

How Sensitive is Young Firm Investment to the Cost of Outside Equity?

Evidence from a UK Tax Relief¹

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We estimate the sensitivity of investment to the cost of outside equity for young firms. For estimation, we exploit differences across firms in eligibility to a new tax relief program for individual outside investors in the UK. On average, investment increases 1.6% in response to a 10% drop in the cost of outside equity. This average conceals substantial heterogeneity: 1% of eligible firms issue equity in response to a subsidy that would have doubled investors' returns, implying large outside equity issuance costs for the majority of firms. Conditional on issuing new equity, however, firms invest eight times the issued amount. The results imply a large complementarity between outside equity and non-equity liabilities in young firms.

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The disproportionate contribution of high-growth young firms to economic growth is a well-established fact (Haltiwanger, Jarmin and Miranda, 2012; 2016). Yet, high-growth young firms are not well understood in terms of either theory or practice. Although the evidence of their role in job creation, productivity and real output is mounting, little is known about their characteristics, in particular, their capital and ownership structure. Figure 1 presents one new stylized fact about these businesses: high-growth young firms are disproportionately more likely than other young firms to bring new owners into the firm within three years of incorporation. This stylized fact is in practice reasonable. Most of these businesses have no cash flows to sustain debt, and entrepreneurial wealth is generally limited. Theoretically, however, this stylized fact is intriguing. The large agency and information asymmetry costs in these businesses, implies outside equity is the most expensive financing source for high-growth young firms (e.g., Jensen and Meckling, 1976; Myers and Majluf, 1984; Fluck, 1998; Myers, 2000).

In this paper we provide a first exploration into the link between high-growth and outside equity in young firms. There are two main empirical challenges: data availability and endogeneity concerns. Sources of data for young firms with information on both, real outcomes of interest (such as investment) and capital structure are not common. In addition, changes in the cost of outside equity are seldom exogenous to the investment opportunities facing firms.

We overcome the first challenge using novel balance sheet and ownership data for young companies in UK. These data allows us to document new stylized facts about outside equity and young firm growth. We show new outside equity issuances are very rare among these businesses: within three years of incorporation, less than 1% of young firms issue outside equity. In addition, we show outside equity has a “multiplier effect” on assets: for every pound of outside equity issued, four pounds are invested in the firm. Both stylized facts are consistent with the notion that young firms face large agency and information asymmetries costs: debt-like securities improve screening for outside investors and mitigate incentive conflicts (cf., Gompers, 1993).

To establish a causal link between outside equity and asset growth, we focus on a tax relief program in UK. For estimation, we exploit differences in access to such relief across young firms of different sizes. The Seed Enterprise Investment Scheme (SEIS) is only available for investors in young firms with less than £200,000 in assets. For the average eligible firm, the relief would have roughly

doubled returns of outside equity investors. Using a difference-in-difference approach, we compare equity issuances and investments by eligible and non-eligible firms with assets close to the £200,000 threshold, before and after the SEIS launch.

There are two main results. First, the vast majority of eligible firms do not respond to the subsidy: only 1% issue new equity. Because equity issuances are such rare events among firms, though, this response rate corresponds to a 16.67% increase over the unconditional mean. Second, we find a multiplier effect on investment: firms invest 8 times the equity issued. This investment adjustment is economically significant: it corresponds to a 36% rise over the unconditional mean.

Results are most consistent with agency and information asymmetry models of young firm growth. High agency and information asymmetry costs make outside equity prohibitively costly for most firms. In equilibrium, the bulk of young firm investment is financed with debt-like instruments that improve screening and mitigate incentive conflicts. Neoclassical models cannot explain the modest take-up rates, and real frictions' models make no capital structure predictions. Other market frictions such as illiquidity, and search costs also do not appear to be the main driver of the effects. Consistent with this notion we show that take-up rates (equity multipliers) are higher (lower) where agency and information asymmetry costs are lowest: among firms with outside and institutional investors to which new owners can delegate monitoring, among firms where outsiders manage the firm, and for firms in industries where private benefits are not the main motivation for business creation. We show suggestive evidence against the alternative explanation that securing outside equity, or submitting to the government's scrutiny, certifies firm quality for third parties. For a small subsample of firms, we show the equity multiplier is financed by debt to the owners of the firm, and not to third parties such as banks, other financial institutions, or unrelated individuals.

We finalize the analysis by using a back-of-the-envelope calculation to quantify the macroeconomic consequences of financial frictions for young firm growth. To that end, we estimate the average aggregate elasticity of young firm investment to the cost of outside equity using our regressions estimates. We find that on average, investment increases 1.6% in response to a 10% drop in the cost of outside equity. Then, we compare such elasticity to a counterfactual neoclassical elasticity we also

estimate. We conclude the elasticity of young firm investment to the cost of outside equity would have been at least 5 times larger absent frictions to young firm growth.

Our paper contributes to several strands of the literature. First, it relates to research on small and young firms' contribution to output growth. Our results are consistent with the large heterogeneity across small and young firms documented by prior work: only a small fraction of young firms contribute to the prowess of these types of firms in explaining economic growth (Haltiwanger, Jarmin and Miranda, 2012; 2016; Hurst and Pugsley, 2011). Our contribution is two-fold. First, we provide new stylized facts that help characterize high-growth firms. Second, we estimate the macroeconomic costs of financial frictions in young firms.

We also contribute to the literature that measures the sensitivity of investment to the cost of capital. As summarized by Chirinko et al., (2001), a large body of work in the macroeconomics literature has attempted to pin-down this elasticity. However, this prior work faces potential econometric issues such as the endogeneity of the user cost of capital (see Cummins et al., 2004) and measurement error (Goolsbee, 2000; Cummins et al., 2006). To date there is little consensus over the value of the elasticity, with published estimates ranging from zero to negative two. Our main contribution to this literature is to provide an estimate using a cleaner set-up, free of parametric or modelling assumptions (e.g., regarding the user cost formula; cf., Schaller, 2007). Our work also complements the development literature, which explores how responsive is investment to rates of returns in developing countries such as the works by Banerjee and Munshi (2004), Foster and Rosenzweig (1996), Goldsetin and Udry (1999) and Dufflo et al., (2003). Our contribution to this literature, is to focus on a subset of firms—young businesses in develop economies—that remains understudied and yet is generally recognized to be the main engine of growth an innovation.

Third, our paper contributes to studies on capital structure. Similar to the work by Gordon and MacKie-Mason (1990), Graham (1999), Campello (2001) and Panier et al., (2014), we use changes in tax policy as a source of variation in the relative cost of different sources of capital to explore capital structure decisions by firms. We contribute to this literature by focusing on young businesses and complement recent work by Robb and Robinson (2014) documenting modest use of outside equity among these companies. Our data allow us to confirm young businesses' reliance on non-equity

liabilities for the universe of firms in the UK—the second largest private equity market worldwide. Our second contribution to this literature is to provide estimates of the magnitude of frictions in outside equity markets that can help explain the modest use of outside equity in these firms.

Finally, our work also relates to the literature on financial frictions and entrepreneurship (see Kerr and Nanda, 2009). Most of the rigorous evidence in this literature focuses on subsistence entrepreneurship in developing countries (e.g., De Mel, McKenzie and Woodruff, 2008). Yet a central question for policymakers is whether transformational ventures (see: Schoar, 2010; Levine and Rubinstein, 2013) indeed hold the potential for economic growth. We provide rigorous evidence on the returns to investment for the universe of young firms in the UK. Because our variation stems from changes in government programs, our work closely relates to papers such as Hombert et al, (2016) among others that explore the impact of public programs on entrepreneurship.

The rest of the paper proceeds as follows. In Section 1, we provide a detailed description of the data and document new stylized facts of young firms. In Section 2 we describe the institutional setting of the tax relief program in UK. We describe the empirical strategy in Section 3, present results in Section 4, and summarize a battery of robustness checks in Section 5. In Section 6 we explain our estimate of the sensitivity of young firm growth to outside equity. In the final section we conclude.

1. Data

In this section we summarize our data and variable construction; Appendix 1 provides further details. The main data source used in this study is the Financial Analysis Made Easy (FAME) database. FAME is provided by Bureau Van Dijk, and contains financial and ownership information for private and public incorporated companies in the United Kingdom (see Brav, 2009; Michaely and Roberts, 2011).

Our original extract from FAME encompasses a 6 year period from year 2009 to 2014. We retrieve information for private limited liability companies only, and exclude firm-year observations with missing or negative value of total assets. There is no survivorship bias in our sample: FAME reports historical information for up to 10 years, even if a firm stops reporting financial data. To mitigate the potential impact of outliers, we winsorize variables at the most extreme 1% in either tail of the distribution.

FAME coverage varies by financial account. Coverage of summary accounts from the balance sheet, such as total assets and book equity, is comprehensive. Instead, coverage of balance sheet accounts detailing asset and liability structure (such as plant, property and equipment and debt), or of profit and loss statement accounts (such as sales and employment), is generally poor. Differences in FAME coverage reflect differences in filing requirements across firms. While all firms are required to file balance sheet summary accounts, reporting of detailed balance sheet, and profit and loss statements is mandatory only for large firms (see Appendix 1).

We focus on equity issuances, and investment decisions of young firms. We measure these outcome variables using several balance sheet accounts with comprehensive coverage in FAME. We report equity ratios calculated as the ratio between the FAME accounts: shareholders' funds and total assets. To estimate equity issuances, we use two subcomponents of the capital and reserves account in the balance sheet: issued capital (called up share capital), and share premium account. Issued capital corresponds to the nominal face value of total outstanding shares. The share premium account corresponds to the difference between the value at which the shares were issued by the company and their nominal worth. We refer to the sum of these two accounts as *issued equity* throughout. Our main proxies for equity issuance are two: the year-to-year change in issued equity, $\Delta \textit{issued equity}$, and $D(\Delta \textit{issued equity} > 0)$, an indicator variable for positive changes in issued equity. For a detailed example on the construction of these proxies see Appendix 2.

We distinguish between inside and outside equity issuances (post-incorporation). Because firms do not make such distinction in their filings, our proxy of outside equity events is changes in the number of owners—i.e., new issued equity is classified as outside equity issuance if the number of owners increases. We also characterize the ownership structure of young firms. We distinguish between three types of owners: *Non-related owners*, *institutional owners* and *manager owners*. *Non-related owners* correspond to non-original owners (i.e., not listed in the firm's first available owners' register) whose last name differs from that of all original owners. *Institutional owners* correspond to any non-individual owner such as venture capital firms and equity crowdfunding platforms (if acting on behalf of participants, as SEEDRs in the UK is). Finally, *manager owners* are those who are also reported to be directors in Annual Return filings.

To measure non-equity capital issuances, we first estimate non-equity liabilities (liabilities henceforth) as the difference between total assets and shareholders' funds.² Non-equity capital issuances correspond to the year-to-year changes in liabilities, Δ *liabilities*.

For firms that disclose the structure of liabilities, roughly 15% of the sample (see Appendix 1), we measure year-to-year changes in three broad types of liabilities: Δ *outside debt*, Δ *inside debt*, Δ *operational liabilities*. Outside debt includes bank loans and overdrafts, leasing and other long or short term loans. Inside debt includes short- and long-term group and director loans, where group loans correspond to loans from parent companies, loans from subsidiaries or loans from non-director owners. Operational liabilities include all other liabilities such as trade credit and accruals.

Finally, we measure firm investment with the year-to-year changes in total assets: Δ *total assets*. In Sections 3 and 5, we also use logarithmic transformations of our outcome variables (e.g., $\Delta \ln$ (*total assets* + 1)) in order to mitigate the potential impact of outliers.

1.2. Stylized Facts about Young Firms Equity Issuance and Investment

We set the stage for the main analysis by providing stylized facts on equity issuance and investment for young firms. We restrict the observations to the 2009-2011 period prior to the SEIS launch. We only keep young firms that were incorporated from 2009 onwards (i.e., within 3 years of incorporation) and for which we have information the year of incorporation.³ Young firms amount to 50% of the universe of private limited liability firms (428,037).

Table 1 presents summary statistics for young firms. Panels A and B present, respectively, median values and interquartile ranges of key variables at incorporation, and during subsequent years during which firms issue new equity.⁴ Figures 2 and 3 plot the industrial and regional distribution of the sample. We use the North American industry classification system (NAICS) at the two-digit and four-digit levels, and the Nomenclature of Territorial Units for Statistics (NUTS) codes of the United

² This estimate equals the sum of current liabilities and long-term liabilities for the 95% of firms in our original data extract that explicitly report non-equity liabilities.

³ If no filings are available the year of incorporation, we use the filings of the next calendar year. Firms with no filings for the first two years after incorporation (inclusive) are dropped from the sample.

⁴ We choose to report medians and interquartile ranges, rather than the more traditional combination of means and standard deviations, because of outliers. For reference: the interquartile range in a normal distribution corresponds to 1.34 standard deviations.

Kingdom. For ease of reference, we sort the data in the figures in terms of increasing frequency or value of the variables.

Panel A in Table 1 shows the median young firm has £8,076 of total assets (Column 1) at incorporation. Firm size is, however, largely heterogeneous: the interquartile range in the value of assets is £36,197. Median equity value is £100 at incorporation, and also heterogeneous: the interquartile range equals £4,389. The relatively small median equity value (compared to the median value of assets) may appear surprising. However, it is at least partly explained by regulation: in contrast to other countries (e.g., Denmark), the UK requests no minimum capital for firms. Notwithstanding, the median equity ratio is 0.34. It compares to the median equity ratio of 0.27 for European private firms (cf., Bethmann, Jacob and Muller, 2016)⁵, to the average equity ratio of 0.36 for US entrepreneurial firms in the Kauffman Firm Survey (cf., Robb and Robinson, 2015), and to the average equity ratio of 0.4 for US public firms (cf., Graham, Leary and Roberts, 2015). The modest value of the equity ratio points to the importance of non-equity liabilities for young firms, despite their low tangibility ratios (Panel A shows the median tangibility ratio at incorporation is 0.00). This new stylized fact complements recent work on the prevalence of leverage in corporations (e.g., Robb and Robinson, 2015; Graham et al., 2015).

The majority of young firms are in service-related industries as shown in Figure 2. The top two NAICS2 industries are Professional, Scientific and Technical Services (Panel A; 17.6%) and Administrative Waste Management Remediation Services (17.1%). The distribution of young firms compares to that of small businesses in US (Panel B): fifteen of the top 40 NAICS4 industries are among the US top 40 industries with the largest shares of small business (cf., Hurst and Wild, 2011). Young firm characteristics at incorporation are heterogeneous across industries (Panels C-F). The median equity ratio at incorporation ranges from 0.07 for Transportation and Warehouse, to 0.54 for Management of Companies and Enterprises (Panel D). Less than half of 20 NAICS2 industries have

⁵ Table 3 in Berhmann et al., (2016) reports the median leverage ratio of 0.7279, calculated as the ratio between total liabilities and total assets. We report the equity ratio defined as 1 minus the leverage ratio. Table 4 in Robb and Robinson (2015) reports average: owner equity, outsider equity, total financial liabilities and trade credit. We estimate the equity ratio as the ratio between the sum of owner equity and outside equity, and the sum of total financial liabilities and trade credit. In contrast to our sample of limited liability firms, the sample of Robb and Robinson also includes sole proprietorship, partnerships and corporations. Data from Graham, Leary and Roberts (2015) correspond to the 2010 equity ratio reported in Figure 2, and defined as 1 minus the leverage ratio (total liabilities over total assets).

positive median tangibility ratios at incorporation; the highest tangibility ratio is for Agriculture at 0.18 (Panel E).

Young firms concentrate in London (26.3%), followed by South East England (16.0%) and North West England (10.0%) as shown in Figure 3 (Panel A). Median equity ratios are relatively similar across regions ranging from 0.24 in Yorkshire and The Humber to 0.46 in London (Panel C); although median tangibility ratios are only positive in East Midlands, North East and North West of England and Yorkshire and The Humber (Panel D). The median number of owners is 2 across most regions except in London, and North UK, where the median is 1 (Panel E).

1.2.1. Equity Issuances and Investment: the Outside Equity Multiplier

We now present new stylized facts about (post incorporation) equity issuance by young firms. In addition to their descriptive value, these results provide a context for the subsequent analysis.

The first new stylized fact is that outside equity issuances are very rare events among young firms as shown in Panel B of Table 1. Only 0.30% of all young firms issue outside equity within 3 years after incorporation (1,148 firms). Relative to inside equity rounds post-incorporation, outside equity rounds are also less common: they amount to 23% of all new equity rounds for young firms. This modest use of outside equity is consistent with survey evidence: outside equity corresponds to 2% of financing sources in surveyed small and medium sized firms by the UK Finance Monitor (British Business Bank, 2017). It is also consistent with theory: outside equity is the most expensive source of funds in capital structure models of agency conflicts and information asymmetries (Jensen and Meckling, 1976; Myers and Maljluf, 1984; Myers, 2000).

The second new stylized fact is that substantial heterogeneity exists in investment responses from outside, relative to inside equity issues (Columns 3 and 2). The median investment ratio for outside equity issuances is 4.19, which is statistically higher than the investment ratio of 1 for inside issuances (Column 7). The main implication is that outside equity has a “multiplier effect”: for every pound of outside equity issued by young firms, roughly four pounds are invested in assets. This multiplier effect is consistent with the pattern exhibited in Figure 1: high-growth young firms in the 99th percentile of asset growth have disproportionately more outside owners than all other firms.

The multiplier effect points to a large complementarity between outside equity and other funding sources in young firms. This complementarity is consistent with theories of financial frictions. In models of agency conflicts, large equity stakes by insiders are necessary to align incentives. Otherwise, the desire to consume private benefits of control may increase, and enough effort may not be provided. In this context, the optimal financial contract may not be straight outside equity, but rather, convertible debt (Gompers, 1993). Similarly, in models of information asymmetries, convertible securities can be more efficient screening mechanisms: the downside discipline of the debt portion makes the deal unattractive to low quality entrepreneurs.

