

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

## **Evidence from a UK Tax Relief<sup>1</sup>**

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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 1.5% 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 young firms. Conditional on issuing new equity, however, firms invest eight times the issued amount. Additional evidence suggests that the marginal funding is provided by the same investors that provide equity, but in the form of debt. Consistent with financing frictions' theories of capital structure, the results imply a large complementarity between outside equity and debt-like securities in young firms.

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The disproportionate contribution of young firms to employment growth has been well established (Haltiwanger, Jarmin and Miranda, 2012; 2016). We show that young firms also account for a disproportionate fraction of aggregate investment. Using firm population data for the UK between 2009 and 2011, we document that firm births contribute close to 40% of the aggregate net investment by limited liability firms—even though nascent firms account for less than 1% of the economy’s total corporate assets (see Panel A of Figure 1).<sup>2</sup> Thus, to understand the determinants of aggregate investment, it is crucial to understand the determinants of investment behaviour by young businesses. It is a common perception by policymakers that young firm investment is hindered by high external financing costs, as witnessed by the non-trivial amount of government resources devoted to subsidizing the cost of capital of young businesses. In the United Kingdom alone, the subsidy expenditures exceed the fiscal budget of the police and nearly matches that of all public universities (Hughes, 2008). Despite the public policy appeal of the subsidies, the role of the cost of outside capital in shaping young business investment is yet to be well understood.

In this paper we investigate how sensitive is young firm investment to the cost of outside equity, defined as the expected return by equity investors other than the founders and managers of the firm (Grinblatt and Titman, 2002). In corporate finance theory, outside equity is the most expensive source of financing, due to agency conflicts and asymmetric information between firm insiders and outside investors (e.g., Jensen and Meckling, 1976; Myers, 1984; Myers and Majluf, 1984).<sup>3</sup> We attempt to answer empirically several related questions. How high must the expected return be in order to induce outside investors to hold additional equity in the average young firm? If the expected return by outside equity investors drops by 10%, how much more do the average and the marginal firm invest, and how is the marginal investment financed? The answers to these questions provide new insights into the relevance and magnitude of the frictions that make outside equity costly for young firms.

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<sup>2</sup> Using population data for limited liability firms, we calculate aggregate net investment (i.e., sum of the change in net book assets) by the subpopulation of firms that experience book asset growth between 2009 and 2011.

<sup>3</sup> More starkly, with few exceptions (see Fluck, 1998; Myers, 2000), corporate finance theory offers no rationale for seeking outside equity when managers can divert cash flows.

To distinguish between inside and outside equity, we construct a database on equity ownership and issuance for the population of young UK firms between 2009 and 2014. An outside equity issuance is identified as an equity issuance that increases the number of equity investors in the firm. This is the first measure of outside equity issuance for a population of young firms (for survey data, see Berger and Udell, 1998; Robb and Robinson, 2016). Two stylized facts emerge that corroborate the uniqueness of outside equity investment. First, consistent with survey data, outside equity finance is rare among young firms: only one of every five new equity issuance events during the first three years of incorporation involves an outside investor. Second, on average, young firms invest four times more when they raise £1 of outside equity than when they raise £1 of inside equity. Moreover, young firms in the upper tail of the asset growth distribution attract several times more outside equity investors than do other young firms. The strong positive associations between outside equity issuance, investment, and growth constitute a novel stylized fact that suggests outside equity plays a special role in the development of young firms.

To establish a causal link between outside equity and investment, we exploit the variation induced by a UK tax-relief program—the Seed Enterprise Investment Scheme (SEIS)—that subsidized outside equity investment in young firms.<sup>4</sup> The potential subsidy was large: for the average eligible firm, the tax relief would have roughly *doubled* the return on equity investment. The launch of the relief program in 2012 introduces time-series variation, and an eligibility rule that excluded firms with more than two years old or more than £200,000 in assets introduces cross-sectional variation, in the expected return by outside equity investors. We use a difference-in-differences approach that compares outcomes by eligible and non-eligible firms due to the asset requirement, albeit with assets near the £200,000 threshold, before and after the SEIS launch (and we use firms ineligible due to their age to form placebo tests for this approach).

The estimates show that the probability of issuing equity increased by 17% as a consequence of the subsidy to outside equity financing. However, since the average baseline probability of issuing equity is low, this implies that only 1% of eligible firms issue equity in response to the subsidy. Thus,

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<sup>4</sup> The assumption here is that competition in private equity is not strong enough for the equity investors not to pass at least some of the subsidy to young firms.

even a sizeable increase in the expected return to outside equity investors did not induce them to hold more equity in most young firms.

We use indirect least-squares and instrumental variables estimates to evaluate the effect of the subsidy on marginal firms, those that do issue more equity in response to the subsidy. The results indicate that marginal firms issue the maximum amount of outside equity allowed by the scheme (£150,000), and the number of equity investors in these firms increase by five (from a baseline average of two). We also find that marginal firms invest an additional £7 for every £1 of new equity raised in response to the subsidy. This investment adjustment is economically large: it corresponds to a 36% increase over the unconditional mean.

Finally, using a subsample of firms for which we have detailed data on all funding sources, we find that firms fund the investment in excess of the new outside equity with debt-like securities, and that these securities are funded by the same investors that supply equity to the young firm. Thus, there is a large multiplier effect of outside equity on investment, and debt-like securities funded by equity investors are the marginal source of financing.

Two new insights follow from these results. The first is that, for the vast majority of young firms, investment is insensitive to a relatively large drop in the cost of outside equity. The point estimates indicate that 99% of young firms operate at a scale at which they face steeply declining returns to marginal investment. This could be due to real frictions (e.g., absence of profitable investment opportunities, lumpy investments, transaction cost of issuing equity), or due to financing frictions (e.g., conflicts of interest and asymmetric information between inside and outside investors). We explore the cross-sectional variation of the impact of the subsidy and find suggestive evidence consistent with financing frictions. Subsidy take-up rates are higher, and equity multipliers are lower, among firms in which the incentives of managers are better aligned with those of outside investors and information asymmetries are lower—namely, firms with outside and institutional investors, firms managed by outsiders, and firms in industries where private benefits are *not* the primary driver of business creation (following the classification of Hurst and Pugsley, 2011). In contrast, the effect does not appear to vary in the cross section with the firm's tangible assets, a variable typically associated

with the cost of external debt. Thus, the cross sectional heterogeneity of the subsidy's impact is correlated exclusively with indicators of equity financing frictions.

The second insight is that there is a strong complementarity between equity and debt financing in young firms. The fact that the marginal debt funding is provided by equity holders is not consistent with explanations that rely on outside equity reducing the cost of debt from third parties (e.g., reduced moral hazard, certification). Also, since young high-growth firms hardly pay any corporate taxes, explanations based on debt being cheaper due to the corporate tax shield advantage are difficult to justify in this context. Explanations based on fixed transaction costs of issuing equity (e.g., fees) cannot explain why young firms use debt as the marginal source of financing once the fixed cost of issuance has been paid.

A parsimonious explanation for the findings is that securities that combine debt and equity features, rather than straight equity or straight debt, are better at mitigating agency conflicts and information asymmetries between insiders and potential outside investors in young firms (for theory, see, Gompers, 1993; Repullo and Suarez, 2004; Casamatta, 2003; Schmidt, 2003 and Chemmanur and Chen, 2014). The observed complementarity between outside equity and other funding sources in young firms is consistent with the prevalence of convertible securities that exhibit features of both equity and debt in the deals of private equity investors (e.g., venture capital firms: Sahlman, 1990; Gompers, 1997; Kaplan and Stromberg, 2003; Van Osnabrugge and Robinson, 2000; and angel investors: Wong, 2010; Goldfarb et al., 2012). Taken together, then, the evidence indicates that financing frictions play an important role in young firms' investment decisions.

To quantify the magnitude of these frictional effects, we use our estimates to obtain an average aggregate elasticity of investment to a change in the cost of outside equity and then compare it with the elasticity predicted by a standard neoclassical model *without* frictions (financial or real). We find that investment increases 1.5% on average in response to a 10% drop in the cost of outside equity, an elasticity that is 5 times smaller than the neoclassical benchmark.

This paper contributes to several strands of the literature in economics and finance. First, it relates to research on the contribution of small and young firms to output growth. Our results are consistent with the large extent of heterogeneity across small and young firms documented by prior

work: only a small fraction of young firms contribute to this firm type's predominance in explaining economic growth (Hurst and Pugsley, 2011; Haltiwanger, Jarmin and Miranda, 2012; 2016). The paper's contribution is twofold. We provide new stylized facts that characterize the outsized contribution of young firms to aggregate corporate asset formation and the salience of outside equity as a source of funding of high-growth firms.

Second, our paper contributes to studies on average and marginal capital structure. Much as in the research of Gordon and MacKie-Mason (1990), Graham (1999), Campello (2001), and Panier et al. (2014), we explore firms' marginal capital structure decisions by using tax policy changes as a source of variation in the relative cost of different capital sources. We contribute to this literature by focusing on young private businesses, which remain relatively understudied due to data limitations. Our paper also complements work by Berger and Udell (1998) and Robb and Robinson (2016) on the average capital structure of young firms using survey data from the US. We confirm that young businesses rely on non-equity liabilities using firm population data from the second-largest private equity market worldwide and, more importantly, new stylized patterns for these young firms relating outside equity, investment and asset growth.

We contribute also to a large body of work devoted to measuring the sensitivity of investment to the cost of capital (for a summary, see Chirinko et al., 2001). Published estimates range from 0 to  $-2$ , and as yet there is little consensus on the extent of elasticity that is attributable to such econometric issues as measurement error and the endogeneity of user capital costs (see Goolsbee, 2000; Cummins et al., 2004). Our contribution provides an estimate that is free of modelling assumptions (e.g., as regards the "use cost" formula; cf. Schaller, 2007), and focuses on a subset of firms—young businesses in developed economies—that remains understudied despite being widely regarded as the main engine of growth and innovation.<sup>5</sup>

Finally, our work relates to the literature on financial frictions and entrepreneurship (see, for example, Kerr and Nanda, 2009). A central question for policy makers is how to identify, and incentivize investment in, *transformational* ventures that can spur economic growth (cf. Schoar,

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<sup>5</sup> The results are also related to work that examines the responsiveness of investment to the cost of funding in developing countries; along these lines, see the work of Foster and Rosenzweig (1996), Goldsetin and Udry (1999), Duflo et al. (2003), and Banerjee and Munshi (2004).

