in probability. While the local polynomial regressions are fairly smooth, nowhere else is a jump apparent.

Our results therefore reject the prediction laid out in the theoretical model by Gentry and Hubbard (2004) that taxes applied at the upper end of the income distribution act as success taxes. Instead it appears that treatment (in this case assignment to the group that pays the 40% marginal income tax rate) alters incentives and leads to a higher probability that a person will enter self-employment. Our results provide quasi-experimental individual-level evidence supporting the findings of Blau (1987) and Parker (1996) who use time-series data on the rate of self-employment in the US and UK respectively to analyse the effect of changes to the top marginal rate of income tax. Similar conclusions are reached by Kneller and McGowan (2011) who find changes to the top marginal income tax rate lead to more entry and less exit using cross-country industry data. Robson and Wren (1999) also find increases in the top rate of personal income tax to be positively correlated with entrepreneurship and attribute this finding to the greater ease with which income can be under-reported in self-employment. We return to this issue later in the paper.

[Insert Figure 2]

We repeat the analysis in Figure 3 though we now focus on whether assignment to treatment affects the likelihood that a person will declare themselves to be an entrepreneur. In comparison to the plot in Figure 3 here we find that assignment to the treatment group has a negative effect on the probability that an individual will consider starting a business during the next year. However, the magnitude of the effect is somewhat smaller with the treatment effect estimated to be -0.01 in probability

[Insert Figure 3]

Parametric Regressions

In this section we use local linear regressions in the neighbourhood of the cutoff to estimate an ATE of taxation on self-employment and entrepreneurship. To capture possible non-linearities in the trend relation, we extend equation (1) to include a flexible functional form for $f(x_i)$ using a 2nd-order polynomial and to control for potential asymmetries in the slope of the regression function

either side of the cutoff we interact the transformed assignment variable with the treatment indicator. That is[13]

$$y_i = \alpha + \beta_1 \tilde{x}_i + \beta_2 \tilde{x}_i^2 + \gamma_1 d_i \tilde{x}_i + \gamma_2 d_i \tilde{x}_i^2 + d_i \theta + u_i \quad . \qquad (2)$$

Centring x_i at x_0 is a normalisation that ensures the treatment effect at $x_i = x_0$ is the coefficient on d_i in a regression model with interaction terms. The model with the interaction terms has the attraction that it imposes no restrictions on the underlying conditional mean functions. The validity of RD design estimates of causal effects based on equation (2) turns on whether polynomial models provide an adequate description of the trend relation. However, by focusing on comparisons of average outcomes in a small enough neighbourhood just to the left and right of the cutoff, the sample becomes smaller and the number of polynomial terms needed to model $E(y_i|x_i)$ should be reduced. Moreover, since pre-treatment variables are unaffected by the treatment, there should be no jump in the conditional expectation function of these variables at the cutoff which will therefore yield unbiased estimates of θ.

[Insert Table 3]

In Table 3 we report the results for the estimation of equation (2) where self-employment is the dependent variable. Compared to the non-parametric results reported above we choose to use the individual-level data rather than aggregate this into bins of some arbitrary width. Initially we include only the treatment dummy, the 2nd-order polynomial terms and the interaction between the treatment dummy and the polynomial terms in the regression and compare how varying the window around the cutoff point affects the estimated effect of the treatment. As a reminder the treatment indicator yields an estimate of the effect of being assigned to the group that pays a 40% rate of income tax rather than the 22% rate.

The results in regressions 1 to 3 of Table 3 indicate that treatment affects a behavioural response: individuals who pay the higher 40% income tax rate in period *t* are between 12.4%-18.5% more likely to be self-employed in the next period. Furthermore, the results are statistically significant at conventional levels and the magnitude of the ATE remains consistent even when we focus on a small neighbourhood £500 either side of the cutoff in our preferred specification, regression 3. Our

[13] We experimented with a number of alternative specifications but found the 2nd-order polynomial to best fit the data.

results are consistent with evidence reported elsewhere and contrast with the model predictions of Gentry and Hubbard (2004). For example, Blau (1987) and Parker (1996) find using long time series for the US and UK respectively that increases in the top marginal rate of income tax raise the rate of self-employment. Robson and Wren (1999) attain similar findings using cross-country data as do Kneller and McGowan (2011) using cross country-industry data and a difference in difference estimation strategy to correct for omitted variable bias.