No causal relationship between young firm growth and outside equity can be established based on these stylized facts alone. Panel A in Table 1 shows that outside equity issuers are different from inside equity issuers at incorporation (Column 12). Thus, one potential explanation for the association between young firm growth and outside owners, is that firms with high-growth potential seek new owners to finance projects that only accrue cash flow in the longer run. Alternatively, outside equity owners may also add substantial value to young firms (cf., Sorensen, 2008; Kerr, Lerner and Schoar, 2014). In the rest of this paper, we exploit a tax relief program in the UK to establish a causal link from outside equity to young firm growth. For estimation, we exploit differences in access to such relief across young firms of different sizes. In the next section we provide a background of the tax relief, and in Section 3 we explain our methodology in detail.

2. Tax Relief for Individual Investors in Young UK Firms

The UK government has several programs to subsidize capital for young firms. Annually, £13 billion are spent on such programs, more than the fiscal budget of the police and close to the universities' budget (Hughes 2008). Our focus is on the Seed Enterprise Investment Scheme (SEIS), the newest of such programs, which was launched in 2012. We now present a summarized overview of this tax relief program. For further details see Appendix 3.

SEIS is a tax relief program for investors who purchase new full-risk ordinary shares in young firms—i.e., the relief is not available for convertible equity or preferred shares. SEIS was launched in 2012 and offers investors a three-way subsidy. First, income tax relief on 50% of the investment (e.g., for every £100 invested, investors get £50 back). Second, capital gains and inheritance tax exemption

(e.g., for every £100 pounds in after-tax profits, investors receive £139 through the SEIS). Finally, a more generous loss relief against income at the income tax rate (on average 45%), rather than against capital gains at the capital gains tax rate (28%) (e.g., for every £100 pounds in after-tax losses, investors lose only £76 via the SEIS).

Eligible investors include *outside individuals* who at any time from the company's incorporation date to the third year anniversary of the SEIS issuance have no "substantial interest" in the company—i.e., possess (or are entitled to acquire) no more than 30% of voting and ownership rights in the firm. These outside investors, as well as their business associates, cannot be employed by the firm (except as directors) or any of its subsidiaries (after the SEIS shares are issued).⁶

Eligible firms correspond to sufficiently young and small (unquoted) businesses: that have been trading for less than 2 years and with gross assets not exceeding £200,000 before the share issue.⁷ These firms roughly correspond to 25% of UK firms and amount to circa 3.2M businesses (during the 2009-2014 period). Additional requirements include a permanent establishment in the UK, fewer than 25 employees, and independence: cannot be controlled by another company and must be in control of any subsidiaries.

Investors must hold-on to the shares for a period of at least three years (and of up to five years after which tax exemptions and loss relief expires), and cannot receive any compensation from the firms (such as a loan or wage).⁸ Individuals can claim a maximum of £50K annually in tax relief through the scheme (i.e., relief is available at 50% of the cost of the shares, on a maximum annual investment of £100K). The relief is given by way of a reduction of tax liability, providing there is sufficient tax liability against which to offset it.

Companies must use the funds raised through the program for the purposes of a *qualifying* business activity within 2 years. A qualifying activity need not be investment related; for example, firms can choose to spend the funds in activities such as marketing. The SEIS rules only specifically require

⁶ The definition of associates does not include siblings.

⁷ There is no limit on assets after the issue. Where the SEIS company has subsidiaries, these limits apply to the total assets of the group. All forms of property that appear on the company's balance sheet are treated as assets for the purpose of this rule, and HMRC will normally determine the value of the company's assets by reference to the values shown on the balance sheet.

⁸ There is no relief for dividend taxes.

the funds to be “spent”—they must be paid out to independent, unconnected third parties for commercially supplied good or services. Companies can raise a maximum of £150K under SEIS in any three-year period.⁹ A share issue under SEIS can be followed with further issues of shares under SEIS or the Enterprise Investment Scheme (EIS)—a similar tax incentive for medium sized firms with at most £15M in gross assets (see Section 5.3). However, at least 70 per cent of the monies raised by the SEIS must have been spent before the new issue.

The SEIS is not unique to the UK: several European countries have similar programs including, Spain, Portugal, Finland, Belgium, France, Germany and Netherlands. Young firms as well as UK investors are likely aware of the program. While it launched on 2012, the SEIS is actually an extension of the Venture Capital Scheme, which has been offering tax incentives for equity investors in small UK firms for more than 20 years through the EIS. In addition, the government has aggressively advertised this initiative. For example, during its launch, the government partnered with Telefonica and sent all users of this mobile company a text message inviting people to learn more about the SEIS. Crowdfunding equity platforms such as SEEDRs and Crowdcube have also aggressively advertised the incentive. These platforms run educational campaigns about the tax relief. They also encourage user-businesses to advertise their SEIS (and EIS) eligibility in these sites in order to attract individual investors. Finally, business angels themselves claim to extensively use the tax relief programs. A recent report on business angels in the UK found that circa 90% of surveyed angels invested through the EIS or SEIS, and almost 80% of the total investments in angels portfolios were made under these schemes with over half (55%) investing in EIS and a quarter (24%) in SEIS (ERC, 2015a). One investor went as far as saying “I give myself a specific amount of money to invest each year and that sum is related to tax thresholds under the current Government schemes to encourage investment¹⁰”.

We estimate the potential equity capital pool from the SEIS tax relief amounted to £1.8 billion in 2012. We summarize our estimation in Table 2. We use three assumptions regarding the participation rate, and value of private equity, based on the distribution of the UK population across annual income thresholds. First, only “high-income” individuals—i.e., those with (annual) incomes above £100K—

⁹ SEIS is a form of state aid under EU rules.

¹⁰ See <http://www.enterpriseresearch.ac.uk/nation-angels-assessing-impact-angel-investing-across-uk/>.

buy shares in (third-party) private companies. Second, among these high-income individuals, the private equity participation rate is 25%. As reference, households with positive financial wealth in the US (roughly 83% of households in the Panel Study of Income Dynamics), had a stock market participation rate of 44% in 1994 (Vissing-Jorgensen, 2002). Third, the investment rate is constant across income thresholds, and equals 10% of the lower limit in each income threshold—e.g., the investment value of private equity participants with incomes in the \$150K-\$199K threshold is \$15,000.

In practice, £433 million of funds have been approximately raised through the scheme since its launch.¹¹ In 2013 alone, funds (number of investments) raised through SEIS amounted to £140 million (2,000) as shown in Figure 4. Relative to the estimated capital pool in Table 2 this amount appears modest. Relative to the size of the private equity market in the UK this amount is more sizable. It corresponds to roughly 2.3% of the value of venture capital investments, which in 2013 totalled £6,000 million (Figure 4; British Business Bank, 2016).

2.1. Example SEIS subsidy

In this section we set ideas about how the SEIS subsidizes the cost of outside equity using a simple example. A summary is provided in Table 3.

Assume an “outside” individual invests £100 in a firm that has no debt and that generates a profit in 3 years of £10 or -£10. Assume also that the investor sells his shares after the 3-year period for a price that reflects the realized profits: £110 or £90, respectively. Finally, assume the individual has an income tax liability (capital gains tax liability) above £100 (£2.8). The capital gains tax is 28% and the income tax rate is 45%.

Before the SEIS, the after-tax return on the investment would equal $\frac{(110-100) \times (1-0.28)}{100} = 0.07$ and $\frac{(90-100) \times (1-0.28)}{100} = -0.07$, in the case of positive and negative profits, respectively.

With the SEIS, the after-tax return on the same equity investment increases on three accounts. First, the outside investor would need to disburse only £50 to make the same £100 investment as, via the deduction on the income tax liability, the government effectively provides a matching scheme.

¹¹ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/562937/October_2016_Commentary_EIS_SEIS_National_Statistics_final.pdf.

Second, if profits are positive, the investor is exempt from taxes on capital gains. The after-tax return with SEIS would equal $\frac{50+(110-100)*(1-0)}{100} = 0.60$, which corresponds to an extra 53p per invested pound relative to the no-SEIS-relief case. Third, if profits are negative, losses can be offset against income tax at the marginal rate, rather than against capital gains and at the capital gains tax. Thus, the after-tax return would equal $\frac{50+(90-100)\times(1-0.45)}{100} = 0.45$, which corresponds to an extra 52p per invested pound relative to the case with no SEIS relief, effectively turning the loss into a capital gain.¹²

3. Empirical Strategy

Our empirical strategy uses the launch of the SEIS program as a source of variation in the cost of outside equity for young firms. To identify the effect of outside equity on growth, we exploit cross-sectional variation in access to the SEIS across young firms of different size. In this section we describe the analysis sample and the empirical methodology. Results are summarized in Section 4.

3.1. Sample

We classify firms in 2011 into two groups: automatic qualifiers and non-eligible firms, according to their total assets reported in 2011—below or above £200K (and above £100K and below \$300K), respectively. We restrict the analysis sample to young firms that are alive in 2012 and reported assets in 2011 ranging between £100K and £300K. There are 28,641 automatic qualifiers (129,351 firm-year observations) and 11,169 non-eligible firms (51,174 firm-year observations) in our final sample (39,810 firms in total).

The restriction on firm size allow us to focus on firms close to the qualifying asset threshold during the SEIS launch. For these firms, it is plausible that no differential trend in investment opportunities across automatic-qualifiers and non-eligible firms exists. However, because the choice of bandwidth is somewhat arbitrary we make sure results are robust to alternative sample restrictions (See section 5.2).

Table 4 presents summary statistics for the main sample used in the analysis. We report firm-year characteristics in the table. The average firm in the analysis sample has average beginning-of-period assets in 2012 of £167,902. The firm's book value of equity, total assets, and liabilities amount

¹² For more examples see: <https://www.crowdcube.com/pg/eis-tax-relief-for-investors-44>.

to £53,732, £210,435, and £164,490, respectively. The average firm has 2 owners and is 6.32% likely to issue new equity in a given year.

Panel A in Figures 2 and 3 show that the industry (at the NAICs 2-digit level) and regional distribution of the sample is comparable to that of the universe of young firms in 2011. Relative to the universe of young firms, the sample concentrates slightly more in Construction (10.9% vs 10.0%), Transportation (8.0% vs 6.4%), Health Care (5.9% vs. 4.5%) and Manufacturing (5.2% vs. 3.8%), and less in Professional Services, (16.0% vs.19.1%) and Administrative Services (15.4% vs. 18.89%). The sample is also more concentrated in London (26.4% vs. 23.1%), and thus regions such as South West England (7.1% vs. 8.3%), Yorkshire (6.1% vs. 6.6%), East Midlands England (5.5% vs 6.3%) and Scotland (5.2% vs. 5.9%), are slightly underrepresented in the regression analysis.

3.2. Methodology

We compare equity issuances and investment trends across automatic qualifiers and non-eligible firms by estimating the following type of *difference-in-difference* equation:

$$(1) k_{it} = \alpha_i + \gamma_t \times Industry FE + \beta Small_i \times Post_t + \varepsilon_{it}$$

where $Small_i$ is an indicator variable of automatic-qualifiers and $Post_t$ is a dummy equal to one in the years 2012-2014. We control for heterogeneity across firms, years and industries, using firm fixed effects, α_i , and including separate year effects for each industry using the 5-digit 2007 SIC classification.¹³ Industry controls are important given the large heterogeneity in outside equity issuance (Panel G, Figure 2). The standard errors in all regressions are adjusted for heteroskedasticity and clustered at the firm level.

The coefficient of interest in (1) is β , which measures the average change in the outcome variable (k_{it}) after the SEIS launch for automatic qualifiers, relative to bigger firms that did not qualify to the tax incentive program in 2012. We expect a positive β .

This difference-in-difference methodology identifies the causal effect of the cost of outside equity on firm outcomes as long as two assumptions are satisfied. First, firms did not manipulate SEIS

¹³ Results are unchanged in we use the NAICS4 classification.

eligibility status during the program's launch in 2012. Second, both, automatic-qualifiers and non-eligible firms, would have evolved similarly in the absence of the tax relief program.

Two facts suggest the first assumption is likely satisfied. First, firms have limited scope for eligibility manipulation. Qualification in 2012 depended on total assets reported 1 year prior to SEIS' launch, and, while there was an active discussion about the launch of the program prior to 2012, there was uncertainty about its final approval, and the exact level of the qualifying threshold was not known by the public beforehand. Second, the SEIS eligibility threshold is not a standard restriction for participation in other subsidy programs, hence concerns regarding other potential sources of sorting at the threshold are mitigated.¹⁴ We formally test the first assumption in Figure 5: the distribution of total assets in 2011 appears continuous at the eligibility threshold of £200K. The McCrary test gives a discontinuity estimate (log difference in density height at the eligibility threshold) of 0.07 with a standard error of 0.05, insignificantly different from zero (See McCrary, 2008). In the robustness section 5.1, we deploy two groups of tests for the second identification assumption.

Other potential methodological concerns include: bandwidth choice, misspecification of eligibility due to our reliance on only assets thresholds rather than also on employment numbers, and eligibility changes of control firms after the relief launch. In robustness section 5.2, we discuss in more detail these issues, and show suggestive evidence against their empirical relevance.

Finally, one last issue regards the interpretation of results. As is well-known, measuring the *aggregate* impact of policies with difference-in-difference estimates is challenging as control firms may also be affected by the tax relief. For example, equity issuance by small firms may crowd-out equity issuance of non-eligible companies. Partially because of these limitations, an evaluation of the SEIS relief is not our main objective. Rather, our aim is to use SEIS as an exogenous source of potential differential growth in outside equity issuance *across* different types of firms, and trace whether there is in practice a corresponding differential growth in investment. We return to a discussion of this interpretation issue in Section 6, where we estimate the implied *aggregate* investment sensitivity to the cost of outside equity.

¹⁴ Examples of these programs include several investment funds administered by the British Business Bank: Enterprise Capital Funds (early-stage venture capital) and VC Catalyst Fund (later-stage venture capital).

4. Results

Table 5 summarizes results from estimating equation (1). Panel A presents estimates based on the main outcome variables. Panel B presents estimates using logarithmic transformations of the continuous outcome variables to mitigate potential impact of outliers. Panel C presents results after collapsing the data to two observations per firm (one before and one after the SEIS launch) in order to mitigate inconsistency in standard errors from potential serial correlation in outcomes (cf., Bertrand, Duflo and Mullainathan, 2004). In each panel, the outcome variables are indicated on top of each column.

4.1. Equity

The relief had a modest take-up rate among eligible firms as shown in Table 5. The probability of an equity issuance by young and small firms, relative to non-eligible firms, increased by 0.01 after the SEIS launch (Column 1, Panel A). Since outside equity issuances are rare events among young firms, this modest take-up rate corresponds to a 16.67% over the sample mean (0.06). Relative to a neoclassical benchmark of 100% response rate, the estimated take-up rate of 1% appears low. The take-up rate is nevertheless consistent with official statistics: 4,775 individual companies have received investment through the scheme since its launch, which roughly corresponds to 1% of young firms (Table 1).

Column 2 shows the average equity issuance increase is £1,795. This estimate is sizable: it represents a 128% increase over the sample mean of £1,401. Relative to the maximum subsidy of £150K the estimate seems low, but this is an artefact of the modest take-up rate. To get a better sense of the size of the equity issuance conditional on take-up, we estimate a conditional issuance using the ratio between the coefficients in columns 2 and 1. The table shows that *conditional* on issuing new equity, eligible young firms issued on average £145K in equity after the SEIS launch.¹⁵ The average conditional issuance roughly equals the maximum subsidy value and has a 95th confidence interval ranging between £53K and £514K (estimated using bootstrap; Efron, and Tibshirani, 1986).¹⁶ Panels B and C show the

¹⁵ We divide the estimate in column 2 by the estimate in column 1: results are presented in the “Conditional Coefficient” row in the table. Standard errors are calculated using clustered bootstrap.

¹⁶ This average conditional equity issuance is consistent with official statistics: since its launch, investments of over £50,000 have contributed to 85% of the total amount of SEIS investments raised, and the average investment in 2014 was £77,000. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/562937/October_2016_Commentary_EIS_SEIS_National_Statistics_final.pdf

estimated equity response is robust to using logarithmic transformations and collapsing the data to two observations per firm, respectively.

Column 3 confirms the equity issuance corresponds to outside equity: the number of new owners increases 100% over the sample mean. This increase is as expected: the tax incentive is only available to outside investors that do not hold a substantial interest in firms (see Section 2). The conditional coefficient, although noisy, implies that conditional on issuing new equity, eligible firms increase the number of owners by 5 on average. This increase in number of owners is also roughly consistent with official statistics: on average, 4 investors claimed SEIS tax relief per firm raising funds through the scheme in 2014.¹⁷

The equity response is consistent with models of financial frictions. The modest take-up rate reflects how the relief is not enough to compensate the agency and information asymmetry costs for the majority of young firms. A host of other potential explanations, such as general market underdevelopment or real frictions, can help explain the modest participation rate. Similar to US, private equity markets in UK exhibit high search costs and are illiquid. Crowdfunding equity platforms are at their infancy, entry costs to business angel networks remain high, and no formal secondary markets exist. A 2010 study by Nesta estimated the average time to exit from a UK VC investment in 2009 at 5.7 years.¹⁸ Finally, high adjustment costs, investment irreversibility or investment “lumpiness”, may limit the degree to which firms react to changes in the user cost of capital (see Caballero 1999).¹⁹ In the most extreme, it is possible that at least some young firms have no profitable investment opportunities. The main implication is that neoclassical models have limited ability to explain behaviour in young firms.

4.2. Investment

¹⁷ The total number of investors that claimed income tax relief for SEIS in 2014 was 8,150. Total number of firms that raised funds through the scheme in 2014 was 2,290.

¹⁸ The study also showed that the time to exit has been on the rise since 2001, reflecting in part increasing lack of exit opportunities. Indeed, the likelihood of exit via an IPO fell significantly in the previous decade in both Europe and the USA, whilst the time-to-IPO increased (BVCA, 2013). Recent evidence for the US shows that investment holding period for business angels is 4.5 years on average, with the bigger wins commonly taking up 9 to 10 years to complete (Wiltmande and Brooks, 2016).

¹⁹ Further, firms may have exhausted all low-scale projects and have no growth opportunities other than some requiring extremely large investments which may require considerable due-diligence and monitoring, for which the skill and time of venture capital firms, relative to business angels, is a must. However, the incentive is restricted to individual investors.