2010). Our results indicate that the vast majority of young firms in the U.K. offer very low marginal returns to outside investors. For the small minority that do not, subsidies to outside equity have large multiplier effects on investment.

The rest of this paper proceeds as follows. In Section 1 we describe the data in detail and document new stylized facts about young firms; in Section 2, we characterize the institutional setting of the UK tax-relief program. We detail 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 investment to outside equity. Section 7 concludes.

## **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 originally extracted from Companies House—the business register in UK (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 (e.g., plant, property and equipment and sources of debt), or of profit and loss statement accounts (e.g., sales and employment), is generally poor. Differences in FAME coverage reflect differences in filing requirements across firms of different sizes. 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, and share premium account. Issued capital corresponds to the nominal face value of total outstanding shares and is also known as called up share capital. 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,  $\Delta$  *issued equity*, and  $D(\Delta$  *issued equity*  $> 0)$ , an indicator variable for positive changes in issued equity. For a detailed example on the construction of these proxies see Appendix 1.

We distinguish between inside and outside equity issuances (post-incorporation). Because firms do not make such distinction in their filings, we identify an equity issuance as outside equity if it increases the number of equity investors in the firm. We also characterize the ownership structure of young firms. We distinguish between three types of owners: Unrelated outside *owners*, *institutional owners* and *manager owners*. *Unrelated outside 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 at Companies House.

To measure non-equity capital issuances, we first estimate non-equity liabilities (liabilities henceforth) as the difference between total assets and shareholders' funds.<sup>6</sup> Non-equity capital issuances correspond to the year-to-year changes in liabilities,  $\Delta$  *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:  $\Delta$  *other debt*,  $\Delta$  *owners' debt*,

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<sup>6</sup> 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.

$\Delta$  *operational liabilities*. Other debt includes bank loans and overdrafts, leasing and other long or short term loans. Owners' 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:  $\Delta$  *total assets*. In Sections 3 and 5, we also use logarithmic transformations of our outcome variables (e.g.,  $\Delta \ln(\text{total assets} + 1)$ ) 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 of the year of incorporation.<sup>7</sup>

Table 1 presents summary statistics for young firms during the pre-SEIS period. 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.<sup>8</sup> 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 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.

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<sup>7</sup> 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.

<sup>8</sup> 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.

Notwithstanding, the median equity ratio is 0.34, and compares to the median equity ratio of 0.27 for European private firms (cf., Bethmann, Jacob and Muller, 2016)<sup>9</sup>, to the average equity ratio of 0.36 for US entrepreneurial firms in the Kauffman Firm Survey (cf., Robb and Robinson, 2016), 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 firms (e.g., Robb and Robinson, 2016; 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 fifteen of the top 40 NAICS4 industries are among the top 40 industries with the largest shares of small business in US (Panel B; Hurst and Wild, 2011). Young firm characteristics at incorporation are heterogeneous across industries (Panels C-F). The median equity ratio at incorporation ranges from 0.05 for Accommodation and Food Services, to 0.54 for Management of Companies and Enterprises (Panel D). Less than half of 20 NAICS2 industries have positive median tangibility ratios at incorporation; the highest tangibility ratio is for Accommodation and Food Services at 0.0.25 (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 South West of

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<sup>9</sup> 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 (2016) 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 (2016) correspond to the 2010 equity ratio reported in Figure 2, and defined as 1 minus the leverage ratio (total liabilities over total assets).

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**

We now present new stylized facts about investment and equity issuance (post incorporation) 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 young firms disproportionately contribute to both asset creation and asset destruction. We use analogue definitions to asset size, asset creation and asset destruction as those in Davis and Haltiwanger (1992)—see Appendix 2 for more details. Panel A of Figure 1 shows that while young and new firms account for less than 10% the aggregate asset value, they account for more than 50% of asset creation and 25% of asset destruction. These findings complement the evidence in Haltiwanger et al., (2016) on the disproportionate contribution of young firms to job, revenue and productivity growth.

The second new stylized fact is that high-growth young firms are disproportionately more likely than other young firms to bring new owners into the firm within three years of incorporation—and thus issue outside equity. Panel B in Figure 1 shows that the percentage change in number of owners within three years of incorporation is 5 times larger for firms among the top 1% of asset growth relative to the top 25% asset growers.

The third 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 (Column 3; 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 (Column 1 and 3; 1,148/5,015). This modest use of outside equity is consistent with survey data of UK firms: 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 survey data of young firms in the U.S. (Berger and Udell, 1998; Robb and Robinson, 2016).<sup>10</sup> Finally,

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<sup>10</sup> The primary source of Berger and Udell (1998) is the National Survey of Small Business Finances, and the focus is on nonfarm, nonfinancial, nonreal-estate small businesses with less than 500 full-time employees. The

it is also consistent with theory: outside equity is the most expensive source of funds in capital structure models of financing frictions such as agency conflicts and information asymmetries (Jensen and Meckling, 1976; Myers and Majluf, 1984; Myers, 2000).

The fourth 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 to equity issuance ratio for outside equity is 4.19, which is statistically higher than the investment ratio of 1.00 for inside issuances (Column 7).<sup>11</sup> The main implication is that outside equity is associated with an apparent multiplier effect: for every pound of outside equity issued by young firms, roughly four pounds are invested in assets. This apparent multiplier is consistent with the pattern exhibited in Figure 1: high-growth young firms in the 99<sup>th</sup> percentile of asset growth have disproportionately more outside owners than all other firms.

The apparent multiplier points to a large complementarity between outside equity and other funding sources in young firms. This complementarity is consistent with theories of financing frictions. For example, 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, a security that combines both equity- and debt-like features such as convertible debt (e.g., Gompers, 1993). Similarly, in models of information asymmetries, hybrid securities can be more efficient screening mechanisms: the downside discipline of the debt portion makes the deal unattractive to low quality entrepreneurs (e.g., Stein 1992).

No causal relationship between young firm asset growth and outside equity can be established based on these stylized facts alone. Panel A in Table 1 shows that outside equity issuers are statistically different in size from inside equity issuers at incorporation (Column 12). In the rest of this paper, we exploit a tax relief program in the UK to establish a causal link from outside equity to

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data source of Robb and Robinson (2016) is the Kauffman Firm Survey, which had a target population of all new businesses that were started in 2004 calendar year in the United States (representing activity in each state). Berger and Udell (1998) report that 89% of equity by small firms was sold to insiders (66% to owners, the remainder to other founding team members, family and friends). Robb and Robinson (2016) report that less than 5% of firms in the Kauffman Firm Survey issue outside equity within 4 years of incorporation (205 out of 4,928; Table 4).

<sup>11</sup> We estimate Hodges-Lehmann median differences using the `cendif` command in `stata`.

young firm asset 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 debt 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 (directly, indirectly or are entitled to acquire) no more than 30% of voting and ownership rights in the firm via ordinary or issued shared capital, voting power, rights on winding up, or, as having control of the company.<sup>12</sup> When assessing the percentage ownership, loans will be taken into account (given the rights of debtholders upon liquidation), specially loans which are not considered to be normal commercial loans, such as those that have conversion rights (for example to

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<sup>12</sup> These conditions apply throughout the period beginning 2 years before the issue of the shares and ending 3 years after the issue (or 3 years after the commencement of the trade if that followed the share issue). So if an investor takes a 15% stake and are given Income Tax relief, and a year later you take an additional 20% stake, the investor has become become connected, and the relief will be withdrawn.

acquire shares or interest at a rate above the commercial rate).<sup>13</sup> In addition, shareholdings and voting rights held by the investor's associates are also taken into account.<sup>14</sup> Finally, outside investors, as well as their associates, cannot be employed by the firm (except as directors) or any of its subsidiaries (after the SEIS shares are issued).

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.<sup>15</sup> These firms roughly corresponded to more than 50% of UK firms and amounted to circa 2.0M 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).<sup>16</sup> 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 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

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<sup>13</sup> For this reason, investment funds specializing in SEIS eligible investments, advise investors not to make any loans to the company during their period of investment. See for example:

<https://info.sapphirecapitalpartners.co.uk/blog/can-a-founder-claim-eis-or-seis-relief>.

<sup>14</sup> Associates are defined as business partners, trustees of any settlement where the investor is a settlor or beneficiary, and relatives. Relatives are defined as ‘spouses or civil partners, parents and grandparents, and children and grandchildren’. Note that brothers and sisters and more distant relatives are not counted as associates for the purpose of the SEIS.

<sup>15</sup> 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.

<sup>16</sup> There is no relief for dividend taxes.

any three-year period.<sup>17</sup> 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 the SEIS tax relief. 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. Crowd-funding equity platforms such as Seedrs<sup>18</sup> and Crowdcube<sup>19</sup> 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).<sup>20</sup>

We estimate the potential outside 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—buy shares in (third-party) private companies. Second, among these high-income

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<sup>17</sup> SEIS is a form of state aid under EU rules.

<sup>18</sup> <https://www.seedrs.com/>

<sup>19</sup> <https://www.crowdcube.com/>

<sup>20</sup> 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 investment”. See <http://www.enterpriseresearch.ac.uk/nation-angels-assessing-impact-angel-investing-across-uk/>.

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.<sup>21</sup> 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 her 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. Second, if profits are positive, the investor is exempt from taxes on capital gains. The after-tax return

<sup>21</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/562937/October\\_2016\\_Commentary\\_EIS\\_SEIS\\_National\\_Statistics\\_final.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/562937/October_2016_Commentary_EIS_SEIS_National_Statistics_final.pdf).

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  $\frac{50+(90-100)*(1-0.45)}{100} = 0.45$ , 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.<sup>22</sup>

### **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 marginal capital structure and asset 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: eligible and non-eligible firms, according to their total assets reported in 2011—below or above £200K (and above £100K and below £300K), respectively. We refer to the eligible firms as “small” or eligible indistinguishable throughout. 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 25,431 eligible (114,907 firm-year observations) and 9,454 non-eligible firms (43,372 firm-year observations) in our final sample (34,885 firms in total and 158,279 firm-year observations).