Our results suggest that assignment to the higher tax rate alter incentives. Most obviously the returns to additional wage income are relatively lower for those individuals just to the right of the cutoff compared with the group that pay the 22% marginal tax rate. An explanation for this may be that the returns to self-employment are on average higher, but more variable, than the returns to wage income (Gentry and Hubbard, 2004) and that the effect of paying the higher tax rate stimulates entrepreneurship as individuals seek a higher return. Alternatively, the increased likelihood of self-employment may be due to opportunistic behaviour as it is easier to under-report one's income when in self-employment. At the very least our results demonstrate that assignment to the top income tax bracket alter peoples' incentives and stimulate entrepreneurial behaviour.

In the remaining regressions of Table 3 we conduct a series of robustness checks to ensure the validity of our findings. As noted by Lee (2008) an individual's lack of control over assignment to treatment yields an unbiased estimate because assignment does not depend on other potentially relevant omitted variables that may be correlated with the outcome. However, Imbens and Lemieux (2008) and Lee and Lemieux (2010) recommend where possible the inclusion of other control variables due to the small sample size that typically characterise RD designs. In regression 4 we append equation (2) with a number of individual-specific controls that have been found elsewhere to affect the probability of self-employment (see for example Gentry and Hubbard (2000) and Cullen and Gordon (2007)). Home ownership may affect an individual's choice between self-employment and wage income by providing an asset against which they can borrow. However, we find neither home ownership nor entrepreneurial behaviour by a persons' parents to affect the likelihood of being self-employed. Older individuals are more likely to be self-employed although the magnitude of the estimated coefficient is small to the extent that it is practically irrelevant. Similarly, a positive effect is found for being male but the estimate is only weakly significant. The remaining variables in the regression study the effect of education. Here we find that those who attain advanced educational qualifications are more likely to choose employment over self-employment. Relative to those without formal educational qualifications those who graduate from university are 17.9% less

likely to be self-employed while the probability of being self-employed among those who leave university with a masters or doctorate is 18.6% lower. Other levels of educational attainment such as Higher National Diplomas are found to be negatively correlated with self-employment while individuals whose highest level of attainment is either A Levels or GCSEs are no more or less likely to be self-employed.

We are also concerned that there may be difficult to measure (for the econometrician at least) omitted variables that may be correlated with assignment to treatment. For example, the affluence of the area in which a person lives may affect the conditions for self-employment as well as the tax rate they pay. To capture effects such as these we include a full set of region-year effects in regression 5. These dummy variables capture all time-varying local factors which may be collinear with the treatment indicator, although it is worth mentioning that since assignment to treatment is essentially randomised this is not likely to be a large concern. Indeed the inclusion of region-year effects in regression 5 has only a limited impact on our results. Higher educational attainment continues to be associated with a lower likelihood of self-employment while those individuals to the right of the cutoff point remain more likely to be self-employed. The strength of the treatment effect is now stronger however with the coefficient estimated to be 0.187. Overall our results suggest that assignment to the treatment group raises the probability of entering self-employment by between 13% and 20%.

5.1 Taxation and Entrepreneurship

We now consider whether assignment to the group that pays the higher marginal income tax rate has an effect on the probability that an individual will declare themselves to be interested in creating a business within the next year. The previous section analysed how taxation affected the creation of new firms by altering the returns of employment relative to self-employment. Here we investigate the impact of marginal income tax rates on the incentive to become an entrepreneur. Henley (2007) investigates what effect individual-specific characteristics have upon the probability of an individual being an entrepreneur and finds evidence that this is correlated with several individual characteristics as well as job satisfaction and home ownership. The question of the role of taxation in affecting this choice however remains open.

[Insert Table 4]

Generally we find that income tax has little effect upon the probability of entrepreneurship in the next period. In Table 4 the average treatment effect of taxation is consistently negative with a coefficient estimate of approximately -0.07 in columns 3 to 5, but the statistical significance of the result is weak throughout. It would appear that entrepreneurship is a stochastic process where educational attainment, asset ownership and parental entrepreneurship generally have little bearing upon an individual's desire to start a firm. Alternatively it may be that this group of individuals are inherently more likely to become self-employed and that they are therefore less affected by taxation.