We now turn to the focus of this paper: investment responses to outside equity issuances by young firms. Column 4 shows the relief elicited an average investment increase of £14,951, which corresponds to a 36.42% increase over the sample mean. Conditional on issuing equity, the increase in young firm investment exceeds £1.0 M. The implied outside-equity investment multiplier is 8.33, which is higher than the unconditional multiplier (prior to 2012) of 4.19 reported in Panel B of Table 1 (see Section 1.2.1). The investment multiplier is financed with issuance of non-equity liabilities, which increase 71% relative to the mean (column 6). The investment response is robust to using logarithmic transformations of outcomes and collapsing the data to two time periods per firm (Panel B and C in Table 5). Table 6 shows no differences in investment across eligible and non-eligible firms prior to the relief.

The outside equity multiplier is consistent with models of financial frictions. A combination of straight-equity and convertible debt can help outside investors mitigate agency and information asymmetry costs: insiders retain enough equity so as to offset desire to consume private benefits, and the debt-like portion of the deal provides a better screening device (Gompers, 1993). The outside equity multiplier is less consistent with explanations that hinge on market underdevelopment or real frictions: neither can explain why the multiplier is financed with non-equity liabilities. In addition, Figure 6 shows the average take-up rates for firms in the more liquid market of London are no different from other regions. Instead, take-up rates only appear substantially higher in North East England (Panel C), where financial markets are not particularly developed. Similarly, the highest take-up rate across industries is for mining—an industry where investment opportunities are typically lumpy.

4.3. Heterogeneity

We explore the heterogeneity of results in Table 7 by cutting the data across several firm level characteristics. This additional evidence is largely descriptive: firms' characteristics are endogenous to firms' innovation opportunities, and differences across subsamples are seldom significant. Nevertheless, it is suggestive of the economic forces behind capital structure decisions and investment behaviour in young firms.

Consistent with the predictions of financial frictions' models, Table 7 shows that the response is higher for firms where agency and information asymmetry costs are higher. Take-up rates are higher, and equity multipliers lower, for firms that prior to the relief had: individual outside owners (Panel A),

institutional owners (Panel B), and an owner managing the firm (Panel C). The scope of agency is highest among firms with no outside or institutional investors to whom new outside equity owners can delegate monitoring; and Ang, Cole and Wuh Lin (2000) show evidence of higher agency costs in firms where insiders, rather than outsiders, manage the firm. Also consistent with models of financial frictions, Panel D shows the take-up rate is basically zero in industries where private benefits of control are the main motivation behind business creation. This result is consistent with survey evidence: most respondents of the 2013 SME Journey Towards External Finance Survey revealed they “have concerns regarding equity finance, as they do not want to give up control of their business to third parties”. In Panel D, we classify industries according to the breakdown by industry of responses regarding the main driver of business creation in US as reported in Hurst and Pugsley (2011).²⁰

An alternative interpretation of the findings is that securing outside equity mitigates information asymmetries and allows firms to attract capital from third parties. For example, completing outside equity rounds can signal firms’ quality and lower the required loan rates asked by banks. Against this alternative explanation, Table 8 shows the bulk of the equity multiplier is not financed by bank-debt or other third-party debt, instead it is financed by group debt—i.e., loans from non-director owners (or from subsidiaries). One limitation of these additional results is potential self-selection into reporting detailed non-equity liabilities: only 1,151 firms do so, roughly 3% of firms in the analysis sample. Reducing this concern, Table 8 shows the estimated response to the scheme in the sample of reporting-firms is similar to that of the full sample (i.e., modest take-up rates, high equity multipliers), although it is no longer significant due to the small sample size.

Also against this alternative interpretation, Panel E in Table 7 shows similar take-up rates across high-tangibility and low-tangibility firms. Instead, the certification effect was the main driver behind

²⁰ According to Hurst and Pugsley (2012), companies in the finance and retail sector were statistically more likely to have people report non-pecuniary benefits as an important motive for starting an industry. Thus, we classify companies in these sectors as having a “non-pecuniary” business motivation. Two industries were the dominant reason to start a business was because of a desire to create a new product/service are manufacturing and wholesale trade. Thus, we classify companies in those industries as having a “growth” business motivation. Finally, the data in Hurst and Pugsley (2012) lack enough power to draw decisive conclusions about other industries. Hence, we classify companies in those industries as having “other” business start-up motivation.

the modest response, we would expect a higher response for the low-tangibility firms, which are more likely to have been rationed out of traditional credit markets.

In conclusion, the preponderance of evidence suggests that large complementarities exist between outside equity and other funding sources in young firms because agency costs and information asymmetry costs make outside equity prohibitively costly. Neoclassical models cannot explain the modest take-up rates, and real frictions' models make no capital structure predictions. Other market frictions such as illiquidity, and search costs also do not appear to be the main driver of the effects.

5. Extensions and Robustness Checks

Having estimated the investment response of young firms to the relief, we now provide in Tables 9 and 10 a battery of robustness checks using different controls, subsamples and specifications. We divide the robustness checks into three parts: potential identification issues, potential sample selection concerns, and potential setting limitations.

5.1. Potential identification issues

The main identification concerns in our empirical strategy are: (i) potential manipulation of SEIS eligibility in 2012 and (ii) violation of the so-called “parallel trends” assumption—i.e., treatment and control firms would have evolved similarly absent the SEIS relief. We discussed evidence against the first concern in Section 3.2. We now turn to the second concern.

The standard test for parallel trends in a difference-in-difference estimation, compares trends in outcomes across treatment and control firms during the “pre” period. Table 6 shows results from estimating a more flexible version of equation (1), where we include a full set of interactions between year dummies and the variable $Small_i$. The table shows no significant differences across treatment and control groups before 2012. However, because the SEIS relief is only available for firms that have been trading for less than two years, we can only estimate one pre-policy period (2011), and thus cannot compare pre-trends across treatment and control firms.

To address this concern with the standard test, we use complementary placebo and falsification exercises. First, we run 200 regressions where we randomly select a different threshold every time (between £600K and £800K, so as not to include any data from the actual analysis) and define treatment and control firms following an analogous approach to that of the main analysis. In particular, we restrict

the sample to firms with asset size in 2011 in a window of £100K in either side of the random threshold, and classify firms into automatic qualifiers and non-eligible if their assets in 2011 are below or above the random threshold, respectively. A summary of results are presented in Panel A of Table 9. As expected with randomly picked thresholds, we cannot reject the null of no effect (in either equity or investment) in more than 95% of the cases. These results suggest that our estimates are unlikely to be artificially created by differential trends in the data between firms of different sizes.

Second, we run a falsification test using older firms in our data. In particular, we replicate the analysis for companies with beginning-of-period assets in 2012 close to the £200K threshold but that are slightly too old to qualify for the SEIS program (i.e., registered in 2008). Panel B in Table 9 shows there is no significant change in equity issuance and investment across the smaller and larger of these older companies. These results suggest that our estimates are not artificially created by differential trends in the data between larger and smaller firms, as specifically defined with the £200K threshold.

5.2. Potential sample concerns

The main concern with the sample is that results may be sample specific—i.e., they hold only for the £100K bandwidth. To address this concern, in Panel C of Table 9 we show results continue to hold (statistically and economically so) in two alternative subsamples. A first sub-sample based on a £70K (instead of £100K) bandwidth around the threshold. Second, on a sub-sample based on an asymmetric bandwidth (£145K-£300K) that balances-out the treatment and control groups—i.e., there are 50% automatic qualifiers rather than the 71% of the main analysis sample. In unreported analysis, we also check results hold in a larger subsample based on a larger bandwidth £125K rather than £100K.

A second concern with the sample is that biases may arise from defining automatic-qualifiers based only on the asset threshold, rather than also based on number of employees—recall that SEIS eligibility is also based on employment numbers. For example, our low take-up estimates may be explained by misclassification of firms (across treatment and control groups) if very few companies with assets between £100K and £200K (our treatment group) actually qualify in terms of employment—i.e., have less than 25 full-time employees. Testing this concern is complicated due to data availability: less than 2% of firms in our analysis sample report employee numbers (which is why we define eligibility only in terms of assets in the first place) and selection biases (i.e., those firms that report

employees may have different investment opportunities from non-reporters). Nonetheless, we present suggestive evidence against this concern by taking advantage of the small sub-sample of 719 firms in our data that report employees in the pre-SEIS period. Panel D in Table 9 presents results from estimates of equation (1) on this subsample and defining $Small_i$ in terms of both the asset and employment eligibility thresholds. We find similar results (although not significant given the small sample size): take-up rates are actually lower at less than 1%.

A third concern with the sample are potential biases from “dynamic misclassification”. For example, our low take-up estimate may be explained by misclassification of non-eligible firms in 2012 that decrease their assets in later years in order to qualify (if they still can—which depends on the time they have traded). Against this concern, Panel E in Table 9 shows these “late qualifiers” do not drive the results: take-up estimates are unchanged after we drop these firms from the analysis (roughly 30% of non-eligible firms). We note that estimates from this subsample are nevertheless hard to interpret given selection concerns: firms with shrinking assets (strategically or otherwise) are likely to be different from others. For example, the table shows there is no significant effect on investment, but this is likely mechanical as all control firms (but not treatment ones) that decrease investment are by construction excluded from the sub-sample.

5.3. Potential setting limitations

The main concern with the setting is that results are setting specific. That is, the modest take-up we estimate is not due to costs of outside equity issuances but instead to lack of SEIS awareness, burdensome red-tape, or more generally, government aversion of tax payers and firms.

To present evidence against this concern, we extend the analysis to a similar tax relief program for mid-size firms in the UK—the Enterprise Investment Scheme (EIS). This extension is useful on two accounts. First, the EIS has been around for more than three decades, and is very popular, thus concerns of awareness and government aversion are mitigated. Indeed, since its launch in 1993, 24,625 individual companies have received investment through the scheme, and almost £14.2 billion of funds have been raised. Figure 4 shows that during the 2005-2014 period alone, 12,265 firms raised money using EIS (Panel A) for a total amount of £9.2 billion (Panel B). EIS users surpassed the 9,908 UK firms that

raised venture capital over the same period, and the funds they raised through the scheme roughly equalled 13% of venture capital investment.

Second, the two tax relief schemes are very similar. The main differences are three: coverage, size of tax relief, and relief caps for investors and firms. The EIS is available to unquoted firms with less than £15M in total assets that have fewer than 250 full-time employees.²¹ Relief is at 30% of the cost of the shares, rather than at 50% for SEIS investments. Maximum relief per individual investor in one year is £300K, and the maximum amount a firm can raise per year through the scheme is £5M.²²

To investigate whether the modest take-up is setting specific, we assess firms' response to the 2012 EIS extension for firms with assets between £7M and £15M. In 2011 the scheme was only available for firms with less than £7M in assets. While prior to 2012 a potential extension of the program had been discussed, the eligibility threshold was unknown before 2012. Consistent with this idea, Figure 7 shows the distribution of asset size in 2011 is continuous at the £15M threshold: the McCrary test gives a discontinuity estimate (log difference in density height at the eligibility threshold) of 0.04 with a standard error of 0.07, insignificantly different from zero (See McCrary, 2008).

Following the same idea behind our main methodology, we compare equity issuances and investment across newly eligible firms with assets in 2011 closely below the £15M threshold, to firms whose status remains unchanged during 2012 because their 2011 assets (closely) exceeded £15M. We consider a bandwidth of £2M, and restrict the sample to firms that were alive in 2012, and that had reported assets in 2011 between £13M and £16M in value. Summary statistics for this sample are presented in Panel A of Table 10.

We estimate the following type of *difference-in-difference* equation:

²¹ Eligible firms must also not be controlled by another company, must control all subsidiaries and must be carrying on a qualifying trade. The list of all qualifying trades can be found here: <https://www.gov.uk/government/publications/the-enterprise-investment-scheme-introduction/enterprise-investment-scheme>.

²² Companies are not allowed to raise more than £5M in total in any 12 month period from all the venture capital schemes, which includes the SEIS and EIS, and also Venture Capital Trusts. This limit must also take into account any other investment which the company has received in the relevant 12 month period that is deemed to be State Aid under any other scheme covered by the European Commission's Guidelines on State Aid to promote Risk Capital investments in small and medium-sized enterprises. See: <https://www.gov.uk/government/publications/the-enterprise-investment-scheme-introduction/enterprise-investment-scheme>

$$(2) \quad k_{it} = \alpha_i + \gamma_t \times \text{Industry FE} + \beta \text{Med}_i \times \text{Post}_t + \varepsilon_{it}$$

where Med_i is an indicator variable for firms with asset value in 2011 below £15M and all other variables remain the same as in equation (1). The standard errors in all regressions are adjusted for heteroskedasticity and clustered at the firm level. Results are summarized in Panel B of Table 10. We report results using only the logarithmic transformation of the continuous variables to mitigate the impact of outliers.

Column 1 and 2 show newly eligible firms are no more likely to issue new equity than non-eligible firms. Column 3 shows an increase in investment of eligible firms, which is likely explained by serial correlation in total assets: as shown in Column 6, the investment estimate is no longer significant after we collapse the data to two observations per firm (cf., Bertrand, et al., 2004). These additional results provide an external validity test within our UK setting. They suggest that the modest take-up we observe from SEIS is not explained by lack of awareness of the program or government aversion by firms and investors.

One final setting concern regards the potential gaming of the scheme. Stringent monitoring by the government (e.g., companies and investors are thoroughly checked for eligibility and the usage of the funds is scrutinized), lock-up periods, and restrictions on tax relief claims (e.g., the subsidy loss can only be claimed in the event of liquidation) likely deterred some obvious opportunistic behaviour by entrepreneurs. Yet gaming of the relief was certainly possible and cannot be fully ruled out. Against the relevance of this concern, however, results point to under-use rather than over-use of the relief. In addition, no cases denouncing abuse of the relief exist, which contrasts the experience of other countries with similar programs. Nonetheless, partly for this reason, and also given other limitations of the setting we refrain from stating any evaluation claims about SEIS. Such claims would require more detailed data on project choice, as well as a judicious treatment of potential spillover effects.

6. Estimating the sensitivity of young firm investment to the cost of outside equity

Having established a causal link between outside equity issuances and investment in young firms, we now answer the title of the paper and estimate the sensitivity of young firm investment to the cost of outside equity. Our aim in this section is to explore the macroeconomic consequences of financial frictions facing young firms.

For this exercise, we will purposefully ignore the large heterogeneity in eligible firms' responses we documented in Section 4, as is common in this type of exercises. Moreover, the calculation does not account for the separate potential impact of the tax relief on non-eligible firms given that our difference-in-difference approach only measures relative, rather than absolute changes.

The sensitivity corresponds to the ratio between the relief-implied average percentage changes in young firm investment and outside equity returns. In this section, we first estimate the percentage change in outside equity returns. Then, we combine the return response with the regression results of Section 4, which provide our estimate of the investment response. Next, we estimate a so-called neoclassical benchmark against which to compare our sensitivity estimate. Finally, we discuss external validity of our findings.

6.1. SEIS relief and the cost of outside equity in young firms

We estimate the relief roughly doubled (i.e., increased by 113%) after-tax returns for outside investors in eligible firms. To calculate this estimate, we first restrict the sample to automatic qualifiers (see Section 3). Then, we estimate the after-tax outside-equity returns *without* the relief. Next, we adjust the estimate to reflect the tax relief and estimate a counterfactual after-tax outside-equity returns *with* the relief. Results are summarized in Table 11.

After-tax outside investor returns *without* the relief average 0.06: absent the relief, outside equity investors in eligible firms receive 6p (net) for every pound in total assets on average. These returns correspond to the ratio between cash flow to equity holders and total assets for automatic qualifiers (See Table 3 and Section 2). Cash flow to equity holders amounts to after-tax profits (i.e., profits adjusted by capital gains tax). Most of the sample firms do not report income statements (they are exempt given their small size). For these non-profit-reporting firms, we measure annual profits as the difference in the Profit and Loss Account in the capital statement of the balance sheet (reported by all sample firms). Finally, we choose to use total assets rather than book equity as the ratio's denominator, because many sample firms have negative values of book equity. The distribution of so-constructed after-tax outside equity returns *without* the relief, is summarized in the first row of Table 11.

After-tax outside investor returns *with* the relief average 0.12: with the relief, outside equity investors in eligible firms receive 12p net for every pound in total assets, on average. We estimate this counterfactual return by adjusting the calculation of the equity cash-flows of the “without-relief” calculation in three ways. First, we add the income tax-rebate to the equity cash flow, making sure to keep track of the SEIS investment caps. In detail, we estimate the income tax rebate as 50% of the nominal value of issued equity if this value is lower than £100K, or as £50K otherwise, (recall that under SEIS, investors can claim a maximum of £50K in tax relief). Second, we deduct no capital gains tax from equity cash flows if profits are positive. Finally, we adjust the loss relief if profits are negative, making sure to keep track of the SEIS loss relief base caps. The loss relief base cap corresponds to 50% of the nominal value of issued equity or £50K, respectively, if the value of issued equity is below or above £100K. Hence, the loss relief corresponds to 45% of profits (rather than the no-SEIS value of 28% of profits), if the absolute value of profits is below the loss relief base cap. Otherwise, the loss relief equals the maximum between 45% of the loss relief base cap and 28% of profits. The second row in Table 11, summarizes the distribution of so-constructed after-tax outside equity returns *with* the relief.

The difference between after-tax outside investor returns with and without the relief is 0.06, which corresponds to a 113% increase in after-tax returns for outside investors in eligible firms.

6.2. The young firm investment sensitivity to outside equity: estimates and benchmark

We estimate the sensitivity of young firm investment to outside equity averages -0.16 as shown in Table 12. On average, young firm investment increases 1.6% in response to a 10% drop in the cost of outside equity. This sensitivity corresponds to the ratio between the response in investment and the response in outside equity returns to the relief. In section 4 we estimated investment increased 17% in response to the relief (Column 2 in Panel B of Table 5). In section 6.1., we estimated outside equity returns increased by 113% ($-0.16 = -0.17/1.13$).

On its own, this sensitivity is hard to interpret. Theory provides no prediction of the magnitude in the general case. Under the assumptions that outside equity is no different from any other source of capital, and that firms use Cobb-Douglas production functions, the elasticity in frictionless benchmark macroeconomic models is -1.