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 eligible 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).

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<sup>22</sup> For more examples see: <https://www.crowdcube.com/pg/eis-tax-relief-for-investors-44>.

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 (i.e., total assets in 2011) of £167,902. The firm's book value of equity, total assets, and liabilities amount 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 eligible and non-eligible firms by estimating the following type of *difference-in-difference* equation:

$$(1) k_{it} = \alpha_i + \gamma_t \times \text{Industry FE} + \beta \text{Small}_i \times \text{Post}_t + \varepsilon_{it}$$

where  $\text{Small}_i$  is an indicator variable of eligible firms and  $\text{Post}_t$  is a dummy equal to one in the years 2012-2014. We control for heterogeneity across firms, years and industries, using firm fixed effects,  $\alpha_i$ , and including separate year effects for each industry using the 5-digit 2007 SIC classification.<sup>23</sup> 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  $\beta$ , which measures the average change in the outcome variable ( $k_{it}$ ) after the SEIS launch for eligible firms, relative to bigger firms that did not qualify to the tax incentive program in 2012. We expect a positive  $\beta$ .

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<sup>23</sup> Results are unchanged in we use the NAICS4 classification.

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 eligibility status during the program's launch in 2012. Second, both, eligible 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. In our analysis, qualification in 2008 depends on total assets reported one 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.<sup>24</sup> We formally test the first assumption in Figure 5: the distribution of total assets in 2011 for young firms in the analysis sample (i.e., young firms with total assets in 2011 between £100K and £300K that survived until 2012), 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 additional eligibility requirements such as employment numbers, and eligibility changes of control firms after the relief launch in 2012. 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

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<sup>24</sup> 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).

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.

#### **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), implying that one out of every hundred eligible firms issues equity in response to the subsidy. Since equity issuances are rare events among young firms, this modest take-up rate corresponds to a 16.67% over the sample mean (0.06). The low estimated take-up rate is 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 (see notes in Table 1, young firms amounted to roughly 170,000 businesses in the period).

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.<sup>25</sup> The average conditional issuance roughly equals the maximum subsidy value and has a 95<sup>th</sup> confidence interval ranging between £53K and £514K (estimated using bootstrap; Efron, and Tibshirani, 1986).<sup>26</sup> Panels B and C show the 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.<sup>27</sup>

The results imply that for the majority of young firms in the UK, a relatively large drop in the cost of outside equity is not sufficient induce firms to raise more outside financing. This could be due to real frictions, such as high adjustment costs, investment irreversibility or lumpiness, which may limit the degree to which firms react to changes in the user cost of capital (see Caballero 1999).<sup>28</sup> In the extreme, it is possible that some young firms have no profitable investment opportunities. The results are also consistent with the existence of severe financing frictions (e.g., conflicts of interest and asymmetric information between inside and outside investors). The modest take-up rate may reflect how the relief is not enough to compensate the agency and information asymmetry costs for

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<sup>25</sup> 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.

<sup>26</sup> 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](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/562937/October_2016_Commentary_EIS_SEIS_National_Statistics_final.pdf)

<sup>27</sup> 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.

<sup>28</sup> 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.

the majority of young firms.<sup>29</sup> In results that follow we attempt to evaluate the relative merits of these alternative explanations.

#### 4.2. Investment

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 36.4% increase over the sample mean. The magnitude of the effect is substantially larger than the estimated increase of £1,795 for equity issuance reported in column 2. Conditional on issuing equity, the increase in young firm investment exceeds £1.0 M (obtained by scaling up the average effect on assets by the estimated effect on the probability of equity issuance). Column 6 shows the excess investment is financed with issuance of non-equity liabilities, which increase 71% relative to the mean. 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 7 shows no differences in investment across eligible and non-eligible firms prior to the relief.

We calculate the implied outside-equity investment multiplier by dividing the estimated response in investment (£14,951) over the estimated response in equity issuance (£1,795), and estimate the confidence interval using clustered bootstrap. The outside-equity multiplier so constructed equals 8.33, which is higher than the unconditional investment to outside equity ratio (prior to 2012) of 4.19 reported in Panel B of Table 1 (see Section 1.2.1).

We also estimate the implied outside-equity investment multiplier using an instrumental variables (IV) approach, which requires additional identification assumptions. The IV estimates the investment multiplier, as long as the tax incentive affected investment only through its effect on outside equity issuance. This assumption would be violated if firms that do not issue new equity in response to the subsidy, do increase their investment. This would occur if the option of subsidized

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<sup>29</sup> The existence of these frictions is also consistent with the general underdevelopment of private equity markets. 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, although initiatives for this purpose were recently launched by crowdfunding equity platforms such as Seedrs. A 2010 study by Nesta estimated the average time to exit from a UK VC investment in 2009 at 5.7 years. 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).

future equity financing encourages more firm investment today. With this caveat, we summarize IV estimates in Table 5. We estimate the following specification:

$$(2) \Delta \text{Total Assets}_{it} = \alpha_i + \gamma_t \times \text{Industry FE} + \beta \Delta \text{Issued Equity}_{it} + \varepsilon_{it},$$

by instrumenting Issued Equity<sub>it</sub> using *Small<sub>i</sub> × Post<sub>t</sub>*. We also present estimates using logarithmic transformations of investment and equity issuance. To provide a benchmark against which to compare the IV estimates, we also report results from simple ordinary least squares estimations of equation (2). Finally, we reproduce the estimates of the corresponding first-stage (i.e., the regression of  $\Delta$  Issued Equity against *Small<sub>i</sub> × Post<sub>t</sub>*, and firm, and industry cross year fixed effects) together with their F-test statistics.

Column 2 in Table 6 shows the IV estimate of the investment multiplier coincides with the estimate reported in column 6 of Table 5, suggesting that most of the observed increase in investment is due to firms that issued equity in response to the subsidy. The investment multiplier is 8.33, substantially above the unconditional sensitivity of investment to equity issuances reported in column 1. Column 4 shows the multiplier based on logarithmic transformations of investment and equity issuance is also significant. The F-tests reported in the last row of columns 2 and 4 suggest the instrument is not weak. While the value of the F-test in column 2 is 8.6, and thus below the rule of thumb of 10, the difference between the IV and OLS estimates suggests we do not have a weak instrument problem (Bound, Jaeger, and Baker, 1995). Concerns of weakness of instruments are also mitigated in our just-identified setting of only one instrument for the endogenous variable (i.e., outside equity issuance).

The outside equity multiplier is difficult to explain with real frictions alone (e.g., investment lumpiness). On the other hand, the existence of an equity multiplier is consistent with models of financing frictions. Combining equity with debt-like securities can help outside investors mitigate agency and information asymmetry costs: insiders retain enough equity so as to offset the desire to consume private benefits, and the debt-like portion of the deal provides a better screening device (e.g., Stein, 1992; Gompers, 1993). The outside equity multiplier is less consistent with explanations that hinge on fixed transaction costs of issuing equity or real frictions: neither can explain why the

multiplier is financed with non-equity liabilities. The transaction costs associated with issuing common stock are typically fixed, which once incurred to take advantage of the tax relief, should not prevent the investor from investing the full amount in common equity. These type of costs include, for example, legal fees.<sup>32</sup> Consistent with this notion, Figure 6 shows the average take-up rates for firms in more developed markets such as London are no different from other regions where transaction fees may be larger. Similarly, the highest take-up rate across industries is for Mining—an industry where real frictions can be larger than average, as investment opportunities are typically lumpy.

### 4.3. Heterogeneity

We explore the heterogeneity of results in Table 8 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 marginal capital structure decisions and investment behaviour in young firms.

Consistent with the predictions of financing frictions' models, Table 8 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: unrelated 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. 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).<sup>33</sup> This additional result is consistent with survey evidence: most

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<sup>32</sup> The transaction costs to issuing preferred stock are much more significant and can vary with the size of the issue, precisely because of information and incentive problems between insiders and outsiders in the firm. Such problems make it both necessary and difficult to document and negotiate preferences and shareholder arrangements, such as redemption rights and negative covenants.

<sup>33</sup> According to Hurst and Pugsley (2011), 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

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”.

#### **4.4. How do marginal firms finance the equity multiplier?**

The question that remains asks how marginal firms finance the equity multiplier? Table 9 shows that the bulk of the equity multiplier is financed by “owner’s debt” (i.e., all other owners’ liabilities different from ordinary equity), which includes debt-like securities, such as straight debt as well as convertible debt, from the new outside investors in the firm (See Section 1 for a detailed explanation on the classification of non-equity liabilities). Results in Table 9 are for the group of 342 young firms in the analysis sample with detailed data on the structure on non-equity liabilities. As explained in Section 1, FAME’s coverage for the structure of non-equity liabilities is limited as small firms in UK can file abbreviated statements with Companies House

Columns 5-6 in Table 9 show positive point estimates for changes in owner’s debt and operational liabilities, and a negative estimate for other debt. The last two rows in Column 5 show that the change in owner’s debt is statistically significantly higher than the change in other debt. The last two rows in Column 7 show that the change in operational liabilities, instead, is not statistically different from the change in other debt. One limitation of these additional results on the marginal source of financing is potential self-selection into reporting detailed non-equity liabilities: only 342 firms do so, less than 1% of firms in the analysis sample. Reducing this concern, Table 9 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.