[Insert Table 5]

So far we have found a large positive ATE on entry through self-employment but that taxation does not affect whether an individual identifies themselves as an entrepreneur. In Table 5 we formally investigate the hypothesis that taxation affects self-employment by altering the incentives of those most sensitive to the relative returns of wage income compared with self-employment. Specifically, we hypothesise that the effect of taxation is largest for those individuals at the margin for whom the utility of employment and self-employment is roughly equal. The results in regressions 1 and 2 of Table 5 suggest this to be the case: it is only non-entrepreneurial types for whom taxation affects the probability of entry. In regression 1 we find that for this group the ATE is a 17.5% increase in the likelihood of self-employment which largely explains the results found in Table 3. In contrast, for entrepreneurs we find no impact of taxation on the probability of future self-employment in regression 2.

5.2 Taxation at Low Income Levels

[Insert Figure 4]

[Insert Figure 5]

The final part of our analysis studies the effect of taxation at the lower end of the income distribution. Here we define the treated group as those earning an income greater than the allowance. For this group the relevant marginal rate of income taxation is 10% (or 20% in 1998) compared with a 0% rate for those who earn an annual income below than the allowance. As such we treat these results with caution compared to previously given the possible bunching of the self-

employed to the left of this cutoff reported in Saez (2010). However, as previously outlined we find no evidence of bunching in our data as outlined in Figure 4 which shows the density of the assignment variable to be constant around the cutoff.

[Insert Table 6]

The results in regression 1 of Table 6 combined with the graphical evidence in Figure 5 again support the view that assignment to the higher tax band affects the choice between employment and self-employment. However, in contrast to the upper end of the income distribution we now find that the ATE of taxation is negative. Those assigned to treatment are 11.4% less likely to be self-employed. However, the difference in the effective average tax rate between individuals at the mid-point of the two groups is not dramatically different (0.005 percentage points for 2007). It may be that it is around this level of income at which other benefits, such as the working tax credit and child tax credit schemes, begin to be phased out. However, our findings are in line with those reported in the industry-level study by Kneller and McGowan (2011) who find that increases in the marginal income tax rate at the 67^{th} percentile of the income distribution lead to lower entry rates.

We continue to find that entrepreneurship is unaffected by taxation in column 2 suggesting that this finding is consistent throughout the income distribution and that entrepreneurial ambition is a function that is difficult to measure. In regressions 3 and 4 we again test to see whether taxation affects individuals symmetrically depending on their entrepreneurial aspirations. Again we find that only non-entrepreneur types are significantly affected by the treatment where again this effect is negative.

6. Conclusions

Entrepreneurs have been identified by policy makers as a crucial component in driving growth and the creation of jobs. In this paper we use a regression discontinuity design to access the impact of marginal income tax rates on the probability that an individual will be self-employed or declare themselves to have entrepreneurial ambitions. Discontinuities in the rate of marginal personal income taxation at government-defined income thresholds allow us to estimate an average treatment effect of taxation upon self-employment and entrepreneurship. We find that selection into entrepreneurship is unaffected by taxation throughout the income distribution but that taxation has a large and statistically significant effect on self-employment. At the upper end of the income

distribution where the marginal tax rate rises from 22% to 40%, those just to the right of the cutoff are approximately 20% more likely to be self-employed in the next period. At the lower end, at the point where the marginal tax rate increases from 0% to 10% we instead find that the probability of self-employment is approximately 10% lower among the treatment group. In both cases these results are driven by the impact of taxation upon non-entrepreneurs; it is this group that is most sensitive to changes in the relative returns to wage income compared with self-employment.

Our results provide strong quasi-experimental evidence that taxation affects the choice between employment and self-employment and that the effect is asymmetric at opposing ends of the income distribution. These findings are similar to those reported in Kneller and McGowan (2011) who find a similar effect using industry-level data on entry and exit rates. Similarly, the finding that higher marginal income tax rates spur entry at higher income levels is supported by findings in Blau (1987), Parker (1996) and Robson and Wren (1999). Our findings contrast with the predictions of the standard risk and reward model in Gentry and Hubbard (2004) and Cullen and Gordon (2007) suggesting that further theoretical work on this issue would be a promising future line of inquiry. The model of taxation and entrepreneurship presented by Asoni and Sanandaji (2009) is however capable of replicating some of the patterns of behaviour that we find.

References

Angrist, J.D. and Pischke, J.S. (2009) 'Mostly Harmless Econometrics', 1st ed., Oxford: Princeton University Press.