Empirically, this is the first paper to estimate the elasticity of young firm investment to the cost of outside equity. The numerous prior papers estimating the cost of capital sensitivity of investment seldom focus on young firms, and never on outside equity. The evidence from this prior work is mixed. The earliest time-series studies find interest rates play a modest role in investment spending (e.g., Bernanke, Bohn and Reiss, 1988 and Caballero, 1994). The more recent micro economic evidence points to a larger cost elasticity (e.g., Chirinko, Fazzari, and Meyer, 2001), especially for studies focusing on tax-related changes. For example, Cummins, Hassett, and Hubbard (1994), estimate user cost elasticities that range from -0.5 to -1. Finally, evidence from the Duke University/CFO Magazine Global Business Outlook survey of financial executives point to a low sensitivity. Sharpe and Suarez (2014) report that only 8% of firms indicate they would increase investment if borrowing costs declined by 100 basis points.

To better interpret the estimated sensitivity, we provide a simple neoclassical benchmark. In a neoclassical economy, young firm investment would increase by 7.9%, rather than by 1.6%, in response to a 10% drop in the cost of outside equity. To estimate this benchmark, we only modify the numerator of the elasticity calculation. We assume all eligible firms react as predicted by the neoclassical model: issue the maximum allowed equity of £150K and invest it in the firm. This investment would correspond to an increase of 89% relative to the mean value of total assets of £168K (in 2011), rather than the 17% we estimated in our regressions (Section 4; Column 2 in Panel B of Table 5).

A comparison between the actual and counterfactual sensitivities provides a measure of the economic cost of frictions facing young firms in UK. We estimate that in the absence of these frictions, young firms investment would have increased roughly 5 (i.e., $0.79/0.16$) times more in response to the tax relief. The lower response is entirely driven by a composition effect: while outside equity investment multipliers are substantial for relief-takers, the vast majority of firms do not increase investment in response to relief that would have doubled investors' returns.

6.3. External Validity

Is the UK special? What are the implications of this estimate for young firms more broadly?

UK is the most developed private market in Europe and worldwide is second only to the US. Outside equity issuances among young firms are therefore likely to be even rarer in all other economies,

except perhaps US. Thus, on this account, our setting likely underestimates the macroeconomic costs of frictions among young firms.

However, the UK is special in that it has been lagging behind other countries in terms of productivity over the last decade: other G7 countries are estimated to be 20% more productive than the UK (ONS, 2015; see also: Pessoa and Van Reenen, 2013). Interestingly, while the country performs relatively well in terms of creating new start-up businesses, it has traditionally been less effective in growing them. According to a recent OECD report (2014), the UK ranks 3rd among 14 OECD countries in terms of the proportion of young (i.e., less than 2 years old) start-up businesses. In contrast, it ranks 13th when it comes to the proportion of start-up businesses with 1-9 employees that grow to at least 20 employees within three years. A generous interpretation of our results is that the financial frictions in young firm growth are at the heart of the UK productivity slow-down (Hsieh and Klenow, 2014; 2009).

Regarding the sensitivity estimate, this is not the first paper to find that investment is unresponsive to changes in rates of return. As mentioned above, a large body of work finds low investment responses to changes in interest rates (see Caballero, 1999). Consistent with the modest reaction we find, Sharpe and Suarez (2014) report that *no* decline in interest rates would induce more investment for 68% of the firms in the Duke University/CFO Magazine Global Business Outlook survey.²³ Similar evidence is available from different contexts. For example, Goldstein and Udry (1999) find that only 18% of the land in Ghana is cultivate in pineapple despite de 1,200% returns they estimate. Duflo et al., (2003) finds that only 15% of maize farmers in Kenya use fertilizer despites estimated returns of 100%.

This is also not the first paper to estimate low-take of subsidies or lack of response to changes in incentives. There is widespread evidence that individuals and firms are generally unresponsive to tax changes (see Graham, 2008). Modest reaction to incentives have also been documented in different settings. For example Miguel and Kramer (2004) document a 57% entirely free de-worming program in Kenya.

²³ Among the most commonly cited reasons for insensitivity, firms mentioned investment decisions were based largely on product demand or long-term plans rather than on current interest rates. Only about 10% of firms providing a reason for insensitivity cited a lack of profitable opportunities.

7. Conclusions

This paper estimates the sensitivity of young firm investment to the cost of outside equity. To establish a causal link between outside equity and investment, we exploit differences across firms in eligibility to a new tax relief program for outside equity investors in the UK. We find that on average, investment increases 1.6% in response to a 10% drop in the cost of outside equity. This average conceals substantial heterogeneity: only 1% of eligible firms issue equity in response to a subsidy that would have doubled investors' returns. Conditional on issuing new equity, however, firms invest eight times the issued amount. The results imply a large complementarity between outside equity and non-equity liabilities in young firms.

We interpret the findings as suggestive of substantial financial frictions such as agency and information asymmetry costs facing young firms. In a frictionless market, all firms would have adjusted their investment until marginal productivity equals the cost of capital. If young firms only faced real frictions, no complementarity between equity and non-equity would arise. Consistent with this interpretation we show that take-up rates (equity multipliers) are higher (lower) where agency and information asymmetry costs are lowest.

Our results contribute to our understanding of the heterogeneity in young-firm growth. While the disproportionate contribution of high-growth young firms to economic growth is a well-established fact little is known about these firms' characteristics. We show high-growth firms are disproportionately more likely to bring outside owners into the firm within three years of incorporation. We also show a causal link between outside equity and growth. Taken together, the main implication of our findings is that the vast majority of young firms cannot fuel their growth with outside equity because the agency and information asymmetry costs they face make outside equity prohibitively costly. We estimate the macroeconomic cost of these frictions on young firm growth. Using a back-of-the-envelope calculation, we show the sensitivity of investment to the cost of outside equity would be at least 5 times in the frictions' absence.

References

- Almeida, H. and M. Campello, 2007, Financial Constraints, Asset Tangibility, and Corporate Investment, *The Review of Financial Studies*, 5, 1429-1460.
- Brav, Omer, 2009. Access to capital, capital structure, and the funding of the firm, *Journal of Finance* 64, 263-208.
- Bertola, Giuseppe and Ricardo J. Caballero, 1994, Irreversibility and Aggregate Investment, *Review of Economic Studies*, 61, 2, 223-246.
- BIS, 2014, Business Population Estimates for the UK and Regions 2015. Available at: <https://www.gov.uk/government/statistics/business-population-estimates-2015>
- British Business Bank, 2016, 2015 Business Finance Survey
- British Business Bank, 2016, Small Business Finance Markets, Available at: <http://british-business-bank.co.uk/wp-content/uploads/2016/02/British-Business-Bank-Small-Business-Finance-Markets-Report-2015-16.pdf>
- Caballero, R. J., 1994, Small Sample Bias and Adjustment Costs, *Review of Economics and Statistics*, 76, 52–58.
- Caballero, R. J., 1999, “Aggregate Investment,” in John B. Taylor and Michael Woodford, eds., *Handbook of Macroeconomics* (New York: Elsevier, 1999), pp.816–862.
- Caballero, R. J., E. M.R.A. Engel and J. C. Haltiwanger, 1995, Plant-Level Adjustment and Aggregate Investment Dynamics, *Brookings Papers on Economic Activity*, 2, 1-54.
- Chirinko, R. S., 1993, Business Fixed Investment Spending: A Critical Survey of Modeling Strategies, Empirical Results, and Policy Implications, *Journal of Economic Literature*, 31, 1875–1911.
- Chirinko, R. S., S. M. Fazzari, and A. P. Meyer, 1999, How Responsive is Business Capital to User Cost? An Exploration with Micro Data, *Journal of Public Economics*, 74, 53–80.
- Chirinko, R. S., S. M. Fazzari, and A. P. Meyer, 2004, That Elusive Elasticity: A Long-Panel Approach to Estimating the Capital-Labor Substitution Elasticity,” Working Paper Washington University in St. Louis.
- C, J.G., K.A. Hassett, and R. G. Hubbard, 1994, A Reconsideration of Investment Behaviour Using Tax Reforms as Natural Experiments, *Brookings Papers on Economic Activity*, 2, 1–59.
- Cowling, Marc, Bates, Peter, Jagger, Nick and Gordon Murray, 2008, Study of the impact of Enterprise Investment Scheme (EIS) and Venture Capital Trusts (VCT) on company performance, HM Revenue & Customs Research Report 44.
- Davis, S., Haltiwanger, J., Jarmin, R., Krizan, C.J., Miranda, J., Nucci, A. and K. Sandusky, 2007. Measuring the Dynamics of Young and Small Businesses: integrating the Employer and Nonemployer Universes” Working Paper no. 13266 NBER
- Dechezleprêtre, A., E. Einiö, R. Martin, K. Nguyen, and J. Van Reenen, 2016, Do Tax Incentives for Research Increase Firm Innovation? An RD Design for R&D, CEP Discussion Paper No 1413.
- de Mel, Suresh, McKenzie, David and Christopher Woodruff, 2008, Returns to Capital in Microenterprises: Evidence from a Field Experiment, *Quarterly Journal of Economics*, 123 (4): 1329-1372.
- Efron, B., and R. J. Tibshirani, 1986, Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy, *Statistical Science* (1), 54–77.
- Enterprise Research Centre, Goldman Sachs and British Business Bank, 2015a, A Nation of Angels: Assessing the Impact of Angel Investing Across the UK, Available at: <https://www.enterpriseresearch.ac.uk/wp-content/uploads/2015/01/ERC-Angels-Report..pdf>
- Enterprise Research Centre, Goldman Sachs and British Business Bank, 2015b, Unlocking UK Productivity—Internationalisation and Innovation in SMEs, Available at: <http://www.goldmansachs.com/citizenship/10000-small-businesses/UK/news-and-events/gew-2015-f/unlocking-uk-productivity.pdf>
- Evans, D. S. and Jovanovic, B. 1989, An Estimated Model of Entrepreneurial Choice under Liquidity Constraints. *Journal of Political Economy*, 97, No. 4, 808-27.
- Guiso, L., A. K. Kashyap, F. Panetta, and D. Terlizzese, 2002, How Interest Sensitive is Investment? Very (when the data are well measured), Working Paper, University of Chicago Graduate School of Business.

Jarvis, R., 2000, Finance and the small firm. In: Carter S, Jones-Evans D, editors. Enterprise and Small Business: Principles, Practice and Policy. Harlow: FT Prentice Hall; E2000. p. 337-353.

Haltiwanger, J., Jarmin R. and J. Miranda, 2012. Who Creates Jobs? Small vs. Large vs. Young, Working Paper no. 16300 NBER

Haltiwanger, J., Jarmin R. and J. Miranda, 2016. High Growth Young Firms: Contribution to Job, Output and Productivity Growth, US Census Bureau Center for Economic Studies Paper No. CES-WP-19-49

Hurst, E. and B. W. Pugsley, 2011, What Do Small Business Do? Brooking Papers on Economic Activity.

Michaely, R., Roberts, M. R. , 2011. Corporate dividend policies: Lessons from private firms, Review of Financial Studies 25, 711-746.

OECD, 2014, The Dynamics of Employment Growth: New Evidence from 18 Countries, Available at: http://www.oecd-ilibrary.org/science-and-technology/the-dynamics-of-employment-growth_5jz417hj6hg6-en

ONS, 2016, Economic Review, January 2016. Available at: <http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/rel/elmr/economic-review/january-2016/index.html>

ONS, 2015, International Comparisons of Productivity—First Estimates, 2014. Available at: <http://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/bulletins/internationalcomparisonsofproductivityfirstestimates/2015-09-18>

Perez-Gonzalez, F., F. Panier, and P. Villanueva, 2014, “Capital Structure and Taxes: What Happens When You (Also) Subsidize Equity?” Mimeo, Stanford GSB.

Pessoa, Joao Paulo Pessoa and John Van Reenen, 2013, The UK Productivity and Jobs Puzzle: Does the Answer Lie in Labour Market Flexibility? CEPR Special Paper No. 31.

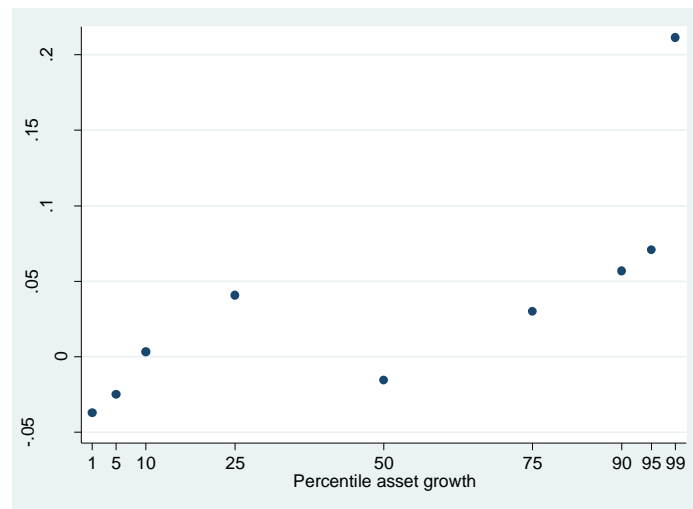
Robb, Alicia and David Robinson, 2016, The Capital Structure Decisions of New Firms, Review of Financial Studies.

Smith, J., 2008, That Elusive Elasticity and the Ubiquitous Bias: Is Panel Data a Panacea?, Journal of Macroeconomics, 30 (2), 760-779.

Vissing-Jorgensen, A. 2002. Limited Asset Market participation and the Elasticity of Intertemporal Substitution, Journal of Political Economy, Vol. 110, no.4

Vos, E., Yeh, AJY., Carter, S and S. Tagg. The happy story of small business financing. Journal of Banking & Finance 2007;31(9):2648-2672.

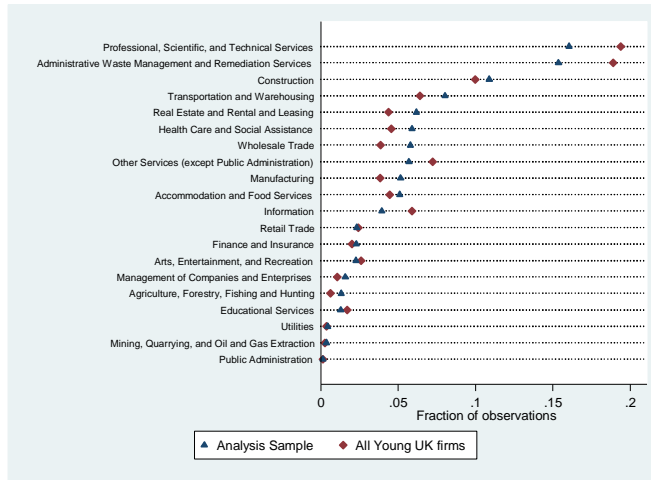
Figure 1—Growth and Number of Owners in Young Firms



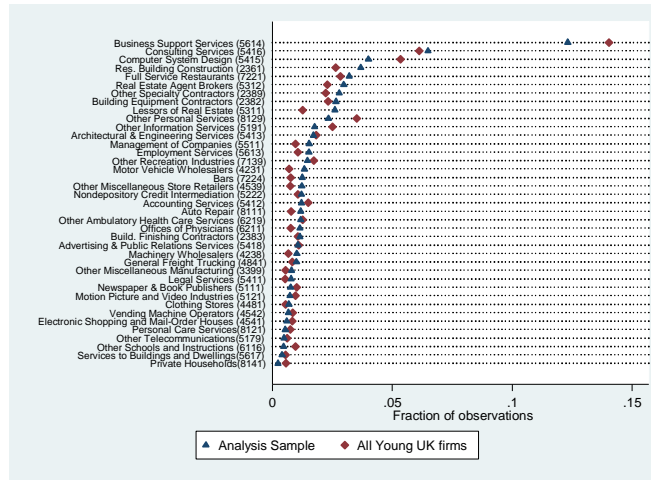
The figure plots the average 2009-2011 percentage change in number of owners against percentiles of asset growth, for all limited liability firms in UK incorporated in 2009 (170,907 firms). Change in number of owners corresponds to the difference between the number of owners in 2011 and the number of owners in the first register of owners as reported by firms to Companies House in their 2009 Annual Return (or 2010 if 2009 is not available). We classify firms according to percentile asset growth as measured by the difference between the value of assets reported in 2011 and the value of assets reported in 2009. For firms with no filings during 2009, we use the information filed in 2010. Firms with no filings during 2009-2010 are excluded from the sample.