There are several ways to describe these additional results: equity and debt are complements in young firms, the marginal capital structure of young firms is highly levered, and debt-like securities are the marginal source of funding for young firms’ investment. Standard interpretations that are less

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classify companies in these sectors as having a “non-pecuniary” business motivation. Two industries where 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 (2011) lack enough power to draw decisive conclusions about other industries. Hence, we classify companies in those industries as having “other” business start-up motivation.

plausible include at least four. First, results are not mechanically driven by restrictions of the tax relief program. When assessing investors' SEIS-eligibility (i.e., no substantial interest in the company), debt-like securities are also taken into account as explained in Section 2. Thus, any issuance of debt-like securities to the new outside investors of the firm are unlikely to be driven by a desire to retain eligibility for the tax relief. Second, potential certification effects from issuing outside equity or from government's scrutiny (e.g., reduced moral hazard) are also unlikely to explain the results, given that the marginal debt is provided by the same equity investors in the firm. Also not consistent with this alternative explanation, Panel E in Table 8 shows similar take-up rates across high-tangibility and low-tangibility firms. Instead, the certification effect was the main driver behind 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. Third, since young high-growth firms hardly pay any corporate taxes, explanations based on debt being cheaper due to the corporate tax shield advantage are difficult to justify in this context. Finally, as argued above, explanations based on fixed transaction costs of issuing equity (e.g., fees) cannot explain why young firms use debt as the marginal source of financing once the fixed cost of issuance has been paid.

In conclusion, the preponderance of evidence suggests that securities that combine debt and equity features, rather than straight equity or straight debt, are better at mitigating financing frictions, such as agency conflicts and information asymmetries between insiders and potential outside investors, in young firms (for theory, see, Gompers, 1993; Repullo and Suarez, 2004; Casamatta, 2003; Schmidt, 2003 and Chemmanur and Chen, 2014).<sup>34</sup> This complementarity between outside

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<sup>34</sup> Gompers (1993) builds a model of early stage financing that combines both moral hazard and adverse selection. The entrepreneur's ability is unknown to the investor who designs a contract to screen out potentially bad entrepreneurs and limit risk taking behaviour. The model shows that one mechanism to reduce the desire to take such risks is to use convertible securities—only after more information is available about the entrepreneur and the company would the venture capitalist choose to utilize common equity. The intuition is that convertible securities can act as both an incentive compensation system for the entrepreneur (because he shares substantially in the upside of the firm but does not benefit from increasing risk) and as a screening mechanism (because the downside discipline of the preferred (debt) portion makes the deal unattractive to low quality entrepreneurs). Another stream of theories build dual-moral-hazard problems and show the optimality of convertible securities in such settings too (Casamatta, 2003; Repullo and Suarez, 2004; and Schmidt, 2003). For example, Casamatta (2003) considers a model where investors can add value through advice, and shows that convertible securities are best at incentivizing effort provision by both entrepreneurs and investors when the level of outside financing is high relative to the provision of funds by the entrepreneur. Relatedly, Schmidt (2003) shows that, if the entrepreneur and the venture capitalist contribute their (observable but not verifiable) effort sequentially, the use

equity and other funding sources in young firms is consistent with the prevalence of convertible securities that exhibit features of both equity and debt in the deals of private equity investors (e.g., venture capital firms: Sahlman, 1990; Gompers, 1997; Kaplan and Stromberg, 2003; Van Osnabrugge and Robinson, 2000; and angel investors: Wong, 2010; Goldfarb et al., 2012).<sup>35</sup> Instead, neoclassical models cannot explain the modest take-up rates, and real frictions' models make no capital structure predictions. Other fixed transaction costs to issuing equity such as legal fees 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 10 and 11 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.

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of convertibles allows to impose a credible punishment on the entrepreneur who deviates from the first best level of effort.

<sup>35</sup> One specific advantage of combining the equity investment that exploits the scheme with convertible debt is that it can put the individual investors in parity with, rather than subordinate them against, later stage venture capital investors. Convertible debt can be structured to convert into preferred stock at a subsequent Series A round where venture capital investors invest in preferred stock.

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 eligible 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 10. 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 10 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 central concern with the main analysis 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 10 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% eligible firms 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 main analysis sample is that biases may arise from defining eligible firms based only on the asset threshold, rather than also on other eligibility requirements. 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. Columns 1-3 in Panel D of Table 10 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, columns 4-6 in Panel E of Table 10 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.

To present additional evidence against the dynamic misclassification concern, in columns 1-3 of Panel E in Table 10, we show that results are robust to excluding from the sample all companies that reported total assets in 2011 between £140K and £260K—that is, within a £120K window around the threshold. Firms that had reported assets in 2011 closely above the £200K threshold are more likely to be able to manipulate assets in order to qualify after the SEIS launch. This test also presents evidence against concerns that potential spillovers from eligible to non-eligible firms drive the results.

Concerns that the tax relief induces potential substitution of investments in non-eligible firms for those in small firms are more pronounced closer to the eligibility threshold. Finally, columns 4-6 in Panel E of Table 10 show that results are robust to dropping from the sample all firms that report assets rounded to the nearest £50,000. Results from this robustness check mitigates measurement error concerns as well as concerns related to potential eligibility manipulation. As reflected in Figure 5, firms with assets below £1M are unusually likely to report values of assets rounded to nearest £50,000.

### **5.3. Potential setting limitations**

The main concern with the SEIS 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 of the tax relief, 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 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, for firms. The EIS is available to unquoted firms with less than £15M in total assets that have fewer than 250 full-time employees.<sup>36</sup> Relief is at 30% of the cost of the shares, rather than at 50% for SEIS investments. Maximum relief per individual

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<sup>36</sup> 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>.

investor in one year is £300K, and the maximum amount a firm can raise per year through the scheme is £5M.<sup>37</sup>

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 11.

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

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

where  $\text{Med}_i$  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 11. We report results using only the logarithmic transformation of the continuous variables to mitigate the impact of outliers.

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<sup>37</sup> 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 the 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>

Columns 1 and 2 show newly EIS 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 deter some obvious opportunistic behaviour by entrepreneurs. Yet gaming of the relief is 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 frictions, both financing and real, 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 eligible firms (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 12.

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 12.

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 12, 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 -0.15 as shown in Table 13. On average, young firm investment increases 1.5% 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%. Combining the two estimates we obtain the -0.15 estimate ( $-0.15 = -0.17/1.13$ ).

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 1.5%, in response to a 10% drop in the cost of outside equity. To estimate this benchmark, we 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.,  $0.79/0.15$ ) 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 3<sup>rd</sup> 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 13<sup>th</sup> 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 help explain 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.<sup>38</sup> 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% response rate for an entirely free de-worming program in Kenya.

## 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,

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<sup>38</sup> 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.

investment increases 1.5% 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 financing frictions such as 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 asset growth. Taken together, the main implication of our findings is that the vast majority of young firms cannot fuel their investment with outside equity because the costs of the financing frictions they face, such as agency and information asymmetry costs, make outside equity prohibitively costly. We estimate the macroeconomic cost of financing and real frictions on young firm asset 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.
- Berger, Allen and Udell, Gregory, 1998, The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle, *Journal of Banking & Finance*, 22, issue 6-8, p. 613-673.
- 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.
- Casamatta, C., 2003, Financing and Advising: Optimal Financial Contracts with Venture Capitalists. *The Journal of Finance*, 58: 2059–2085.
- Chemmanur, T. and Z. Chen, 2014, Venture Capitalists Versus Angels: The Dynamics of Private Firm Financing Contracts *The Review of Corporate Finance Studies*, Volume 3, Issue 1-2, 1 September 2014, Pages 39–86.
- 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.

Fluck, S., 1998, Optimal Financial Contracting: Debt versus Outside Equity, *Review of Financial Studies*, 11(2): 383-418

Gompers, P., 1993, The theory, structure, and performance of venture capital, Unpublished Ph.D. manuscript.

Gompers, P., 1997, Ownership and Control in Entrepreneurial Firms: An Examination of Convertible Securities in Venture Capital Investments, Available at: <http://www.people.hbs.edu/pgompers/Convert.PDF>

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.

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

Harris, M. and A. Raviv, 1990, Capital Structure and the Informational Role of Debt, *Journal of Finance* 45(2): 321-349.

Hughes, A., 2008. Entrepreneurship and Innovation Policy: Retrospect and Prospect, *Political Quarterly*. Volume 79, Issue s1, Pages 133–152

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

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.

Jensen, M., 1986, Agency Costs of Free Cash Flow, *Corporate Finance, and Takeovers*, *The American Economic Review*, 76 (2): 323-329.

Jensen, M. and W. Heckling, 1976, Theory of the firm: Managerial behavior, agency costs and ownership structure, *Journal of Financial Economics*

Kaplan, Steven N and Per Stromberg. "Financial Contracting Theory Meets The Real World: An Empirical Analysis Of Venture Capital Contracts," *Review of Economic Studies*, 2003, v70(2, Apr), 281-315

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

Myers, S. C., 1984, The Capital Structure Puzzle, *Journal of Finance*, 39, 575-592.

Myers, S. C., 2000, Outside Equity, *Journal of Finance*, Volume 55, Issue 3 Pages 1005–1037

Myers, S. C., N. Majluf, 1984, Corporate Financing and Investment Decisions When Firms Have Information Investors Do Not Have, *Journal of Financial Economics*, 13, 187-221.

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](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*.

Sahlman, William A., 1990, The structure and governance of venture-capital organizations, *Journal of Financial Economics*, 27, issue 2, p. 473-521.

Schmidt, K. M. (2003), Convertible Securities and Venture Capital Finance. *The Journal of Finance*, 58: 1139–1166.

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

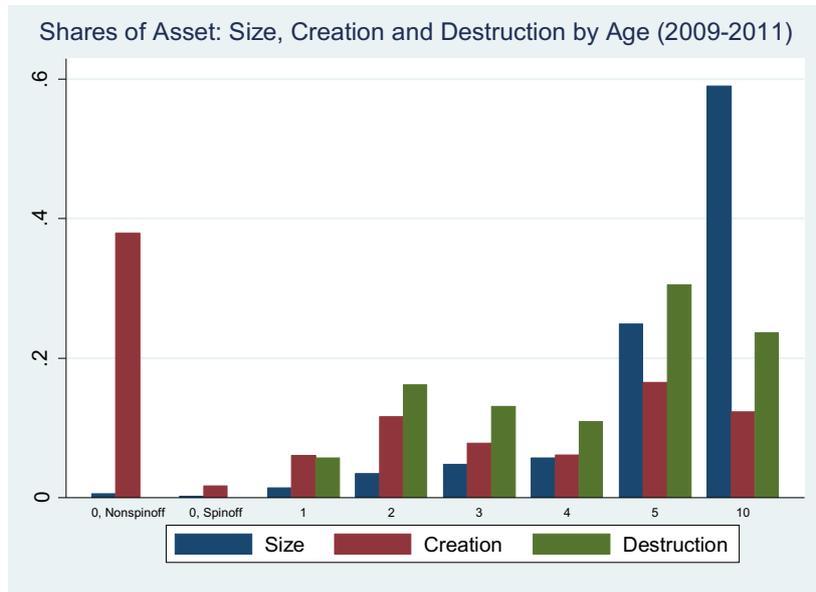
Stultz, R., 1990, Managerial Discretion and Optimal Financing Policies, *Journal of Financial Economics*, 26(1): 3-27.