Asoni, A., and Sanandaji, T. (2009). 'Taxation and the Quality and Quantity of Entrepreneurship' IFN Working Paper No. 813, Research Institute of Industrial Economics, Stockholm.

Blau. D. M., (1987). 'A Time-Series Analysis of Self-Employment in the United States', *The Journal of Political Economy*, Vol. 95, pp. 445-467

Bruce, D. and Mohsin. M. (2006). 'Tax Policy and Entrepreneurship: New Time Series Evidence', *Small Business Economics*, Vol. 26, pp. 409-425.

Carroll, R., Holtz-Eakin, D., Rider, M. and Rosen, H.S. (1998). 'Entrepreneurs, income taxes, and investment', NBER Working Paper, No. 6374.

Cullen, J., and Gordon, R.H. (2007). 'Taxes and Entrepreneurial Risk-Taking: Theory and Evidence for the U.S.', *Journal of Public Economics*, Vol. 91, pp. 1479-1505.

Da Rin, M., Di Giacomo, M., and Sembenelli, A. (2011). 'Entrepreneurship, Firm Entry, and the Taxation of Corporate Income: Evidence from Europe', *Journal of Public Economics*.

Disney, R., Haskel, J. and Heden, Y. (2003). 'Restructuring and Productivity Growth in UK Manufacturing', *Economic Journal*, Vol. 113, pp. 666-694.

Dixit, A. and Pindyck, R. (1999). Investment under Uncertainty. Princeton University Press.

Djankov, S., Ganser, T., McLiesh, C., Ramalho, R. and Schleifer, A. (2010). ' The Effect of Corporate Taxes on Investment and Entrepreneurship', *American Economic Journal: Macroeconomics*, Vol. 2, pp. 31-64.

Djankov, S., La Porta, R., Lopez-de-Silanes, F., and Shleifer, A. (2002). 'The Regulation of Entry', *Quarterly Journal of Economics*, Vol. 117, pp.1-37.

Djankov, S. (2009). 'The Regulation of Entry: A Survey', *World Bank Research Observer*, Vol. 24, pp. 183-203.

Foster, L., Haltiwanger, J., and Krizan, C., (2001). 'Aggregate Productivity Growth Lessons from Microeconomic Evidence', NBER Chapters in: New Developments in Productivity Analysis, pp. 303-372.

Gentry, W., and Hubbard, R.G. (2000). 'Tax Policy and Entrepreneurial Entry', *American Economic Review*, Vol. 90, pp. 283-287.

Gentry, W., and Hubbard, R.G. (2004). 'The Effects of Progressive Income Taxation on Job Turnover', *Journal of Public Economics*, Vol. 88, pp. 2301-2322.

Gordon, R. (1998). 'Can High Personal Tax Rates Encourage Entrepreneurial Activity?' *IMF Staff Papers*, Vol. 45, pp. 49–80.

Gurley-Calvez, T. and Bruce, D. (2008). 'Do tax cuts promote entrepreneurial longevity', *National Tax Journal*, Vol. 61, pp. 225-250.

Holtz-Eakin, D., Rosen, H., and Weathers, R. (2000). 'Horatio Alger Meets the Mobility Tables,' *Small Business Economics*, Vol. 14, pp. 243-74.

Hopenhayn, H.A. (1992). 'Entry, exit, and firm dynamics in the long run' *Econometrica*, Vol. 60, pp. 1127-1150.

Imbens, G. and Lemieux, T. (2008) 'Regression Discontinuity Designs: A Guide to Practice', *Journal of Econometrics*, 142, pp. 615-635.

Kneller, R. and McGowan, D. (2011) 'Tax Policy and Firm Entry and Exit Dynamics: Evidence from OECD Countries', University of Nottingham Discussion Paper Series 11/08

Kihlstrom, R.E. and Laffont, J.J. (1979) 'A General Equilibrium Entrepreneurial Theory of Firm Formation Based on Risk Aversion', *Journal of Political Economy*, vol. 87(4), pp. 719-748.

Lee, D. (2008) 'Randomized Experiments from Non-Random Selection in U.S. House Elections', *Journal of Econometrics*, 142, pp. 675-697.

Lee, D. and Lemieux, T. (2010) 'Regression Discontinuity Designs in Economics', *Journal of Economic Literature*, 48, pp. 281-355.

Lemieux, T. and Milliagn, K. (2008) 'Incentive Effects of Social Assistance: A Regression Discontinuity Approach', *Journal of Econometrics*, 142, pp. 807-828.