Figure 2—Industry Distribution Young Firms 2009-2011

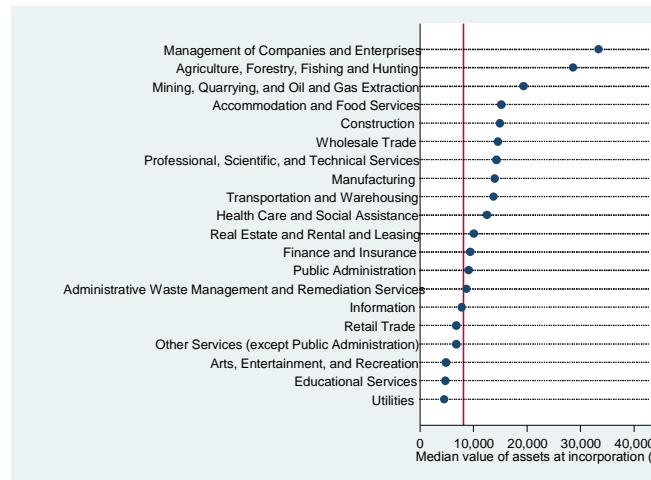
Panel A—Industry Distribution (NAICS 2-digit)



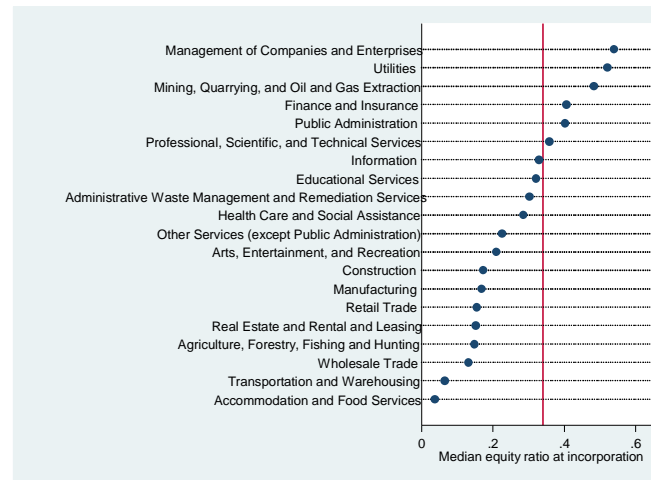
Panel B—Top 40 Industries (NAICS 4-digit)



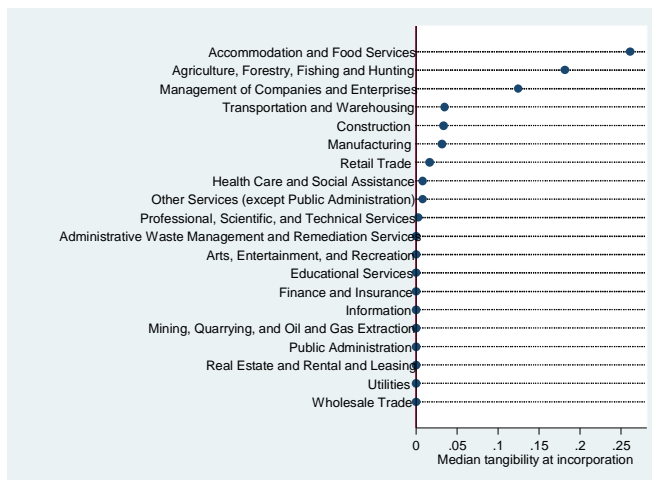
Panel C—Median Value Assets by Industry



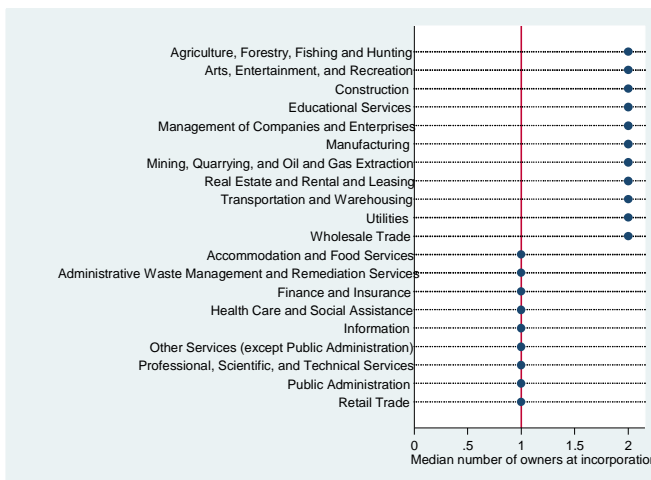
Panel D—Median Equity Ratio by Industry



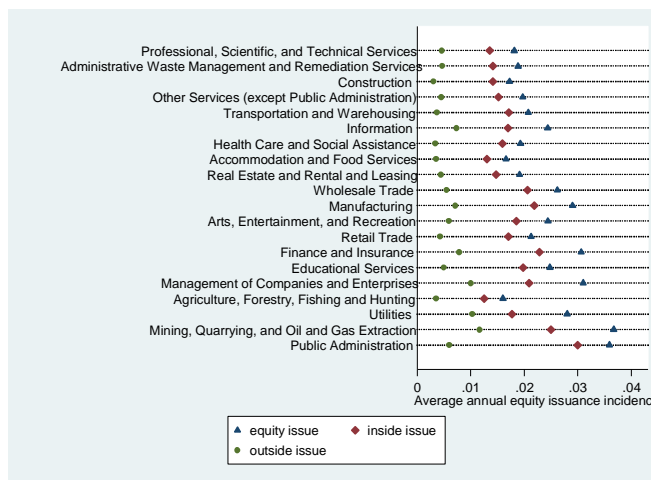
Panel E—Median Tangibility Ratio by Industry



Panel F—Median Number of Owners by Industry



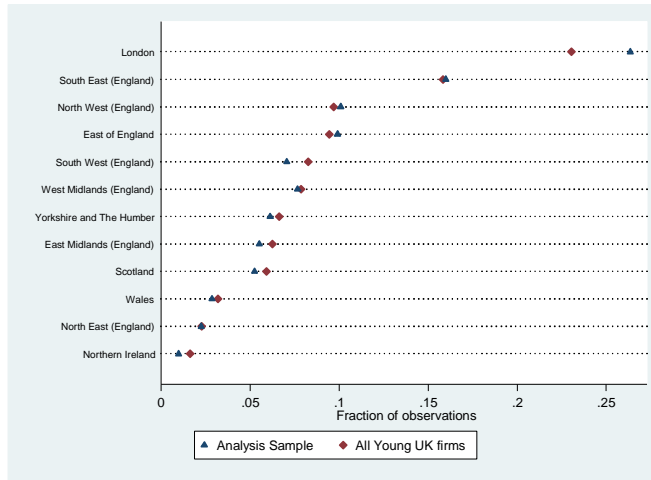
Panel G—Post-incorporation Average Annual Equity Issuance Incidence by Industry



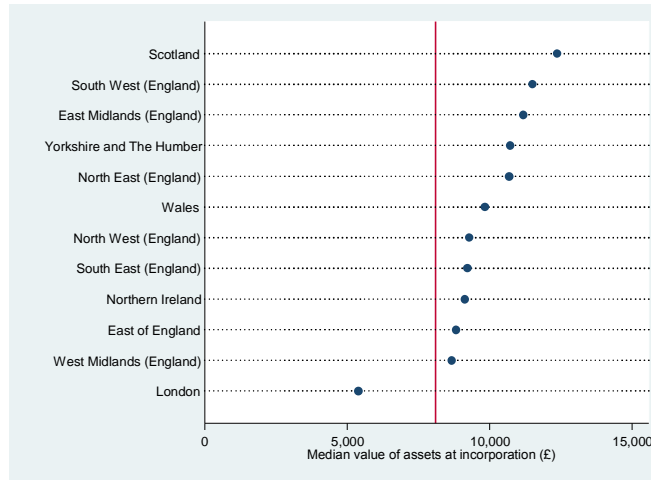
The figure shows the distribution of young UK firms across NAICS 2-digit (Panel A) and NAICS 4-digit industries (Panel B). Panels C-F plot, respectively, the medians at incorporation of asset value, equity ratio, tangibility ratio and number of owners, by industry. Panel G plots the average incidence of new equity issuances post-incorporation, by industry.

Figure 3—Regional Distribution Young Firms 2009-2011

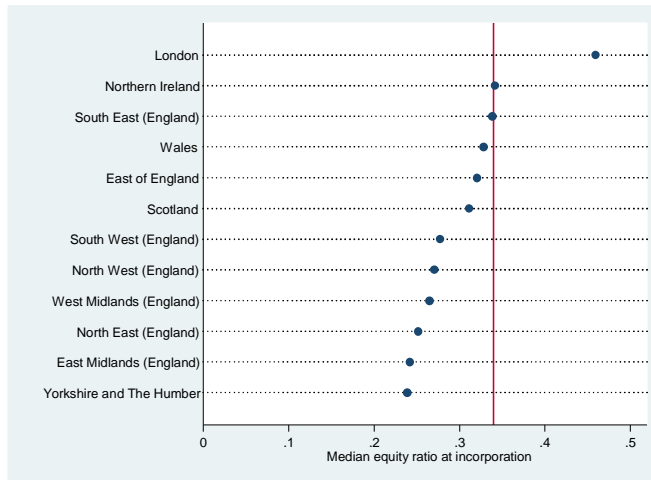
Panel A—Regional Distribution



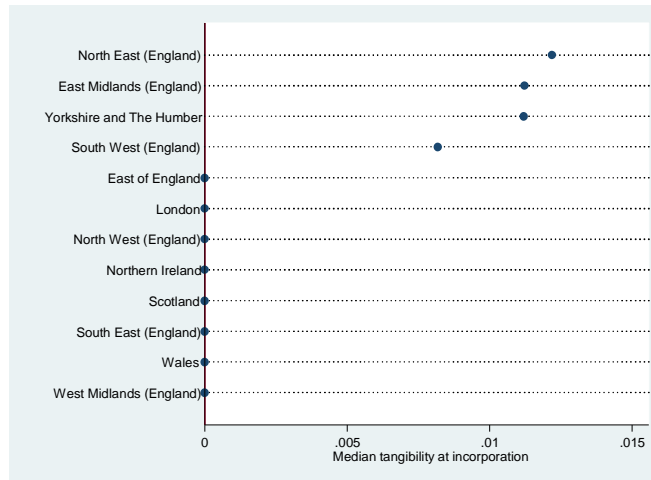
Panel B— Median Value Assets by Region



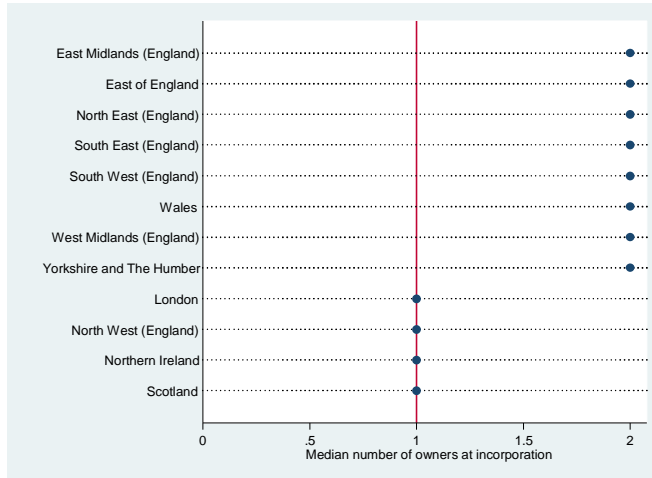
Panel C— Median Equity Ratio by Region



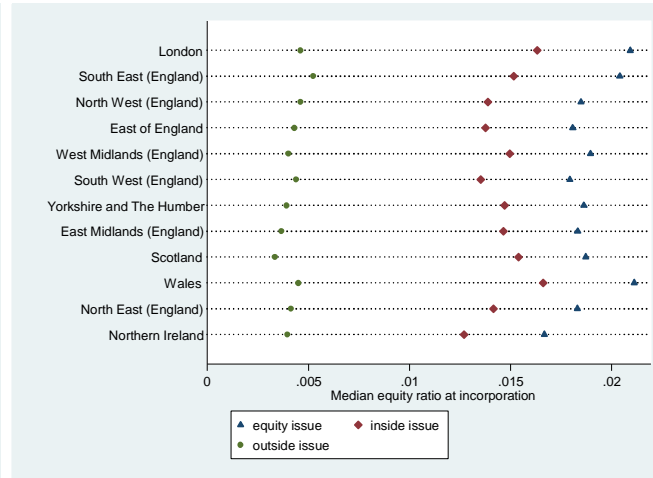
Panel D— Median Tangibility Ratio by Region



Panel E— Median Number of Owners by Region

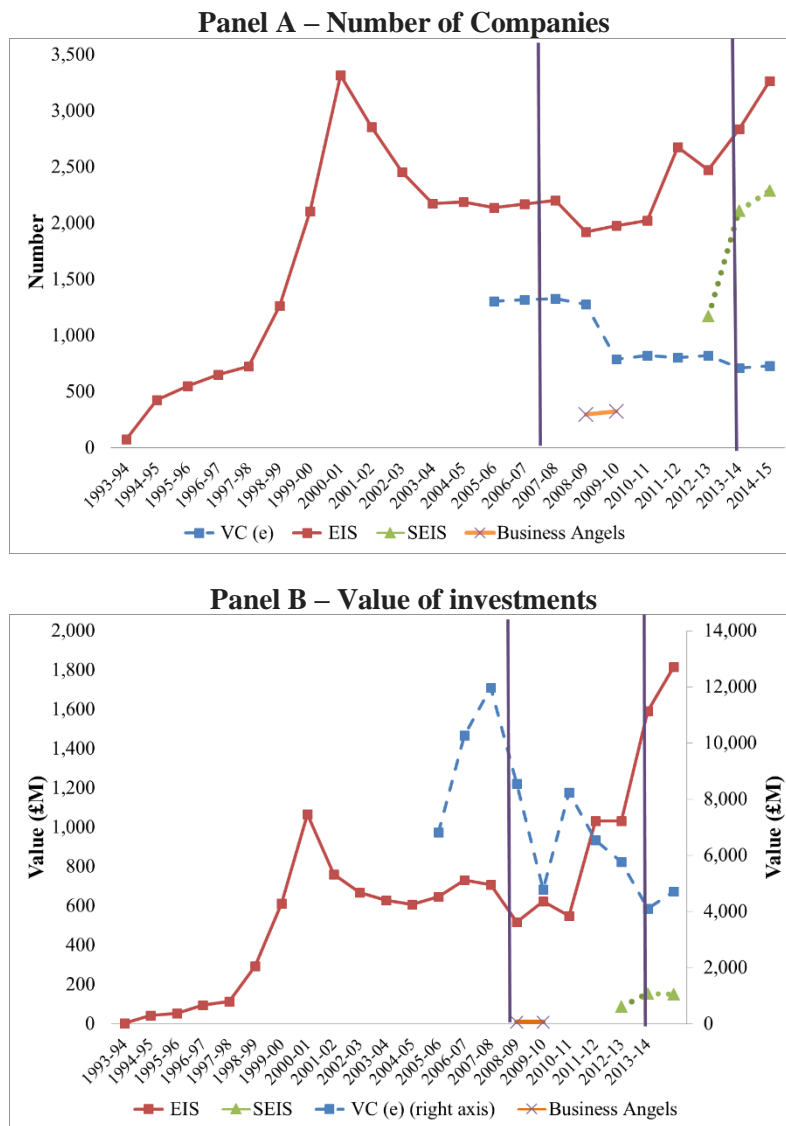


Panel F—Annual Equity Issuance Incidence by Region



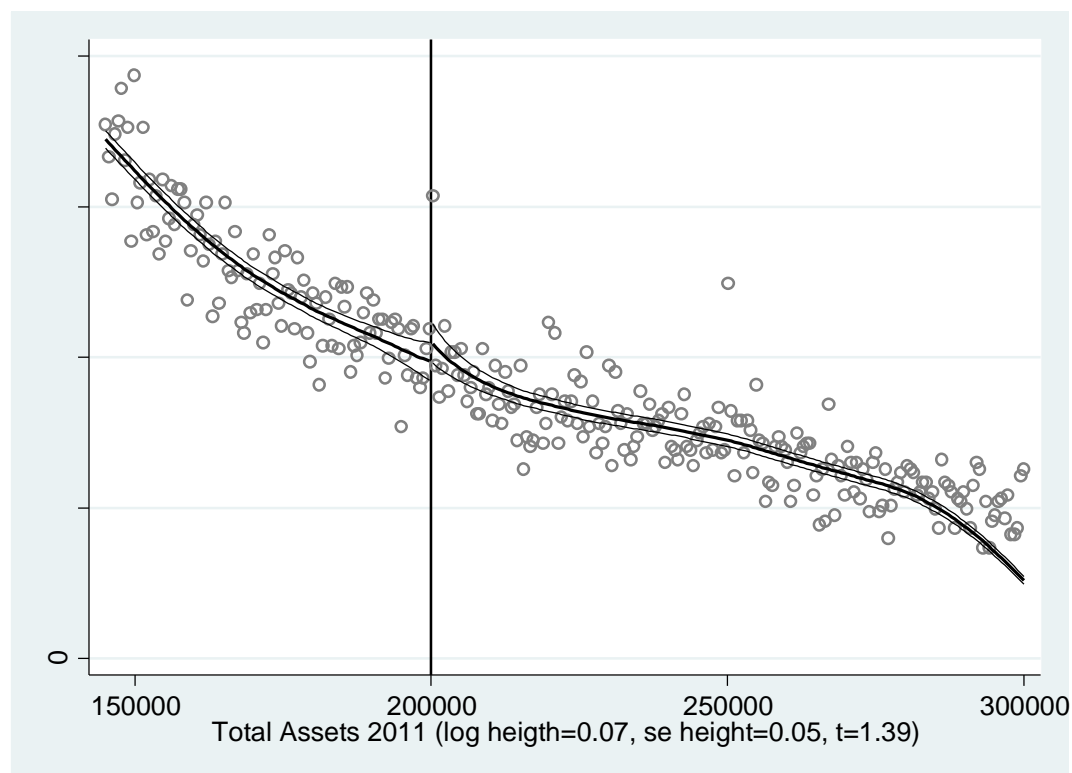
The figure shows the distribution of young firms across UK regions (Panel A). We use the Nomenclature of Territorial Units for Statistics (NUTS) codes of the United Kingdom. Panels B-E plot, respectively, the medians at incorporation of asset value, equity ratio, tangibility ratio and number of owners, by region. Panel F plots the average incidence of new equity issuances post-incorporation by UK region.