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

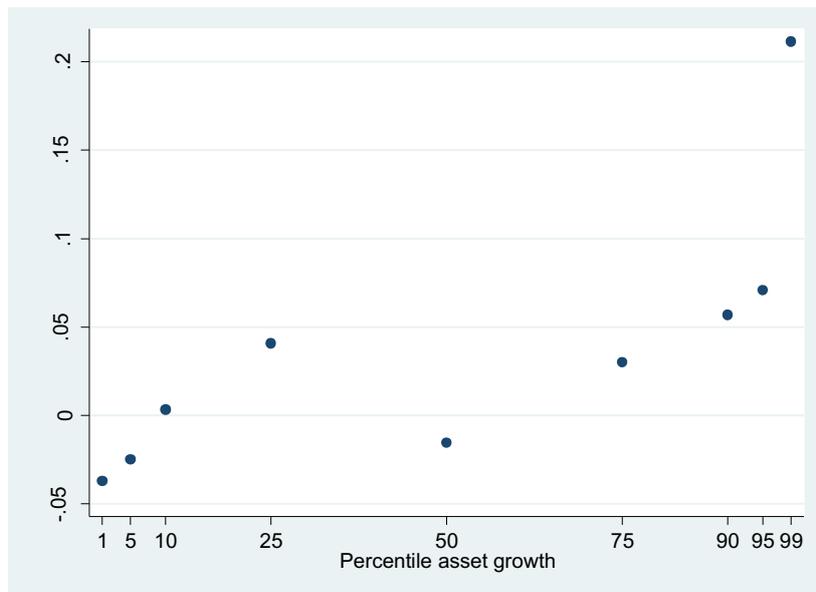
Vos, E., Yeh, AJY., Carter, S and S. Tagg. The happy story of small business financing. *Journal of Banking & Finance* 2007;31(9):2648-2672.

**Figure 1—Patterns in Asset Growth and Outside Ownership for UK Firms**

**Panel A—Shares of Asset Size, Asset Creation and Asset Destruction by Firm Age**



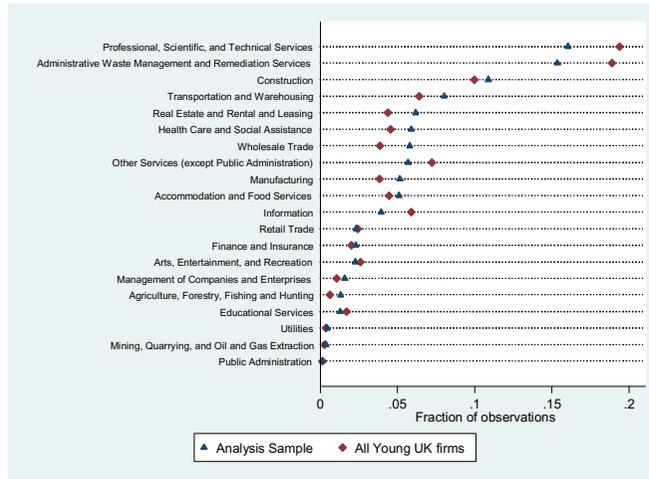
**Panel B—Growth and Number of Owners in Young Firms**



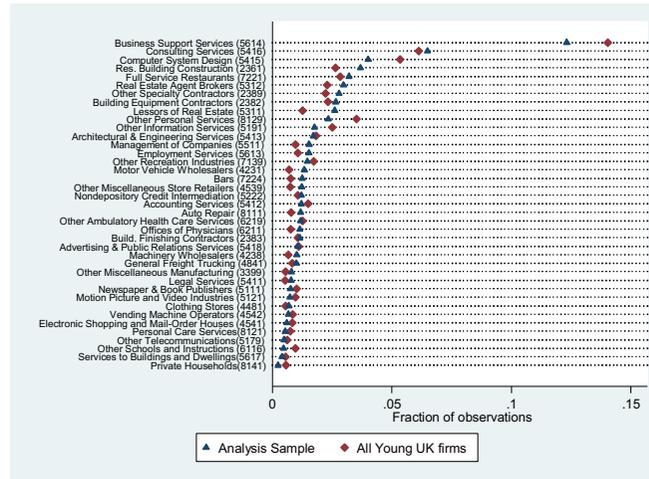
Panel A plots the shares of asset size, asset creation, and asset destruction by firm age during the 2009-2011 period. Asset size corresponds to the value of assets in firms. Asset creation (destruction) corresponds to positive (negative) changes in assets during the period. We classify a new firm as a spinoff if among the owners in the first register of owners there is a corporation. We classify as corporations the following types of owners: banks, financial companies, hedge funds, industrial companies, insurance companies and publicly listed companies. For a more detailed explanation see Appendix 2. Panel B 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

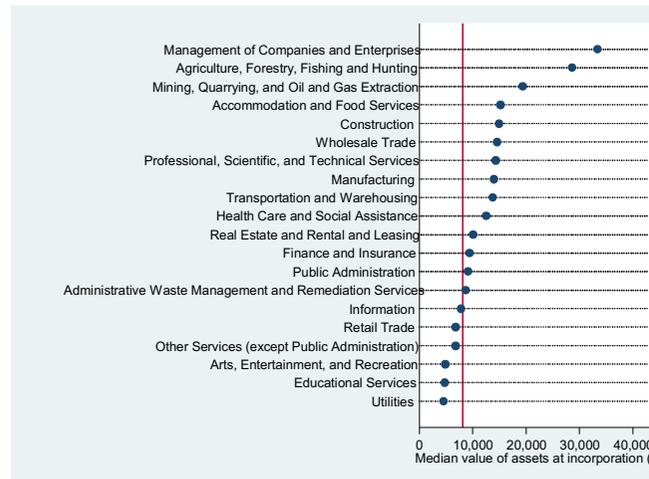
Panel A—Industry Distribution (NAICS 2-digit)



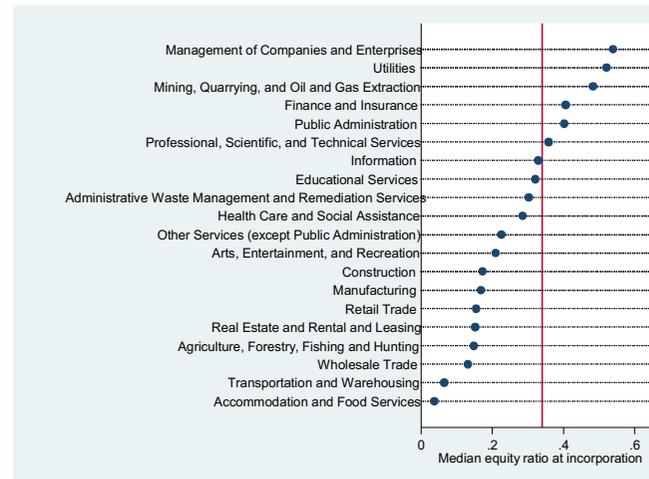
Panel B—Top 40 Industries (NAICS 4-digit)



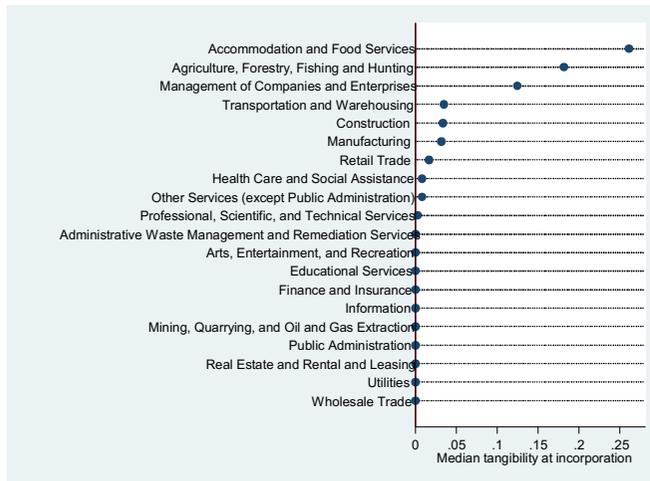
Panel C—Median Value Assets by Industry



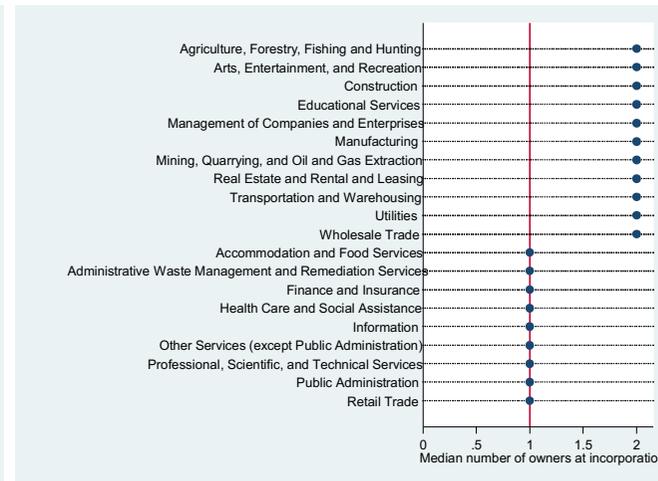
Panel D—Median Equity Ratio by Industry



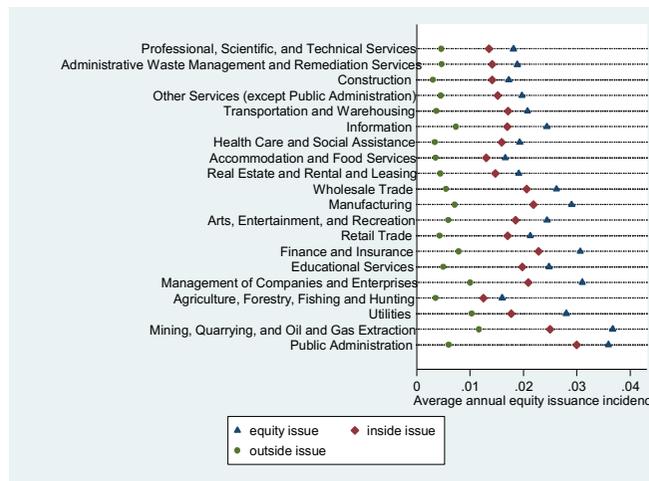
**Panel E—Median Tangibility Ratio by Industry**