Long, J. E. (1982). 'The taxation of self-employment', *National Tax Journal*, Vol. 35, pp. 31-42.

McCrary, J. (2008) 'Manipulation of the Running Variable in the Regression Discontinuity Design: A Density Test', *Journal of Econometrics*, 142, pp. 698-714.

Papke, L.E., (1991). 'Interstate business tax differentials and new firm location: Evidence from panel data', *Journal of Public Economics*, Vol. 45(1), pp. 47-68

Saez, E. (2010) 'Do Taxpayers Bunch at Kink Points?', *American Economic Journal: Economic Policy*, 2(3), pp. 180-212.

Scarpetta, S., Hemmings, P., Tressel, T. and Woo, J. (2002). 'The Role of Policy and Institutions from Productivity and Firm Dynamics: Evidence from Micro and Industry Data', OECD Economics Department Working Papers 329

Stabile, M. (2004). 'Payroll Taxes and the Decision to be Self-Employed', *International Tax and Public Finance*, Vol. 11, pp. 31–53.

Tables

Table 1. Summary Statistics

Variable	Obs	Mean	Std. Dev
Self-employment	84797	0.108	0.311
Entrepreneur	84797	0.043	0.203
Income	84797	20778.05	18616.82
Home owner	84797	0.052	0.222
Age	84797	38.497	12.268
Gender	84797	0.496	0.500
Parent was self-employed	84797	0.020	0.140
Higher degree	84797	0.035	0.183
University degree	84797	0.135	0.342
Higher national diploma (HND)	84797	0.079	0.270
A Levels	84797	0.234	0.423
GCSEs	84797	0.349	0.477

Notes: The sample includes all economically active individuals aged between 16 and 65. All variables are dummy variables except income and age. Income is measured in real 2010 pounds and age in years. Gender takes a value equal to one if an individual is male and zero otherwise. The educational variables take a value of one where that is individual i's highest educational attainment and zero otherwise.

Table 2. The UK Personal Income Tax Structure

Year	Allowance	τ^1	Threshold M	τ^2	Threshold H	τ^3
1998	4195	20%	8495	23%	27100	40%
1999	4335	10%	5835	23%	28000	40%
2000	4385	10%	5905	22%	28400	40%
2001	4535	10%	6415	22%	29400	40%
2002	4615	10%	6535	22%	29900	40%
2003	4615	10%	6575	22%	30500	40%
2004	4745	10%	6765	22%	31400	40%
2005	4895	10%	6985	22%	32400	40%
2006	5035	10%	7185	22%	33300	40%
2007	5225	10%	7455	22%	34600	40%

Notes: The allowance is the level of income below which the marginal income tax rate is 0%. Individuals who earn an income greater than or equal to the allowance but less than the next income threshold, Threshold M, pay a marginal tax rate of τ^1. Where an individual's income is greater than or equal to Threshold M, but less than Threshold H the marginal tax rate is set at τ^2. Individuals who earn an income of at least Threshold H pay a marginal tax rate of τ^3.

Table 3: Taxation and Firm Entry through Self-Employment

Regression No.	**1**	**2**	**3**	**4**	**5**
Window around cut-off	**+/- £2000**	**+/- £1000**	**+/- £500**	**+/- £500**	**+/- £500**
Treatment	0.124**	0.185**	0.131**	0.152**	0.187**
	(4.10)	(4.57)	(2.81)	(3.12)	(2.58)
Male				0.033+	0.033
				(1.73)	(1.22)
Age				0.003*	0.002
				(2.26)	(1.34)
Home owner				0.018	0.025
				(0.54)	(0.29)
Parent self-employed				0.163	0.166
				(0.90)	(1.22)
Highest educational attainment					
Higher degree				-0.186**	-0.176*
				(-2.82)	(-2.24)
University degree				-0.179**	-0.160*
				(-2.84)	(-2.29)
HND qualification				-0.160**	-0.158*
				(-2.45)	(-2.16)
A-levels				-0.095	-0.106
				(-1.38)	(-1.30)
GCSE				-0.069	-0.070
				(-1.01)	(-0.92)
Region-year effects					√
Observations	2438	1242	576	576	576
R-squared	0.01	0.02	0.10	0.10	0.32

Notes: +, *, ** denote significance at the 10%, 5% and 1% levels respectively. Robust t-statistics are in parentheses. Treatment is a dummy variable equal to 1 if individual *i*'s income is greater than or equal to the government threshold at which the marginal personal income tax rate rises to 40%. All regressions include a second order polynomial of the transformed assignment variable (income – cut-off) as well as an interaction between treatment status and the second order polynomial transformed assignment variable.