Figure 4 – Use of tax relief programs and private equity activity in UK



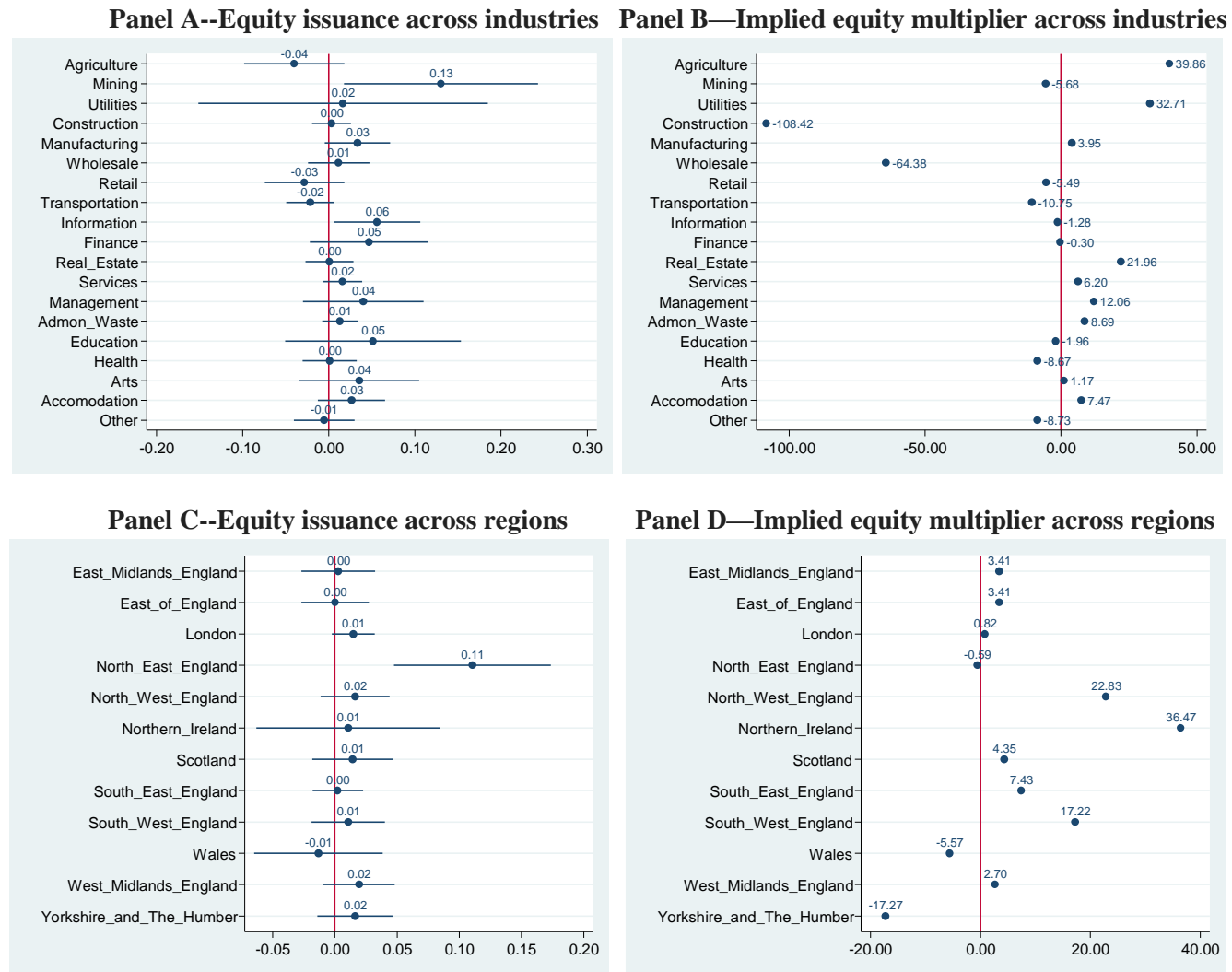
The figure plots the value of investments and number of companies raising funds under the EIS and SEIS schemes. It also plots value of investments made by venture capital (VC) and business angel investors for available years. Sources: HMRC (2015), BVCA(2015), BIS (2010), Deloitte (Business Angels) and Preqin (VC).

Figure 5—Distribution Total Assets Young Firms in 2011



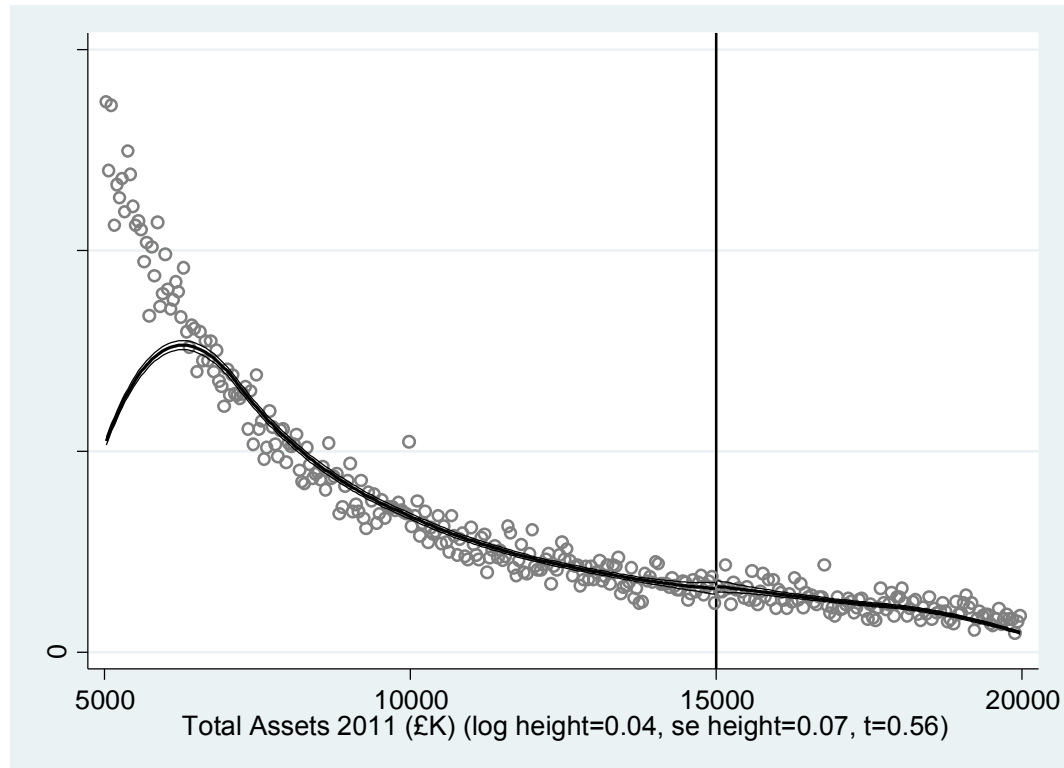
The figure plots the distribution of total assets in 2011 for the firms in the main estimation sample—i.e., firms with total assets in 2011 between £100K and £300K that survived until 2012. The x-axis title includes the results from the McCrary test for discontinuity in this distribution at the asset threshold of £200K before the policy change. We cannot reject the hypothesis that the distribution is continuous at the £200K threshold: the discontinuity estimate (log difference in density height at the £200K threshold) is 0.07 with standard error of 0.05.

Figure 6—Heterogeneity in relief take-up and equity multiplier across industries and regions



The figure presents the estimates of equity and investment responses to the relief based on equation (1), across different industries and regions.

Figure 7—Distribution Total Assets Medium-Sized Firms in 2011



The figure plots the distribution of total assets in 2011 for the firms in the EIS sample—i.e., firms with total assets in 2011 between £14M and £16M that survived until 2012. The x-axis title includes the results from the McCrary test for discontinuity in this distribution at the asset threshold of £15M before the policy change. We cannot reject the hypothesis that the distribution is continuous at the £15M threshold: the discontinuity estimate (log difference in density height at the £15M threshold) is 0.04 with standard error of 0.07.

Table 1-Summary Statistics at incorporation for Young Firms in UK: 2009-2011
Panel A—Firm characteristics at incorporation

	All					Firms that disclose structure of liabilities					Median differences	
	All	Non-issuers	Equity issuers	Inside equity issuers	Outside equity issuers	All	Non-issuers	Equity issuers	Inside equity issuers	Outside equity issuers	Issuers-non-issuers (3)-(2)	Outside-inside issuers (5)-(4)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Assets (£)	8,076 (36,197)	8,067 (36,055)	8,882 (52,754)	6,755 (44,045)	20,464 (88,084)	29,427 (1,109,807)	29,213 (153,652)	142,918 (994,933)	142,918 (996,414)	136,094 (1,109,807)	1.00	4,289***
Equity(£)	100 (4,389)	100 (4,371)	100 (6,381)	100 (4,999)	100 (14,836)	120 (77,768)	120 (12,191)	364.50 (79,347)	1,316 (81,167)	1.50 (77,768)	-1.00	3.00
Equity ratio	0.34 (0.99)	0.34 (0.99)	0.41 (1.00)	0.46 (1.00)	0.25 (1.02)	0.02 (0.44)	0.02 (0.46)	0.02 (0.46)	0.04 (0.48)	0.00 (0.44)	0.00	-0.025
Tangibility	0.00 (0.17)	0.00 (0.17)	0.00 (0.20)	0.00 (0.20)	0.01 (0.21)	0.12 (0.78)	0.12 (0.63)	0.18 (0.68)	0.20 (0.66)	0.12 (0.78)	0.00	0.00
Number of owners	1.00 (1.00)	1.00 (1.00)	2.00 (1.00)	2.00 (1.00)	2.00 (2.00)	1.00 (2.00)	1.00 (1.00)	2.00 (1.00)	2.00 (1.00)	2.00 (2.00)	0.00	0.00
Total liabilities						20,308 (1093742)	19,999 (127,898)	115,013 (950,414)	123,945.50 (899,141)	102,125 (1093742)		
Outside debt						0.00 (48,377)	0.00 (4,295)	0.00 (32,159)	0.00 (23,909)	194 (48,377)		
Inside debt						8.00 (109,455)	4.00 (13,585)	7,339 (112,563)	5,957 (114,616)	19,992 (109,455)		
Trade debt						5,288 (179,492)	5,216 (36,449)	26,115 (154,640)	23,916 (155,139)	28,837 (179,492)		
Assets>£200K	0.08	0.08	0.11	0.10	0.16	0.29	0.23	0.42	0.41	0.46		
£100≤Assets≤£300K	0.08	0.08	0.10	0.09	0.14	0.10	0.10	0.13	0.14	0.09		
Firms	428,037	423,028	5,009	3,855	1,148	16,527	16,387	138	110	28		
Fraction young firms	1.00	0.99	0.01	0.01	0.003	0.04	0.04	0.0003	0.0003	0.0001		

Panel B—Median Equity Issuances and Investment Responses

	All			Firms that disclose structure of liabilities			Difference of medians	
	Inside or outside	Inside equity	Outside equity	Inside or outside	Inside equity	Outside equity	All: Outside – inside (3)-(2)	Disclose: Outside – inside (6)-(5)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of events	5,015	3,867	1,148	143	114	29		
Fraction firm-year obs.	0.01	0.01	0.003	0.01	0.01	0.002		
Number of firms	5,009	3,855	1,148	141	112	29		
Fraction of young firms	0.01	0.01	0.003	0.01	0.01	0.002		
Δ Issued equity (£)	99 (997)	99 (996)	100 (20,040)	1,000 (74,104)	750 (49,910)	1,250 (88,025)	8***	83
Δ(Total assets) (£)	2,903 (37,181)	1,376 (26,068)	15,771 (96,718)	8,685 (294,630)	8,330.50 (255,076)	15,939 (340,329)	8,304***	11,118
Δ Total Assets/ Δ Issued equity	1.00 (316)	1.00 (254)	4.19 (706)	3.66 (320)	3.13 (309)	7.54 (607)	1.23***	1.89
Δ(Total liabilities) (£)				8,569 (172,579)	5,282 (92,844)	74,683 (541,588)		76,330***
Δ(Outside debt) (£)				0.00 (1,808)	0.00 (1,808)	0.00 (1,179)		0.00
Δ(Inside debt) (£)				0.00 (33,648)	0.00 (24,959)	0.00 (46,412)		0.00
Δ(Operational liabilities) (£)				6,014 (69,178)	4,498 (38,699)	25,009 (134,811)		20,205

The table presents summary statistics for all young firms in UK during the 2009-2011 period. Observations are at the firm-year level. Young firms are those within 3 years of incorporation. Young firms amount to 0.4 million during the 2009-2011 period and correspond to 21% of all incorporated firms in UK during the period. The table reports median values reported and interquartile ranges in parenthesis.

Table 2- Potential Equity Capital Pool for Qualifying Companies

Total income (lower limit)	Number tax payers	Average tax rate	Average tax liability	Average investment rate	Fraction of tax payers that invest	Potential Investment	Potential capital pool
£	# (in M)	%	£	%	%	£	£ (in B)
8,105	1.960	1.9	172				
10,000	6.690	5.6	703				
15,000	5.700	9.5	1,660				
20,000	7.210	12.4	3,040				
30,000	6.080	14.7	5,590				
50,000	2.250	22.3	14,800				
100,000	0.394	30.3	36,200				
150,000	0.135	33.5	57,000	10	25	15,000	0.51
200,000	0.134	38.3	110,000	10	25	20,000	0.67
500,000	0.024	42.2	287,000	10	25	50,000	0.31
1,000,000	0.008	43.6	597,000	10	25	100,000	0.20
2,000,000+	0.003	43.2	1,810,000	10	25	200,000	0.15
All Ranges	30.600						1.84

The table presents estimates of the potential equity capital pool for qualifying companies based on average tax liabilities for UK citizens in different income thresholds. We assume that only individuals with total annual income higher than 100,000 invest in private companies, and that the investment rate is constant across income thresholds and is 10% of annual income. To estimate the level of potential investment, we make the conservative assumption that annual income for all individuals in a pre-specified total income threshold corresponds to the lower limit income of the threshold. Source: HMRC, 2012, authors' calculations

Table 3—Example SEIS subsidy

Profit	ROE outside equity		
	Without SEIS	With SEIS	Increase with SEIS
10	$\frac{(110 - 100) \times (1 - 0.28)}{100} = 0.07$	$\frac{50 + (110 - 100) \times (1 - 0)}{100} = 0.60$	0.53
-10	$\frac{(90 - 100) \times (1 - 0.28)}{100} = -0.07$	$\frac{50 + (90 - 100) \times (1 - 0.45)}{100} = 0.45$	0.62

The table summarizes a simple example illustrating the SEIS tax relief. Assume an “outside” individual invests £100 in a firm that has no debt and that generates a profit in 3 years of £10 or -£10. Assume also that the investor sells his shares after the 3-year period for a price that reflects the realized profits: £110 or £90, respectively. Also assume the investor has an income tax liability (capital gains tax liability) above £100 (£2.8). The capital gains tax is 28% and the income tax rate is 45%.

Table 4- Summary Statistics Analysis Sample

	obs.	mean	sd	p50	p75	p99
Beginning-of-Period Total Assets in 2012	158,279	167,902	54,709	153,159	206,340	294,688
Shareholders' Funds	158,279	53,732	181,145	32,015	94,253	476,071
Fixed Assets	158,279	52,830	181,969	13,250	68,026	372,936
Total Assets	158,279	210,435	372,516	157,618	236,100	1.055e+06
Shareholders' Funds/Total Assets	158,279	0.181	0.903	0.241	0.620	1
Issued Equity	158,279	9,132	64,471	100	100	250,000
Number of Owners	135,934	2.008	2.175	2	2	8
Non-equity liabilities	154,455	164,490	509,438	110,000	187,059	1.022e+06
Δ Issued Equity	123,096	1,422	36,526	0	0	37,500
D(Δ Issued Equity)	123,096	0.063	0.243	0	0	1
Δ Fixed Assets	123,096	7,640	159,119	-46	1,364	222,085
Δ Total Assets	123,096	41,081	303,081	11,090	62,495	603,527
Δ Number of Owners	102,123	0.071	0.959	0	0	2
Δ Non-equity liabilities	119,329	25,806	417,611	1,162	31,533	549,000
$Small_i$	158,279	0.726	0.446	1	1	1
$Post_t$	158,279	0.447	0.497	0	1	1
$Small_i \times Post_t$	158,279	0.615	0.486	1	1	1

The table presents summary statistics for the main variables in the analysis. Variable definitions are described in Section 1.1.

Table 5- Outside Equity Issuance and Investment after SEIS launch

Panel A—Basic Results						
	(1)	(2)	(3)	(4)	(5)	Implied Multiplier
Dep. Var.	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Number of Owners	Δ Total Assets	Δ Total Liabilities	Δ Total Assets/ Δ Issued Equity
$Small_i \times Post_t$	0.01*** (0.004)	1,795*** (611.864)	0.07** (0.029)	14,951*** (3,335.085)	16,320*** (2,911.040)	8.33 [4.04 – 26.93]
Conditional Coefficient		145,055	5.30	1,207,981	1,318,602	
95 th Confidence interval		[53,279 – 514,348]	[-267 – 32]	[537,771 – 7,058,572]	[677,645 – 10,020,000]	
Observations	121,598	121,598	100,308	121,598	121,598	
R-squared	0.365	0.261	0.415	0.357	0.308	
Mean Dep. Var.	0.06	1,401.7	0.07	41,047.6	23,004.2	

Panel B—Logarithmic transformation			
	(1)	(2)	(3)
Dep. Var.	$\Delta \ln(\text{Issued Equity})$	$\Delta \ln(\text{Total Assets})$	$\Delta \ln(\text{Total Liabilities})$
$Small_i \times Post_t$	0.08*** (0.022)	0.17*** (0.038)	0.22*** (0.049)
Observations	121,598	121,598	121,586
R-squared	0.254	0.368	0.326
Mean Dep. Var.	0.09	0.21	0.2

Panel C—Collapsed Sample					
	(1)	(2)	(3)	(4)	(5)
Dep. Var.	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Number of owners	Δ Total Assets	Δ Total Liabilities
$Small_i \times Post_t$	0.01*** (0.005)	1,905*** (638.496)	0.06** (0.029)	16,836*** (3,407.824)	18,124*** (2,960.549)
Observations	41,814	41,814	27,448	41,814	41,814
R-squared	0.586	0.531	0.561	0.537	0.545
Mean Dep. Var.	0.06	1,910.5	0.08	34,710.0	20,548.1

The table presents results from estimating equation (1). $Small_i$ is a dummy indicating whether the firm had beginning-of-period total assets below 200K pounds in year 2012 and $Post_t$ is a dummy equal to one in the years 2012-2014. The dependent variable is specified in the top of the column. All columns include firm

fixed effects and separate year effects for each 5-digit 2007 SIC industry. Panel A presents the main results. The conditional coefficients are the ratios between the dependent variable and the dummy indicating equity issuance in column (1); standard errors for these ratios are estimated using bootstrap (clustered at the firm level), we report 95th confidence intervals. The implied equity multiplier in the last column corresponds to the ratio between the estimates of Δ Total Assets and Δ Issued Equity (columns (4) and (2), respectively); the standard error is estimated using bootstrap (clustered at firm level) and we report the 95th confidence interval. Panel B presents estimates using logarithmic transformations of the main outcome variables. Panel C presents results after collapsing the sample to a single pre and a single post period for each firm. The standard errors are presented in parentheses and are adjusted for heteroskedasticity and clustered at the firm level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6- SEIS launch and equity issuance and investment dynamics