**Panel F—Median Number of Owners by Industry**



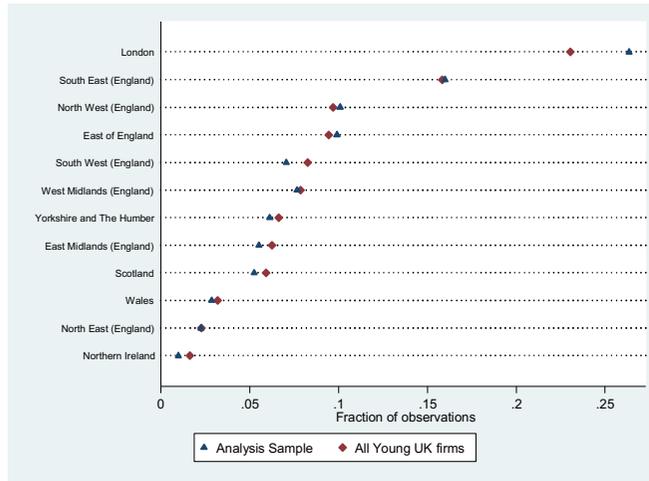
**Panel G—Post-incorporation Average Annual Equity Issuance Incidence by Industry**



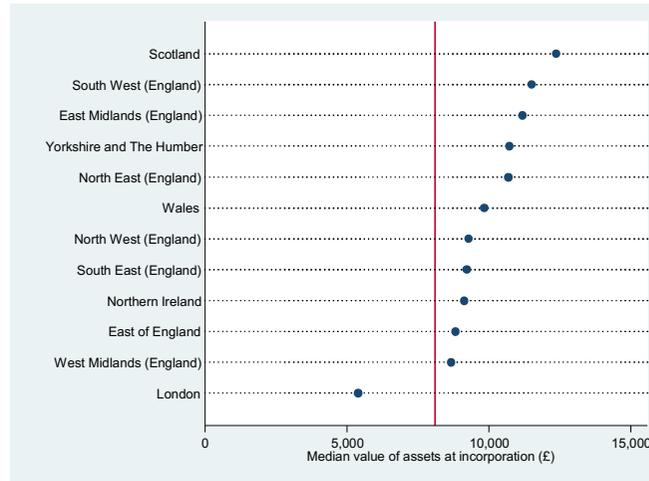
The figure shows the distribution of young UK firms across NAICS 2-digit (Panel A) and NAICS 4-digit industries (Panel B). Panels C-F plot, respectively, the medians at incorporation of asset value, equity ratio, tangibility ratio and number of owners, by industry. Panel G plots the average incidence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

Figure 3—Regional Distribution Young Firms 2009-2011

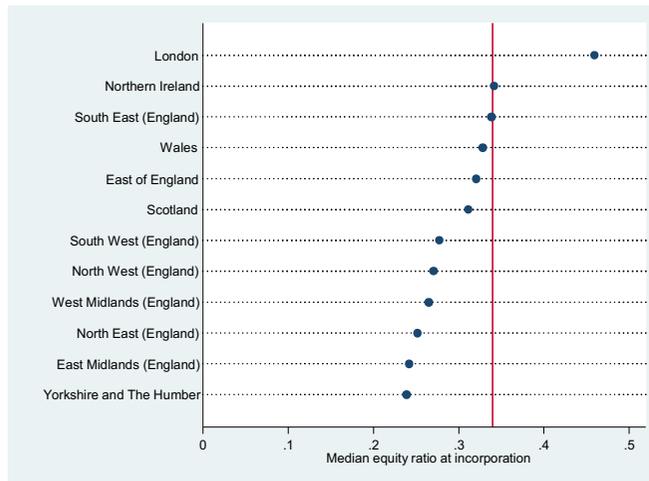
Panel A—Regional Distribution



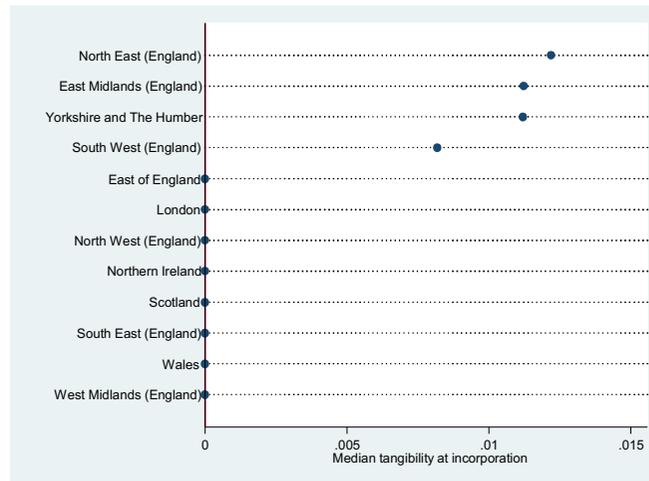
Panel B— Median Value Assets by Region



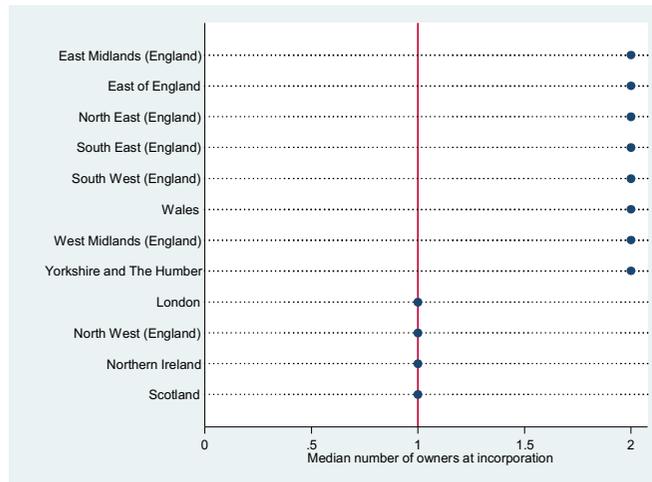
Panel C— Median Equity Ratio by Region



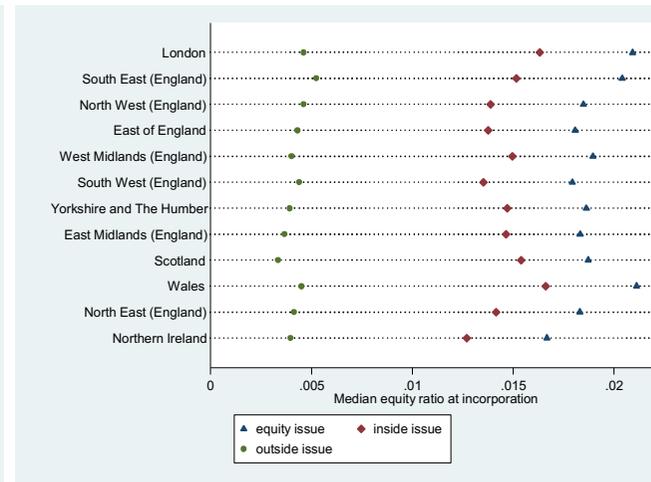
Panel D— Median Tangibility Ratio by Region