Table 4: Does Taxation Create Entrepreneurs?

Regression No.	**1**	**2**	**3**	**4**	**5**
Window around cut-off	**+/- £2000**	**+/- £1000**	**+/- £500**	**+/- £500**	**+/- £500**
Treatment	-0.000	-0.036	-0.079	-0.075	-0.072
	(-0.01)	(-0.88)	(-1.31)	(-1.20)	(-0.86)
Male				0.032*	0.036*
				(2.44)	(2.22)
Age				-0.001	-0.001
				(-0.89)	(-0.73)
Home owner				-0.014	-0.089
				(-0.40)	(-1.32)
Parent self-employed				0.181	0.108
				(1.12)	(0.75)
Highest educational attainment					
Higher degree				-0.019	0.009
				(-0.52)	(0.25)
University degree				-0.033	-0.023
				(-1.04)	(-0.78)
HND qualification				-0.017	0.001
				(-0.50)	(0.02)
A-levels				0.038	0.050
				(0.97)	(1.29)
GCSE				-0.001	-0.016
				(-0.02)	(-0.39)
Region-year effects					√
Observations	2418	1229	572	572	572
R-squared	0.00	0.00	0.01	0.04	0.31

Notes: +, *, ** denote significance at the 10%, 5% and 1% levels respectively. Robust t-statistics are in parentheses. Treatment is a dummy variable equal to 1 if individual *i*'s income is greater than or equal to the government threshold at which the marginal personal income tax rate rises to 40%. All regressions include a second order polynomial of the transformed assignment variable (income – cut-off) as well as an interaction between treatment status and the second order polynomial transformed assignment variable. The number of observations differs from Table 3 owning to missing data.

Table 5: Asymmetric Effects of Taxation

Regression No.	**1**	**2**
Dependent variable	**SE, non-E, t+1**	**SE, E, t+1**
Window around cut-off	**+/- £500**	**+/- £500**
Treatment	0.175**	0.008
	(2.78)	(0.22)
Region-year effects	√	√
Individual-level controls	√	√
Observations	576	576
R-squared	0.33	0.25

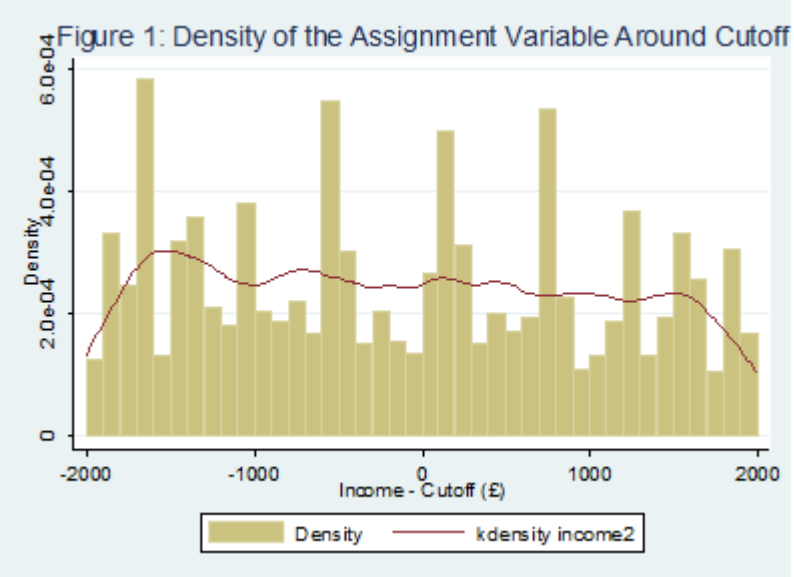
Notes: +, *, ** denote significance at the 10%, 5% and 1% levels respectively. Robust t-statistics are in parentheses. Treatment is a dummy variable equal to 1 if individual *i*'s income is greater than or equal to the government threshold at which the marginal personal income tax rate rises to 40%. All regressions include a second order polynomial of the transformed assignment variable (income – cut-off) as well as an interaction between treatment status and the second order polynomial transformed assignment variable. The coefficient estimates for the individual-specific variables are unreported. SE denotes the self-employment indicator which takes a value of 1 if the individual is in self-employment in period *t*+1 and 0 otherwise. E denotes that the person is an entrepreneur while non-E implies that they are a non-entrepreneur.