	(1)	(2)	(3)
Dep. Variable	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Total Assets
$Small_i \times D_{2011}$	0.01 (0.011)	1,558 (1,586.652)	15,502 (10,338.038)
$Small_i \times D_{2012}$	0.02 (0.011)	2,569 (1,587.443)	31,735*** (10,354.693)
$Small_i \times D_{2013}$	0.01 (0.011)	1,955 (1,667.477)	30,215*** (10,293.879)
$Small_i \times D_{2014}$	0.03*** (0.010)	5,047*** (1,659.758)	20,964* (11,311.390)
Observations	121,598	121,598	121,598
R-squared	0.365	0.261	0.357

The table presents results from estimating an expanded version of equation (1). $Small_i$ is a dummy indicating whether the firm had beginning-of-period total assets below 200K pounds in year 2012, D_i is a dummy equal to one in the years i , and the dependent variable is specified in the top of the column. D_{2010} is excluded to avoid multicollinearity. The standard errors are presented in parentheses and are adjusted for heteroskedasticity and clustered at the firm level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 7- Heterogeneity SEIS effect
Panel A—Non-related owners

	(1)	(2)	(3)	Implied Multiplier
	D(Δ Issued Equity>0)	Δ Issued Equity	Δ Total Assets	Δ Total Assets/ Δ Issued Equity
<i>I. Non-related owners</i>				
$Small_i \times Post_t$	0.02 (0.025)	5,935 (4,043.360)	28,427** (12,100.371)	4.79 (-9.52, 135.41)
Observations	5,840	5,840	5,840	
R-squared	0.471	0.375	0.345	
<i>II. No non-related owners</i>				
$Small_i \times Post_t$	0.01** (0.004)	1,029* (575.005)	14,493*** (3,593.818)	14.08 (3.49, 609.85)
Observations	97,674	97,674	97,674	
R-squared	0.342	0.263	0.359	
t-stat. difference	0.5	1.3	1.2	

Panel B—Institutional owners

	(1)	(2)	(3)	Implied Multiplier
	D(Δ Issued Equity>0)	Δ Issued Equity	Δ Total Assets	Δ Total Assets/ Δ Issued Equity
<i>I. Institutional owners</i>				
$Small_i \times Post_t$	0.03** (0.016)	7,594** (3,721.144)	27,197 (21,489.526)	3.58 (-7.13, 191.21)
Observations	9,844	9,844	9,844	
R-squared	0.447	0.281	0.385	
<i>II. No institutional owners</i>				
$Small_i \times Post_t$	0.01** (0.005)	543 (471.970)	14,146*** (2,760.823)	26.05 (9.94, 444.03)
Observations	93,946	93,946	93,946	
R-squared	0.341	0.294	0.364	
t-stat. difference	1.6	2.0	0.6	

Panel C – Owner managers

	(1)	(2)	(3)	Implied Multiplier
	D(Δ Issued Equity>0)	Δ Issued Equity	Δ Total Assets	Δ Total Assets/ Δ Issued Equity
<i>I. Owner managers</i>				
$Small_i \times Post_t$	0.02 (0.015)	2,526 (2,262.900)	18,199* (10,797.204)	7.20 (-3.10, 926.22)
Observations	14,106	14,106	14,106	
R-squared	0.411	0.347	0.383	
<i>II. Non-owner managers</i>				
$Small_i \times Post_t$	0.01*** (0.005)	1,030* (585.954)	14,489*** (3,618.552)	14.06 (4.07, 144.92)
Observations	89,747	89,747	89,747	
R-squared	0.344	0.268	0.357	
t-stat. difference	0.2	0.7	0.3	

Panel D – Motivations for starting a business

	(1)	(2)	(3)	Implied Multiplier
	D(Δ Issued Equity > 0)	Δ Issued Equity	Δ Total Assets	Δ Total Assets / Δ Issued Equity
<i>I. Private benefits of control</i>				
$Small_i \times Post_t$	-0.01 (0.014)	-58 (1,194.245)	3,988. (6,271.587)	-69.20 (-1,167.65, -67.99)
Observations	11,127	11,127	11,127	
R-squared	0.366	0.172	0.511	
t-stat. difference with Other	-1.87	-1.45	-1.37	
<i>II. Growth</i>				
$Small_i \times Post_t$	0.01 (0.013)	2,091 (1,749.000)	28,835*** (8,435.228)	13.00 (-37.26, 633.04)
Observations	14,874	14,874	14,874	
R-squared	0.400	0.304	0.271	
t-stat. difference with Other	-0.16	0.07	1.60	
<i>III. Other</i>				
$Small_i \times Post_t$	0.02*** (0.005)	1,966*** (716.015)	14,163*** (3,963.816)	7.20 (2.53, 30.48)
Observations	95,290	95,290	95,290	
R-squared	0.359	0.258	0.362	

Panel E – Asset Tangibility

	(1)	(2)	(3)	Implied Multiplier
	D(Δ Issued Equity > 0)	Δ Issued Equity	Δ Total Assets	Δ Total Assets / Δ Issued Equity
<i>III. High tangibility</i>				
$Small_i \times Post_t$	0.01** (0.006)	2,548*** (726.391)	14,830*** (3,681.400)	5.82 (1.33, 14.24)
Observations	59,105	59,105	59,105	
R-squared	0.380	0.271	0.417	
<i>IV. Low tangibility</i>				
$Small_i \times Post_t$	0.01* (0.006)	855 (944.331)	15,244*** (5,639.842)	17.82 (3.39, 1,295.40)
Observations	61,886	61,886	61,886	
R-squared	0.370	0.272	0.347	
t-stat. difference	0.1	1.4	-0.1	

The table presents results from estimating equation (1) across different subsamples as specified in the title and content of each panel. $Small_i$ is a dummy indicating whether the firm had beginning-of-period total assets below 200K pounds in year 2012, $Post_t$ is a dummy equal to one in the years 2012-2014, and the dependent variable is specified in the top of the column. Non-related owners indicates whether the company has at least one individual owner whose last name differs from that of the owners included at registration. Institutional Owner indicates whether the company has at least one non-individual owner including: financial, industrial or insurance companies, mutual or pension funds, private equity firms, foundations, public authorities or venture capital firms. Private benefits of control (Growth) indicates firms in the finance and retail (manufacturing and wholesale) industries were private benefits (desire to create a new product/service) are the main motivation for business creation as reported by Hurst and Pugsley (2012). The standard errors are presented in parentheses and are adjusted for heteroskedasticity and clustered at the firm level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8- Financing the equity multiplier

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Var.	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Total Assets	Δ Total Liabilities	Δ Outside Debt	Δ Inside Debt	Δ Operational Liabilities
$Small_i \times Post_t$	0.02 (0.0449)	2,670 (2,042)	68,895 (52,675)	42,329 (54,939)	-7,110 (11,509)	55,820 (50,679)	2,422 (24,542)
Observations	3,083	3,083	3,083	3,025	3,025	3,025	3,025
R-squared	0.605	0.785	0.756	0.774	0.66	0.62	0.73
Mean Dep. Var.	0.10	2,735	70,195	66,946	10,403	51,113	19,848

The table presents results from estimating equation (1). $Small_i$ is a dummy indicating whether the firm had beginning-of-period total assets below 200K pounds in year 2012 and $Post_t$ is a dummy equal to one in the years 2012-2014. The dependent variable is specified in the top of the column. All columns include firm fixed effects and separate year effects for each 5-digit SIC industry. The subsample corresponds to 1,151 (690 small and 460 control) firms that report detailed liabilities. The standard errors are presented in parentheses and are adjusted for heteroskedasticity and clustered at the firm level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 9-Robustness Checks

Panel A- Placebo Tests

	(1)	(2)	(3)	(4)
Dep. Variable	Average coefficient	Average standard deviation	Average p-value	Non-rejection rate at 5% level
D(Δ Issued Equity >0)	0.0	0.0	0.5	0.5%
Δ Issued Equity	-934	6,322	0.5	0.5%
Δ Total Assets	7,539	32,954	0.4	2.0%
Δ Ln(Issued Equity)	-0.1	0.1	0.4	2.0%
Δ Ln(Total Assets)	0.0	0.2	0.7	1.0%

Panel B – Older Firms

	(1)	(2)	(3)
Dep. Var.	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Total Assets
$Small_i \times Post_t$	-0.00 (0.004)	539 (550.839)	-1,220 (5,324.508)
Observations	66,672	66,672	66,672
R-squared	0.320	0.256	0.259
Mean Dep. Var.	0.06	795	23,275
Mean $Small_i$	0.7	0.71	0.71

Panel C – Alternative Samples

Alternative Sample	(1)	(2)	(3)	(4)	(5)	(6)
	$\pounds 75K$ bandwidth			Symmetric window ($\pounds 145K$ - $\pounds 300K$)		
Dep. Var.	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Total Assets	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Total Assets
$Small_i \times Post_t$	0.01* (0.005)	1,678** (717.128)	8,400** (3,636.046)	0.01** (0.005)	1,497** (715.660)	8,653** (3,602.264)
Observations	80,663	80,663	80,663	67,375	67,375	67,375
R-squared	0.370	0.260	0.379	0.375	0.265	0.400
Mean Dep. Var.	0.06	1,494	45,075	0.06	1,647	50,637
Mean $Small_i$	0.7	0.7	0.7	0.5	0.5	0.5

Panel D – Potential misspecification

	(1)	(2)	(3)	(4)	(5)	(6)
	Including employment restrictions			Excluding late qualifiers		
Dep. Var.	D(Δ Issued Equity >0)	Δ Ln(Issued Equity)	Δ Ln(Total Assets)	D(Δ Issued Equity >0)	Δ Ln(Issued Equity)	Δ Ln(Total Assets)
$Small_i \times Post_t$	0.001 (0.026)	0.05 (0.130)	0.36 (0.249)	0.01** (0.005)	0.06** (0.026)	0.01 (0.044)
Observations	2,621	2,621	2,621	110,962	110,962	110,962
R-squared	0.422	0.260	0.354	0.367	0.256	0.372
Mean Dep. Var.	0.1	0.1	0.3	0.1	0.1	0.2
Mean $Small_i$	0.6	0.6	0.6	0.8	0.8	0.8

Panel D –Excluding late qualifiers

	(1)	(2)	(4)
Dep. Var.	D(Δ Issued Equity >0)	Δ Ln(Issued Equity)	Δ Ln(Total Assets)
$Small_i \times Post_t$	0.01** (0.005)	0.06** (0.026)	0.01 (0.044)
Observations	110,962	110,962	110,962
R-squared	0.367	0.256	0.372
Mean Dep. Var.	0.1	0.1	0.2
Mean $Small_i$	0.8	0.8	0.8

The table presents results from estimating equation (1) in different subsamples. $Small_i$ is a dummy indicating whether the firm had beginning-of-period total assets below 200K pounds in year 2012 and $Post_t$ is a dummy equal to one in the years 2012-2014. The dependent variable is specified in the top of the column. All columns include firm fixed effects and separate year effects for each 5-digit 2007 SIC industry. Panel A presents summary results from 200 placebo tests, where we randomly select 200 thresholds in the interval £600K-800K (such that observations are outside our sample window around £200K). We restrict sample to firms with asset size in 2011 in a window of £100K to the right and £100K to the left of the random threshold. We classify firms into “placebo small” and “placebo non-eligible” if their assets in 2011 are below or above the random threshold, respectively. Panel B presents results using a sample of older firms that do not qualify for the scheme. Panel C presents results using alternative bandwidth definitions. Panel D restrict the sample by imposing employment restrictions (columns 1-3) and excluding control firms that satisfy the asset restriction after 2012 (Columns 4-6). In Panel E late qualifiers are non-eligible firms in 2012 that decreased their assets in later years in order to qualify. The standard errors are presented in parentheses and are adjusted for heteroskedasticity and clustered at the firm level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 10-EIS Analysis

Panel A—Summary Statistics EIS Sample						
	obs.	mean	sd	p50	p75	p99
Beginning-of-Period Total Assets in 2012 (£M)	13,509	14,968	581.9	14,949	15,475	15,780
Shareholders' Funds (£M)	13,509	4,482	4,324	4,027	9,005	9,556
Total Assets (£M)	13,509	12,095	5,871	14,597	15,674	16,075
Shareholders' Funds/Total Assets	13,492	0.380	0.326	0.455	0.620	0.746
Issued Equity (£M)	13,509	468.8	805.8	1,277	616	1,844
Δ Issued Equity (£M)	11,429	66.47	540.4	0	0	9,990
D(Δ Issued Equity)	11,429	0.142	0.349	0	0	1
Δ Total Assets (£M)	11,429	1,981	6,371	36	1,264	14,285
Med_i	11,687	0.525	0.499	1	1	1
$Post_t$	11,687	0.263	0.440	0	1	1
$Med_i \times Post_t$	11,687	0.500	0.500	1	1	1

Panel B-Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	D(Δ Issued Equity>0)	Δ Ln(Issued Equity)	Δ Ln(Total Assets)	D(Δ Issued Equity>0)	Δ Ln(Issued Equity)	Δ Ln(Total Assets)
$Med_i \times Post_t$	0.000 (0.012)	-0.056 (0.081)	0.081** (0.040)	0.00 (0.013)	-0.04 (0.089)	0.08 (0.054)
Observations	9,840	9,840	9,840	3,360	3,360	3,360
R-squared	0.580	0.540	0.901	0.65	0.60	0.87
Mean Dep. Var.	0.14	0.67	1.05	0.14	0.67	1.04
Mean $Small_i$	0.53	0.53	0.53	0.53	0.53	0.53
Collapsed sample	No	No	No	Yes	Yes	Yes

Panel A presents summary statistics for the EIS analysis sample—i.e., firms with total assets in 2011 between £14M and £16M that survived until 2012. Panel B presents results from estimating equation (2) where Med_i is a dummy indicating whether the firm had beginning-of-period total assets below £15M in year 2012. $Post_t$ is a dummy equal to one in the years 2012-2014. The dependent variable is specified in the top of the column. All columns include firm fixed effects and separate year effects for each 5-digit 2007 SIC industry. We collapse the estimation sample to a single pre and a single post period for each firm. The standard errors are presented in parentheses and are adjusted for heteroskedasticity and clustered at the firm level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 11- Distribution of After-tax Outside Equity Returns with and without the Relief

After-tax outside equity returns (ROE)	Mean	Standard deviation	Minimum	Maximum	Median
ROE without the relief	0.06	0.37	-20.20	2.70	0.05
ROE with the relief	0.12	0.40	-20.20	3.75	0.10
Δ ROE implied by relief	0.06				
% Δ ROE implied by relief	113				

The table presents after-tax outside equity returns with and without the relief. After-tax outside equity returns *without* the relief correspond to the ratio between cash flow to equity holders and total assets for automatic qualifiers (See Table 3 and Section 2). Cash flow to equity holders amounts to after-tax profits (i.e., profits adjusted by capital gains tax). Most of the sample firms do not report income statements (they are exempt given their small size). For these non-profit-reporting firms, we measure annual profits as the difference in the Profit and Loss Account in the capital statement of the balance sheet (reported by all sample firms). After-tax outside equity returns *with* differ in that cash flow to equity holders is adjusted to reflect the benefits of the relief: capital gains tax exemption, loss relief against income tax (or capital gains tax) and investment rebates against income tax. For a detailed explanation see Section 6.1.

Table 12—Elasticity of Young Firm Investment to the Cost of Outside Equity

	(1)	(2)
	Actual	Neoclassical Benchmark (assuming 100% take-up, and no multiplier)
ROE without the relief	0.06	0.06
ROE with the relief	0.12	0.12
Δ ROE	0.06	0.06
% Δ ROE	1.13	1.13
% Δ Total Assets	0.18	0.89= £150K/£168
Elasticity	-0.16	-0.79

The table presents the estimation of the elasticity of young firm investment to the cost of outside equity. The neoclassical benchmark estimates the elasticity assuming 100% take-up rate among eligible firms, and no outside equity multiplier. Column (2) estimates the percentage in fixed and total assets under the assumption that all eligible firms take-on the maximum subsidy of £150K and invest in full in fixed and total assets. For a detailed explanation see section 6.2.

APPENDIX 1. DATA

The data source used in this study is the Financial Analysis Made Easy (FAME) database, provided by Bureau Van Dijk (BVD). FAME contains accounting variables in the balance sheet (and when available, profit and loss account) for all private and public incorporated companies in the United Kingdom. UK limited liability companies are legally obliged to keep accounting records and file their Annual Accounts with Companies House (see Companies Act 2006). Failure to deliver the accounts on time is deemed a criminal offence: directors are personally responsible. Filings are made within 10 months of the fiscal year-end (April 25th of every year). Accounts are prepared in accordance with United Kingdom accounting standards, and all statements with annual sales exceeding 1,000,000 pounds are audited.

BVD collects company filings FAME reports historical information for up to 10 years (in the web version or one particular disk), even if a firm stops reporting financial data. Our original extract from FAME encompasses a 6 year period from year 2009 to 2014, taken from the August 2014 disk. We complemented this extract with online data for the years 2013 and 2014 downloaded during October 2015. We exclude from the sample all foreign companies, assurance companies, guarantees, limited liability partnerships, public companies, public investment trusts, and “other” types. We do so to ensure that our sample contains only UK limited liability companies for which the Companies Act 2006 applies, and could potentially benefit from the tax incentives. We also exclude any firm-year observation that has missing or negative book value of gross total assets.

In the UK, large firms are required to file detailed financial statements, while small firms may only report selected financial information. The Large and Medium-sized Companies and Groups (Accounts and Reports) Regulations 2008 and The Small Companies Regulations 2008 specify the filing requirements for UK firms according to size.¹ Small companies need not file profit and loss accounts, nor information about employees or research and development expenses. They may also choose to file abbreviated balance sheet accounts, which include detailed information on assets and capital and reserves, but not on the structure of non-equity liabilities. Small companies are those that, among other requirements, meet at least two of the following conditions: annual turnover lower than £6.5M, balance sheet total (gross total assets) lower than £3.26M, and number of employees lower than 50.²

Most UK companies file abbreviated accounts. In our original extract, only 1% of firms report sales (Turnover from the Profit and Loss account), 5% report employee data, and 16% report detailed current non-equity liabilities.³ Given these data restrictions, we will focus our analysis on investment and equity issuances—we will not analyse trends in profits or employment—and will zoom into the liability structure only in a few parts of the analysis. In addition, given the limited availability of information on sales, we do not restrict the data to audited annual filings (i.e., those with annual sales exceeding £1K) as is common in other work based on FAME data focusing on larger firms (see: Brav,

¹ In 2014, The Small Companies (Micro-Entities' Accounts) Regulations 2013 was introduced, which changed the reporting requirements for small firms, and introduced micro-entities, a new type of firm that can file even simpler (less detailed) accounts. A micro-entity must meet at least two of the following conditions: turnover must be no more than £632,000, the balance sheet total (gross total assets) must be no more than £316,000 and the average number of employees must be no more than 10. This regulation simplified reporting of capital and reserves: separate details on called up share capital, share premium account, revaluation reserve, other reserves and profit and loss account need not be reported. This change in reporting may affect our ability to distinguish new equity issuances in the sample. In the robustness section, we exclude the year 2014 from our sample to address this concern, and show our results continue to hold.