**Panel E— Median Number of Owners by Region**

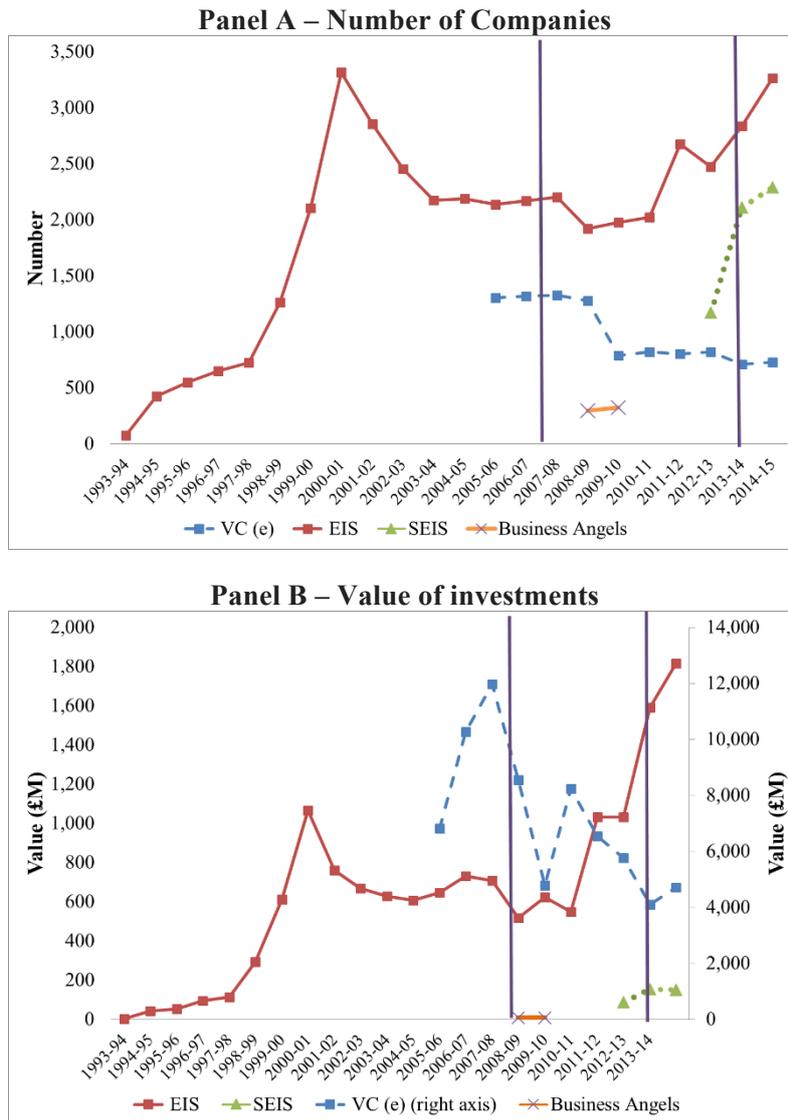


**Panel F—Annual Equity Issuance Incidence by Region**



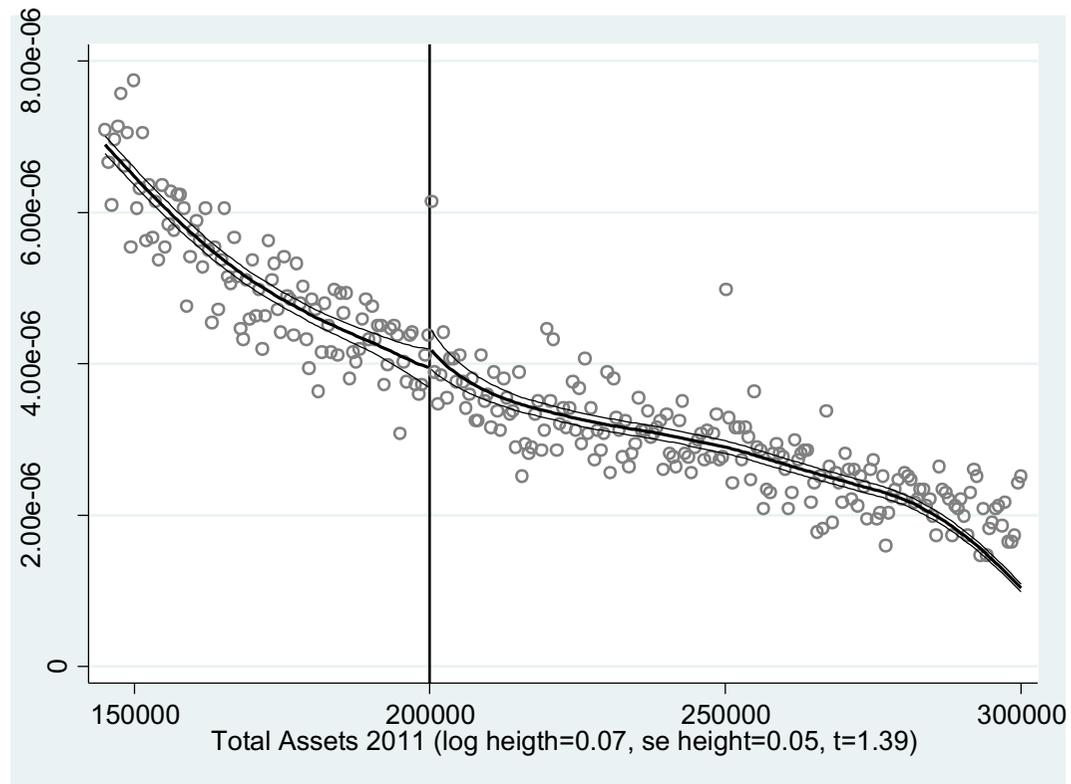
The figure shows the distribution of young firms across UK regions (Panel A). We use the Nomenclature of Territorial Units for Statistics (NUTS) codes of the United Kingdom. Panels B-E plot, respectively, the medians at incorporation of asset value, equity ratio, tangibility ratio and number of owners,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



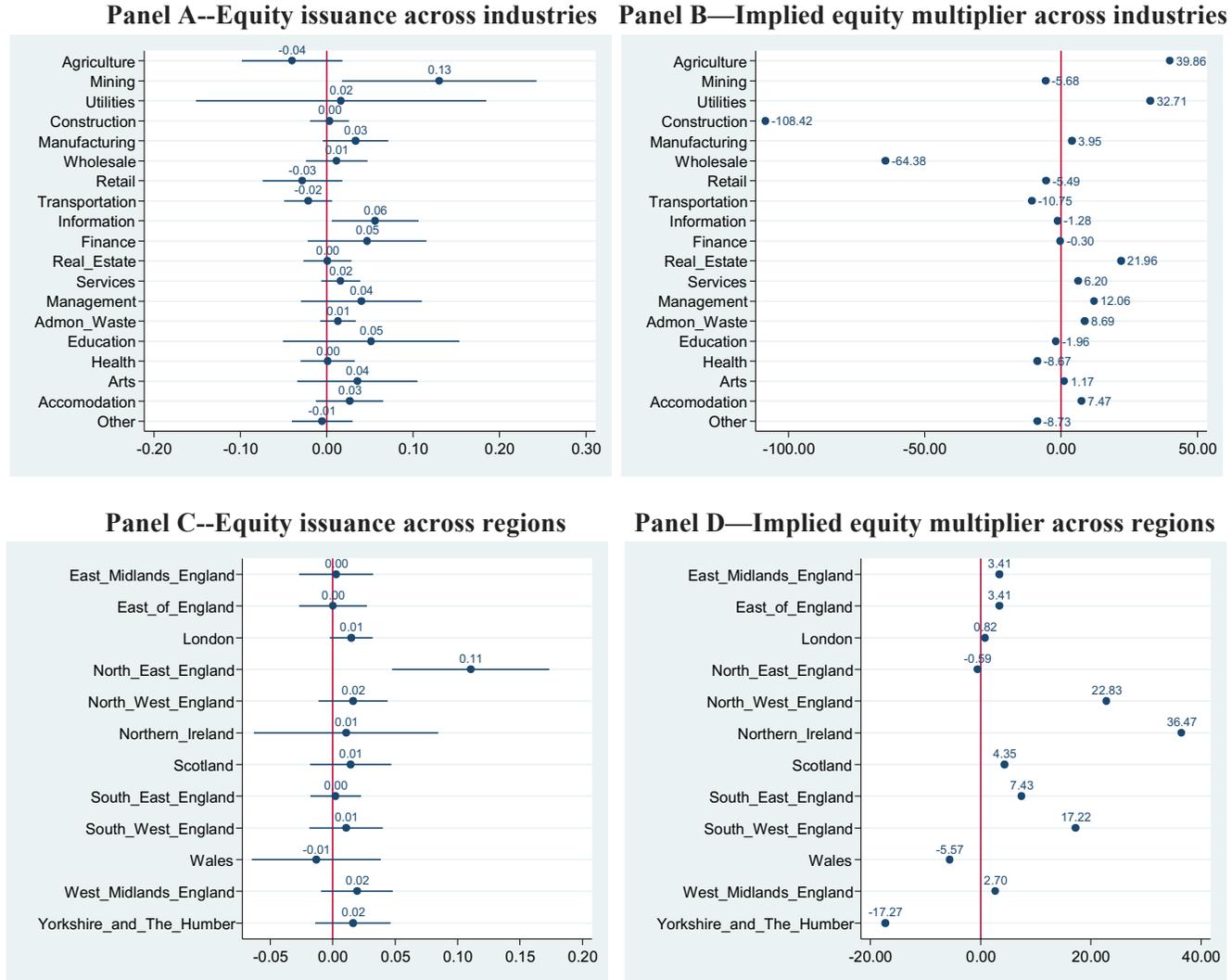
The figure plots the value of investments and number of companies raising funds under the EIS and SEIS schemes. It also plots value of investments made by venture capital (VC) and business angel investors for available years. Sources: HMRC (2015), BVCA(2015), BIS (2010), Deloitte (Business Angels) and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

Figure 5—Distribution Total Assets Young Firms in 2011



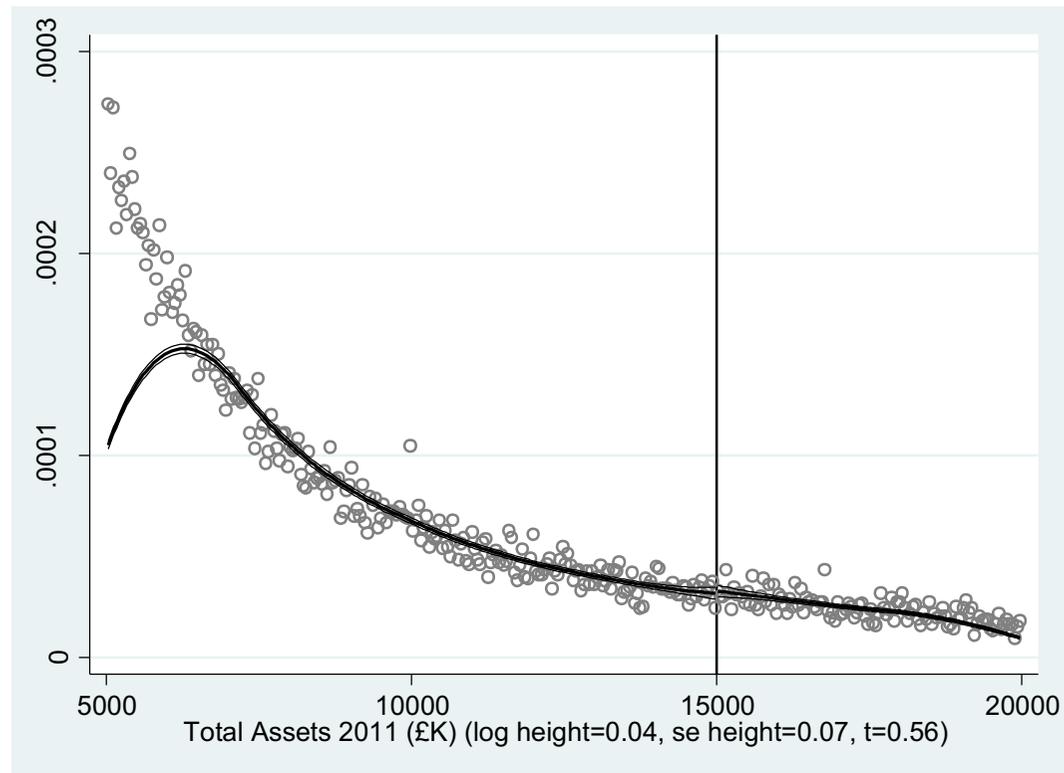
The figure plots the distribution of total assets in 2011 for the firms in the main analysis sample—i.e., young firms with total assets in 2011 between £100K and £300K that survived until 2012. The x-axis title includes the results from the McCrary test for discontinuity in this distribution at the asset 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		
$\Delta$ Issued equity (£)	99 (997)	99 (996)	100 (20,040)	1,000 (74,104)	750 (49,910)	1,250 (88,025)	8***	83
$\Delta$ (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
$\Delta$ Total Assets/ $\Delta$ Issued equity	1.00 (316)	1.00 (254)	4.19 (706)	3.66 (320)	3.13 (309)	7.54 (607)	1.23***	1.89
$\Delta$ (Total liabilities) (£)				8,569 (172,579)	5,282 (92,844)	74,683 (541,588)		76,330***
$\Delta$ (Outside debt) (£)				0.00 (1,808)	0.00 (1,808)	0.00 (1,179)		0.00
$\Delta$ (Inside debt) (£)				0.00 (33,648)	0.00 (24,959)	0.00 (46,412)		0.00
$\Delta$ (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 shows median values and reports 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						<b>1.84</b>