Table 6: Taxation at the Lower End of the Income Distribution

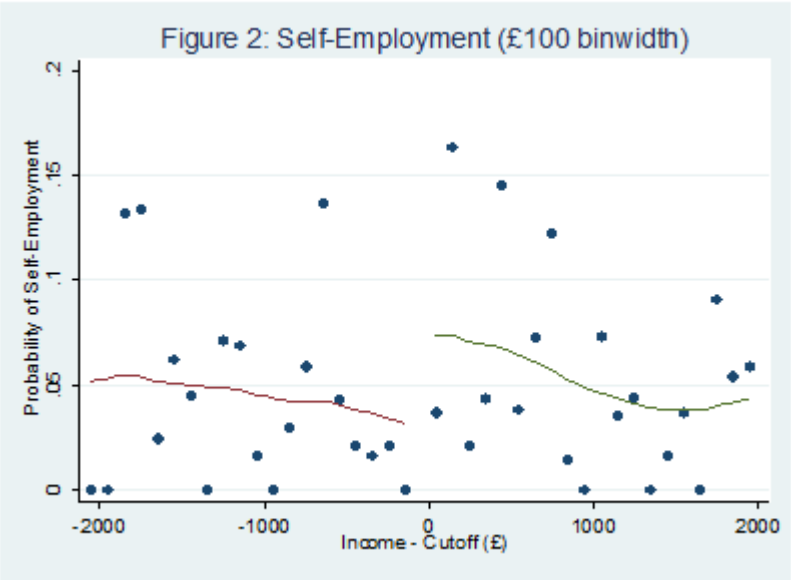
Regression No.	**1**	**2**	**3**	**4**
Dependent variable	**SE, t+1**	**Ent, t+1**	**SE non-Ent, t+1**	**SE Ent, t+1**
Window around cut-off	**+/- £500**	**+/- £500**	**+/- £500**	**+/- £500**
Treatment	-0.114**	-0.002	-0.064*	-0.023*
	(-3.50)	(-0.09)	(-2.06)	(-2.12)
Region-year effects	√	√	√	√
Observations	1729	1729	1749	1749
R-squared	0.27	0.11	0.23	0.13

Notes: +, *, ** denote significance at the 10%, 5% and 1% levels respectively. Robust t-statistics are in parentheses. Treatment is a dummy variable equal to 1 if individual *i*'s income is greater than or equal to the government threshold at which the marginal personal income tax rate rises to 40%. All regressions include a second order polynomial of the transformed assignment variable (income – cut-off) as well as an interaction between treatment status and the second order polynomial transformed assignment variable. The coefficient estimates for the individual-specific variables are unreported.

Figures



Notes: The figure plots the probability of self-employment in period *t*+1 against the midpoint of each bin in year *t* around the upper income threshold. Observations to the right of the cutoff pay a marginal income tax rate of 40% compared to 22% below the cutoff. The probability of self-employment is calculated as the total number of observations where self-employment is equal to 1 in t+1 within each bin divided by the total number of observations in the bin. Bins are £100 wide in real 2010 pounds. Local polynomial regressions are calculated using a triangular triangle and a bandwidth of £990. Optimal bandwidth and binwidth were calculated using the bandw command in STATA.