² In addition, to classify as small a company may not be public or be in a group where any of its members is public, and may not be an authorised insurance or banking company. Other restrictions also apply see Companies Act 2006.

³ The default category used by FAME for non-detailed current liabilities is other current liabilities—roughly 70% observations have this account as non-missing.

2009; Michaely and Roberts, 2012).⁴ Instead, to mitigate the impact of potential filing mistakes and outliers, all outcome variables are winsorized at the most extreme 1% in either tail of the distribution. We check that results are similar using different levels of winsorizing for the dependent variables, including 0.5%, 1.5% and 2.5%, which are levels used in other studies based on FAME data (cf., Dechezleprêtre et al., 2016).

The last part of the FAME data we use regards ownership information. The Companies Act 2006 specifies that limited liability firms must provide a statement of capital and initial shareholdings at incorporation, and annually update this information in the Annual Returns.⁵ The statement of capital shows the company's register of members, which includes name and addresses of the company owners who have agreed to take shares and the number of shares each will take.⁶ ⁷ The ownership information available in FAME, however, is less detailed than the original filings, and does not cover all firms. In particular, roughly 80% of firms in the sample have no ownership information. In addition, while the name, location and type of owner (e.g., bank, employees) is generally available (90% of firms with ownership data), details on ownership stakes are less populated (available for roughly 50% of observations at the firm-owner level). Because of these data restrictions, in the analysis we will focus on distinguishing number and of owners, but we will not look into trends in ownership stakes or valuation.

Variable definitions

We focus on capital structure and investment decisions of young firms. To measure new equity issuances we use information reported in the capital and reserves section of the balance sheet. According to Small Companies and Groups Regulations 2008, even small firms (filing abbreviated accounts) must report detailed information on the capital and reserves account in their balance sheets, including separate components for: called up share capital, share premium account, revaluation reserve, other reserves, and profit and loss. The book value of equity corresponds to the aggregate value of capital and reserves, which FAME records as shareholders' funds. We report equity ratios in section 1.3, calculated as the ratio between shareholders' funds and total assets. To estimate equity issuances, we use two subcomponents of the capital and reserves account: called up share capital, and share premium account. Called up share capital corresponds to the nominal face value of total outstanding shares (for which the company has requested and received full or part payment); FAME reports this account as *issued capital*. The share premium account (same name in FAME) corresponds to the difference between the value at which the shares were issued by the company (or paid up share capital) and their nominal worth. We refer to the sum of these two accounts as *issued equity* throughout. Our main proxy for equity issuance, *new equity*, corresponds to the year-to-year change in issued equity. We also report results using the year-to-year change in the natural logarithm of new equity (plus 1) to mitigate the impact of outliers, and use an indicator variable $D(\text{new equity} > 0)$ that equals one if the year-to-year change in issued equity is positive. Appendix 2 includes a detailed example on the construction of these proxies for equity issuance based on Storemates, a London-based start-up that issued equity through the SEIS tax relief program. Finally, in Section 1.3 we distinguish between inside and outside equity issuances (post-

⁴ For the same reason our main analysis exploits SEIS eligibility thresholds with respect to total assets and not with respect to employment. However, in Robustness Section 5.2 we have an extension using employment data for the subsample of firms that also reported employment.

⁵ Annual Returns additionally report the register of directors (list of names and locations of company directors). The full list of shareholders and company directors must be recorded in the first Annual Return filing after incorporation, and every third Return thereafter. Details on share transfers and company directors must however be provided by firms annually.

⁶ The statement of capital includes the total number of shares of the company, the aggregate nominal value of those shares, and for each class of shares the prescribed particulars of the rights attached to the shares, the total number of shares of that class and the aggregate nominal value of shares of that class.

⁷ In the event of capital changes, firms are also required to file complementary forms. For example, if firms increase their share capital by allotting new shares, then they must file form SH01, as well as include the names of any new owners in the company's register of shareholders. Additional forms are required for other capital changes such as: redenomination of shares and share-repurchases (see Companies Act 2006).

incorporation). Because firms do distinguish between inside and outside equity in their Annual Returns, we classify a new issuance as outside equity if the number of owners increases after the equity round.

We measure firm investment with the year-to-year changes in fixed and total assets: Δ *fixed (total) assets*. We measure non-equity liabilities as the sum of balance sheet accounts: short-term creditors (amounts falling due within one year) and long-term creditors (amounts falling due after more than one year). These accounts are reported in FAME as current liabilities and long-term liabilities, respectively. We measure year-to-year changes in non-equity liabilities: Δ *liabilities*, which is available for roughly 70% of firms in our original data extract.

For firms that disclose the structure of liabilities, we measure year-to-year changes in five broad types of non-equity liabilities: Δ *trade credit*, Δ *bank overdrafts*, Δ *group loans*, Δ *director loans*, Δ *other loans*, and Δ *other liabilities*. Detailed information on the structure of non-equity liabilities is only available for firms that file standard accounts (see Section 1.1), where non-equity liabilities are grouped as: bank loans and overdrafts, inside loans, trade creditors and other creditors, and described in the balance sheet notes.⁸ Inside loans, which are defined as amounts owed to groups undertakings and undertakings in which the company has a participating interest, are reclassified by FAME into two groups: group loans (e.g., loans from parent companies, loans from subsidiaries, loans from non-director owners) and director loans.⁹

Finally, we distinguish between three types of owners: *Non-related owners*, *institutional owners* and *manager-owners*. *Non-related owners* correspond to non-original owners (i.e., not listed in the firm's first available Annual Return filing) whose last name differs from that of all original owners. *Institutional owners* correspond to any non-individual owner such as venture capital firms and equity crowdfunding platforms (if acting on behalf of participants, as SEEDRs in the UK is). Finally, *manager-owners* are those directors who are originally reported in the first Annual Return filing.

APPENDIX 2: THE SEED ENTERPRISE INVESTMENT SCHEME

Largely based on the following Acts: Taxes Management Act 1970, Taxation of Chargeable Gains Act 1992, Income Tax Act 2007, Finance Act (No.2) 2015; and HMRC manuals: Venture Capital Schemes Manual, 2016, VCM10010—Enterprise Investment Scheme, HS297 Enterprise Investment Scheme and Capital Gains Tax, CCM30100—Seed Enterprise Investment Scheme, HS393 Seed Enterprise Investment Scheme, VCM70100—Share Loss Relief, Capital Gains Manual, 2016 and Self-Assessment Claims Manual, 2016.

A.1. General Requirements for the investment:

- The shares must be ordinary shares paid in cash with no preferential treatment (see VCM33020),
- The purpose of the issue must be for a Qualifying Business (see VCM33030),
- The spending of the money raised must be spend within a pre-specified period (see VCM33040),
- There should be No pre-arranged exits (see VCM33060),
- The shares must not be issued for tax avoidance (see VCM33070), and
- No disqualifying arrangements – there needs to be a need for commercial purpose (see VCM33080).

⁸ Medium sized and larger firms classify liabilities further, including: provisions (taxation or other), accruals and deferred income, and hire purchase and leasing. These accounts are missing for the vast majority of firms in our sample. Hence, we do not use, nor discuss these accounts in further detail here. For more information see: The Large and Medium-sized Companies and Groups (Accounts and Reports) Regulation 2008.

⁹ For all liability accounts, except bank loans and trade credit, FAME distinguishes between current (amounts falling due within-one year) and long-term liabilities whenever possible—i.e., firms have the option to classify liabilities according to maturity. The variables Δ *group loans*, Δ *director loans*, Δ *other loans*, and Δ *other liabilities* include changes in both current and long-term components.

A.2. Detailed requirements for issuing companies:

The Company must:

- perform a qualifying trading (see VCM34020 and VCM34030),
- carry on a qualifying business activity (see VCM34040),
- be a UK permanent establishment (see VCM34050),
- be in financial health (see VCM34060),
- have an unquoted status (see VCM34070),
- meet the control and independence status(see VCM34080),
- no partnerships (see VCM34090),
- meet the gross assets limit (see VCM34100),
- meet the number of employees limit (see VCM34110),
- have not done previous other risk capital scheme investments (see VCM34120),
- comply with the amount raised through the SEIS limitation (see VCM34130),
- comply with qualifying subsidiaries status (see VCM34140),
- meet the property managing subsidiaries limitation (see VCM34150).

Company obligations to notify HMRC

The company is obliged to notify HMRC within 60 days of any event as a result of which any of the following happens or will happen:

- the monies raised by a share issue will not be employed as required by ITA07/S175 (see VCM12060)
- the company ceases to be a qualifying company (see VCM13010)
- the company or a person connected with the company provides value to the investor or an associate (see VCM15030)
- there are repayments of share capital to non-EIS investors (see VCM15090)
- the company acquires a trade or assets from parties controlling the company (see VCM15110)
- the company acquires share capital from parties controlling the company (see VCM15110)

A.3. Detailed requirements for investors

- No employee investors (see VCM32020),
- No substantial interest in the issuing company (see VCM32030),
- No related investment arrangements (see VCM32040),
- No linked loans (see VCM32050),
- No tax avoidance (see VCM32060).

Investor obligations to notify HMRC

If an investor becomes aware of an event which should result in the withdrawal or reduction of relief, he or she is obliged to notify HMRC of that event within 60 days of it occurring. Events which the investor is obliged to notify are any which would result in relief falling to be withdrawn or reduced for any of the following reasons:

- the investor ceases to be a qualifying investor (see VCM11010)
- there is a loan linked to the investment (see VCM11030)
- the shares are disposed of before time
- there is a put option or a call option over the shares (see VCM15020)
- the investor or an associate has received value (see VCM15030)

A.4 Benefits to investors

A.4.1. Income tax relief steps

The relief reduces tax liability in accordance with the following steps (see ITA07/Ss22-32):

- total income chargeable to income tax is calculated,
- then personal allowances and other reliefs (such as loss relief) are deducted,
- Income tax liability is then calculated by applying the appropriate income tax rates to the result and
- reliefs are to be deducted in the following order: first of all, VCT relief, then EIS relief, then SEIS relief, then various others (as listed in ITA07/S27).

A.4.2 Size income tax relief

The relief takes the form of a reduction in the individual's Income Tax liability at the SEIS rate of 50% on the amount of the subscription (this excludes any costs incidental to the subscription) or, if that would exceed the liability for the year, whatever amount will reduce that liability to nil. The maximum investment on which an investor may claim relief for any year is £100,000.

Example:

Jenny invests £20,000 in the tax year 2012-13 (6 April 2012 to 5 April 2013) in SEIS qualifying shares. The SEIS relief available is £10,000 (£20,000 at 50 %). Her tax liability for the year before SEIS relief is £15,000 which she can reduce to £5,000 (£15,000 less £10,000) as a result of her investment.

An investor may elect to have part or all of an issue of shares treated as though acquired in the tax year preceding that in which the shares were actually acquired (see ITA07/S257AB(5)). This is subject to the maximum annual investment limit for that earlier year (£100,000). The SEIS rate for the earlier year is then applied to the shares treated as acquired in the earlier year and relief given accordingly. As there is no SEIS rate for periods before 6 April 2012 an election under S257AB(5) will be effective only for shares acquired in 2013-14 and later tax years (see [VCM35160](#) for how to make claims)

Where the investor wishes to treat some of the shares as issued in the year before the year in which they were issued (see [VCM31130](#)), it will be necessary to make two separate claims.

Example:

Mr Illingworth subscribes £50,000 for 50,000 shares which are issued to him on 30 September 2014. He receives form SEIS3 on 31 October 2014. He wants 20,000 shares to be treated as issued in the previous year.

His claim to relief on £30,000 for 2014-15 will be made after the end of the year on his tax return. In the meantime he completes the claim section of form SEIS3 to show a claim to relief on £20,000 for 2013-14, thus amending his tax return for that year. At the same time he uses the same means to obtain a coding adjustment for 2014-15.

A.4.3 Withdrawal or reduction of tax relief for investors

Withdrawal if:

- the investor becomes employed by the company without being a director of the company (see VCM32020)
- the investor's holding in the company becomes a 'substantial interest' (see VCM32030)
- the shares cease to be eligible shares (see VCM33020) or there is a put or call option over them

(see VCM36030)

- the company ceases to meet the qualifying conditions (see VCM34000+)
- the company fails to spend the money raised by the share issue as required (see VCM33040)

Reduction before the end of the 3 years hold period:

- the investor disposes of any of the shares (see VCM36020)
- the investor or associate receives 'value' from the company or from a person connected with that company (see VCM36040)

The CGT exemption may be restricted if the amount of the Income Tax relief is reduced, or is withdrawn in full (see [VCM40070](#)).

A.4.4. Capital loss relief

An investor can claim a loss on the disposal of SEIS shares if the Income Tax relief is not withdrawn. The amount of the capital loss is reduced by the amount of the Income Tax relief still attributable to the shares disposed of (see VCM40100).

The disposal must be by way of a bargain at arm's length (see [VCM74090](#)) or by way of a distribution in the course of winding up or dissolving the company (see [VCM74100](#)).

(A 'bargain made at arm's length' is a normal commercial transaction between two or more persons. All of the parties involved will be trying to obtain the best deal for themselves in their particular circumstances. Whether a particular outcome represents this 'best deal' is to be determined by reference to the particular circumstances of the disposal.

This does not mean that a bad bargain cannot be a bargain made at arm's length. For example Mr A may wish to sell his property quickly so that he can go and live in Malta. Mr B knows that Mr A wants to sell his property quickly so he offers him a low price for a quick sale. No-one else makes an offer. Mr A accepts the price Mr B has offered. This may not have been the best possible price which Mr A could have achieved if he had left the property on the market for longer but he was still trying to achieve the best deal possible for himself. It was a bargain made at arm's length.

Another example where a bad bargain could nonetheless be a bargain made at arm's length is where one party to the transaction has better information about the asset than another. For example Mrs S may sell a picture from her attic to Mr T for £500. Mr T, who is an art dealer, knows that the picture is worth £5,000. There has been a bargain with both people trying to get the best deal for themselves. Again, this is a bargain made at arm's length even if the price paid is not the 'market value' of the asset.) (CG14560+)

Example 1 – disposal of all shares

- In December 2012 an investor subscribes £100,000 for 50,000 shares in a SEIS company. Income Tax relief of £50,000 is given in 2012-13 applying the SEIS rate 50%.
- In January 2014 the investor sells all 50,000 shares for £60,000. Income Tax relief of £30,000 in respect of the £60,000 value received by the investor is withdrawn (£60,000 x 50%), see [VCM36020](#). Income Tax relief of £20,000 is not withdrawn and remains attributable to the shares sold. The allowable loss is calculated as below.

Disposal proceeds	£ 60,000
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Less cost	£100,000	
Reduced by Income Tax relief*	£ 20,000	£ 80,000
Allowable loss		£(20,000)

*This is the SEIS Income Tax relief not withdrawn which remains attributable to the shares sold. (see VCM40110)

Example 2 – part-disposal

- In December 2012 an investor subscribes £100,000 for 100,000 shares in a SEIS company. Income Tax relief of £50,000 is given in 2012-13.
- In January 2014 the investor sells 25,000 shares for £10,000. Income Tax relief of £5,000 is withdrawn, (£10,000 x 50%), see [VCM36020](#). Income Tax relief of £7,500 attributable to the shares sold is not withdrawn. The allowable loss is calculated:

Disposal proceeds		£ 10,000
Less cost	£25,000	
Reduced by Income Tax relief*	£ 7,500	£ 17,500
Allowable loss		£(7,500)

*This is the SEIS Income Tax relief not withdrawn which remains attributable to the shares sold. (see VCM40120)

A.4.1. How to claim the losses

Share Loss Relief is given on a claim. The claim must be made on or before the first anniversary of the normal self-assessment filing date for the year of the loss (see ITA07/S132(4)). Where the customer has received a notice to file a return, a claim must wherever possible

- be made in a return, or
- be made in an amendment to a return.

Where claims cannot be made in a return they can be made outside a return (see SACM3030).

APPENDIX 3: New Equity Issuances—Example Store mates

Storemates raised £40,000 through SEIS on October 2012 (<https://www.seedrs.com/storemates-co-uk>) and £70,588 on July 2013 (<https://www.seedrs.com/storemates-co-uk1>). The funds were raised through the UK equity crowdfunding platform SEEDRs (<https://www.seedrs.com>). Storemates is an online service that aims to match people needing affordable self-storage with people looking to turn their spare household space into extra cash (see: <https://storemates.co.uk/>).

In the table below, the information reported in rows (1)-(5) was extracted from abbreviated accounts filed by Storemates with Companies House during 2012-2015 (see <https://beta.companieshouse.gov.uk/company/07726269/filing-history>). The information reported in row (6) was retrieved from SEEDRs (see links in the paragraph above). Finally, information in rows (7) and (8) correspond to examples of the variables *New Equity* and $D(\text{New Equity} > 0)$ used in the empirical analysis and calculated based on rows (1)-(5).

	2012	2013	2014	2015
(1) Issued Capital (Called up share capital)	3	400	455	455
(2) Share premium account		39,960	110,493	110,493
(3) (1)+(2)	3	40,360	110,948	110,948
(4) Profit and loss account	-1,994	- 35,321	- 62,398	- 92,690
(5) Shareholders' funds	-1,988	45,399	159,498	129,206
(6) SEIS issuance		40,000	70,588	
(7) New Equity (Δ (3))	0	40,357	70,588	0
(8) $D(\text{New Equity} > 0)$	0	1	1	0