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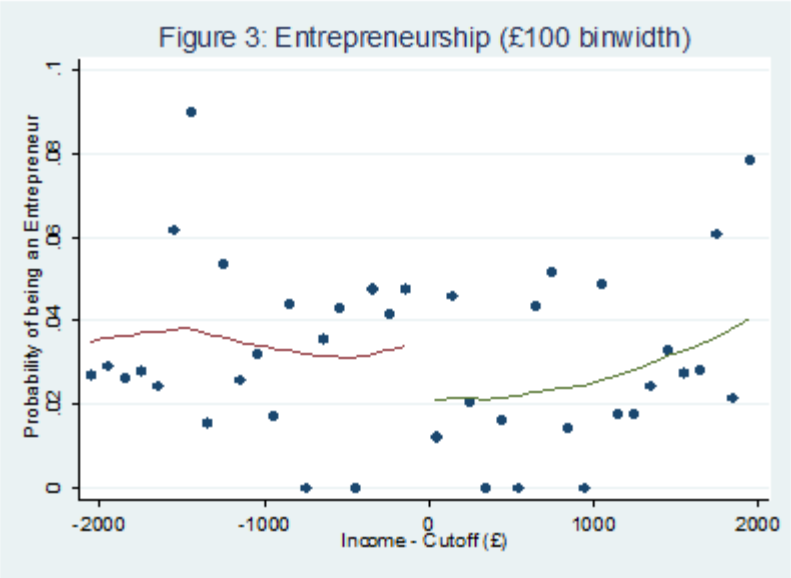
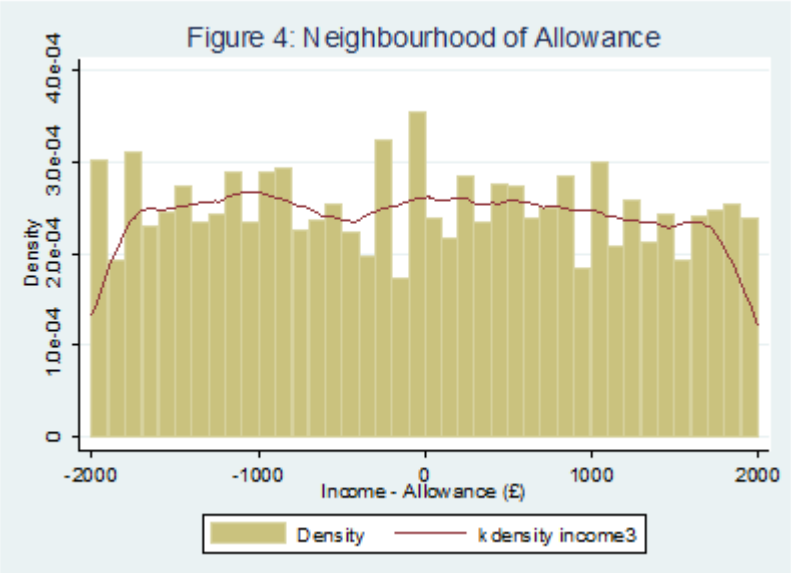


Notes: The figure plots the probability of entrepreneurship in period *t*+1 against the midpoint of each bin in year *t* around the upper income threshold. Observations to the right of the cutoff pay a marginal income tax rate of 40% compared to 22% below the cutoff. The probability of entrepreneurship is calculated as the total number of observations where entrepreneurship is equal to 1 in t+1 within each bin divided by the total number of observations in the bin. Bins are £100 wide in real 2010 pounds. Local polynomial regressions are calculated using a triangular triangle and a bandwidth of £990. Optimal bandwidth and binwidth were calculated using the bandw command in STATA.



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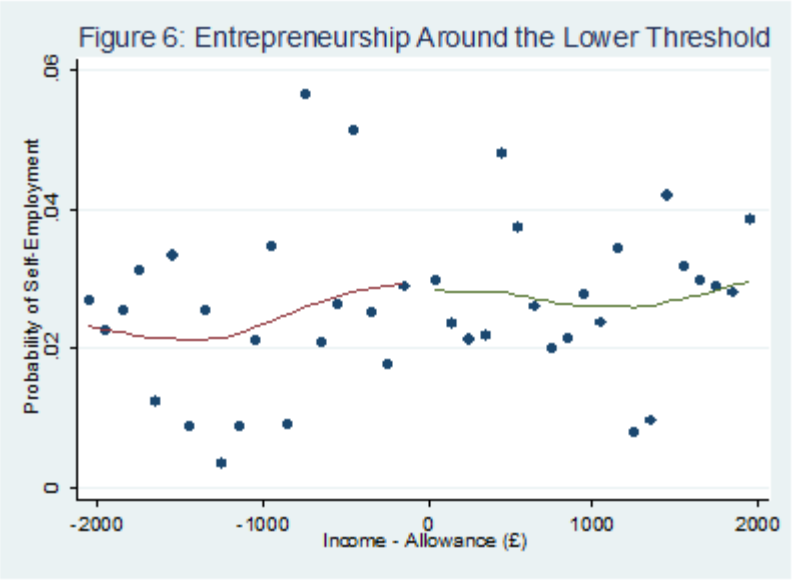

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