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	Return on Investment in 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	0.52

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
Assets in 2011	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
$\Delta$ Issued Equity	123,096	1,422	36,526	0	0	37,500
D( $\Delta$ Issued Equity)	123,096	0.063	0.243	0	0	1
$\Delta$ Fixed Assets	123,096	7,640	159,119	-46	1,364	222,085
$\Delta$ Total Assets	123,096	41,081	303,081	11,090	62,495	603,527
$\Delta$ Number of Owners	102,123	0.071	0.959	0	0	2
$\Delta$ 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	0.615	0.486	1	1	1
$Small_i \times Post_t$	158,279	0.447	0.497	0	1	1

The table presents summary statistics for the main variables in the analysis sample—i.e., young firms with total assets in 2011 between £100K and £300K that survived until 2012. Variable definitions are described in Section 1.1.

**Table 5- Outside Equity Issuance and Investment after SEIS launch**

<b>Panel A—Basic Results</b>						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	D( $\Delta$ Issued Equity >0)	$\Delta$ Issued Equity	$\Delta$ Number of Owners	$\Delta$ Total Assets	$\Delta$ Total Liabilities	Implied Multiplier $\Delta$ Total Assets/ $\Delta$ 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 <sup>th</sup> 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	

<b>Panel B—Logarithmic transformation</b>			
	(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

<b>Panel C—Collapsed Sample</b>					
	(1)	(2)	(3)	(4)	(5)
Dep. Var.	D( $\Delta$ Issued Equity >0)	$\Delta$ Issued Equity	$\Delta$ Number of owners	$\Delta$ Total Assets	$\Delta$ 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 assets in 2011 below 200K pounds 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 95<sup>th</sup> confidence intervals. The implied equity multiplier in the last column corresponds to the ratio between the estimates of  $\Delta$  Total Assets and  $\Delta$  Issued Equity (columns (4) and (2), respectively); the standard error is estimated using bootstrap (clustered at firm level) and we report the 95<sup>th</sup> 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—Instrumental Variables Estimate of Outside Equity Multiplier**

	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
Dep. Var.	$\Delta$ Total Assets	$\Delta$ Total Assets	$\Delta$ Ln(Total Assets)	$\Delta$ Ln(Total Assets)
$\Delta$ Issued Equity	0.66*** (0.17)	8.33** (3.29)		
$\Delta$ Ln( Issued Equity)			0.13*** (0.009)	2.28*** (0.768)
Observations	121,598	121,598	121,598	121,598
<i>First-stage</i>				
$Small_i \times Post_t$		1,795*** (611)		0.08*** (0.022)
Observations		121,598		121,598
R-squared		0.26		0.25
F-test excluded instruments		8.609		11.669

Columns 1 and 3 in the table present results from OLS regressions of  $\Delta$  Total Assets on  $\Delta$  Issued Equity and  $\Delta$  Ln(Total Assets) on  $\Delta$  Ln( Issued Equity), respectively, including firm fixed effects and industry cross year fixed effects. Columns 2 and 4 present results from instrumental variables regressions, where  $\Delta$  Issued Equity and  $\Delta$  Ln( Issued Equity) are instrumented using  $Small_i \times Post_t$ , and we include firm fixed effects and industry cross year fixed effects. 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- SEIS launch and equity issuance and investment dynamics**

	(1)	(2)	(3)
Dep. Variable	D( $\Delta$ Issued Equity >0)	$\Delta$ Issued Equity	$\Delta$ Total Assets
<i>Small<sub>i</sub></i> × <i>D</i> <sub>2011</sub>	0.01 (0.011)	1,558 (1,586.652)	15,502 (10,338.038)
<i>Small<sub>i</sub></i> × <i>D</i> <sub>2012</sub>	0.02 (0.011)	2,569 (1,587.443)	31,735*** (10,354.693)
<i>Small<sub>i</sub></i> × <i>D</i> <sub>2013</sub>	0.01 (0.011)	1,955 (1,667.477)	30,215*** (10,293.879)
<i>Small<sub>i</sub></i> × <i>D</i> <sub>2014</sub>	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 assets in 2011 below 200K pounds,  $D_i$  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 8- Heterogeneity SEIS effect**  
**Panel A—Unrelated outside owners**

	(1)	(2)	(3)	Implied Multiplier
	D( $\Delta$ Issued Equity>0)	$\Delta$ Issued Equity	$\Delta$ Total Assets	$\Delta$ Total Assets/ $\Delta$ 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( $\Delta$ Issued Equity>0)	$\Delta$ Issued Equity	$\Delta$ Total Assets	$\Delta$ Total Assets/ $\Delta$ 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( $\Delta$ Issued Equity>0)	$\Delta$ Issued Equity	$\Delta$ Total Assets	$\Delta$ Total Assets/ $\Delta$ 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( $\Delta$ Issued Equity > 0)	$\Delta$ Issued Equity	$\Delta$ Total Assets	$\Delta$ Total Assets / $\Delta$ Issued Equity
<i>I. Private benefits of control</i>				
<i>Small<sub>i</sub> × Post<sub>t</sub></i>	-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>				
<i>Small<sub>i</sub> × Post<sub>t</sub></i>	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>				
<i>Small<sub>i</sub> × Post<sub>t</sub></i>	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( $\Delta$ Issued Equity > 0)	$\Delta$ Issued Equity	$\Delta$ Total Assets	$\Delta$ Total Assets / $\Delta$ Issued Equity
<i>III. High tangibility</i>				
<i>Small<sub>i</sub> × Post<sub>t</sub></i>	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>				
<i>Small<sub>i</sub> × Post<sub>t</sub></i>	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<sub>i</sub>* is a dummy indicating whether the firm had total assets in 2011 below 200K pounds, *Post<sub>t</sub>* is a dummy equal to one in the years 2012-2014, and the dependent variable is specified in the top of the column. Unrelated outside 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 9- Financing the Outside Equity Multiplier**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Var.	D( $\Delta$ Issued Equity >0)	$\Delta$ Issued Equity	$\Delta$ Total Assets	$\Delta$ Total Liabilities	$\Delta$ Other debt	$\Delta$ Owners' debt	$\Delta$ Operational Liabilities
$Small_i \times Post_t$	0.04 (0.06)	1,023 (929)	17,113 (19,624)	30,724.70 (24,037.756)	-18,248 (25,725)	80,292 (65,872)	2,402 (17,141)
Observations	1,072	1,072	1,072	1,072	1,072	1,072	1,072
R-squared	0.577	0.684	0.732	0.785	0.699	0.626	0.714
Mean Dep. Var.	0.11	1,864	46,931	74726.28	18,907	76,055	21,205
<i>Difference with <math>\Delta</math> Other debt</i>						98,540**	20,651
<i>95% Confidence Interval</i>						[943 - 461,475]	[-37,238 - 121,857]

The table presents results from estimating equation (1).  $Small_i$  is a dummy indicating whether the firm had total assets in 2011 below 200K pounds 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 342 (222 small and 119 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 10-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( $\Delta$ Issued Equity >0)	0.0	0.0	0.5	0.5%
$\Delta$ Issued Equity	-934	6,322	0.5	0.5%
$\Delta$ Total Assets	7,539	32,954	0.4	2.0%
$\Delta$ Ln( Issued Equity)	-0.1	0.1	0.4	2.0%
$\Delta$ Ln(Total Assets)	0.0	0.2	0.7	1.0%

**Panel B – Older Firms**

	(1)	(2)	(3)
Dep. Var.	D( $\Delta$ Issued Equity >0)	$\Delta$ Issued Equity	$\Delta$ 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)
	£75K bandwidth			Symmetric window (£145K-£300K)		
Dep. Var.	D( $\Delta$ Issued Equity >0)	$\Delta$ Issued Equity	$\Delta$ Total Assets	D( $\Delta$ Issued Equity >0)	$\Delta$ Issued Equity	$\Delta$ 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( $\Delta$ Issued Equity $>0$ )	$\Delta$ Ln( Issued Equity)	$\Delta$ Ln(Total Assets)	D( $\Delta$ Issued Equity $>0$ )	$\Delta$ Ln( Issued Equity)	$\Delta$ 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 E – Additional concerns**

	(1)	(2)	(3)	(4)	(5)	(6)
	Spillovers from eligible to non-eligible firms			Differences in firms that round assets		
Dep. Var.	D( $\Delta$ Issued Equity $>0$ )	$\Delta$ Ln( Issued Equity)	$\Delta$ Ln(Total Assets)	D( $\Delta$ Issued Equity $>0$ )	$\Delta$ Ln( Issued Equity)	$\Delta$ Ln(Total Assets)
$Small_i \times Post_t$	0.02*** (0.008)	0.09** (0.040)	0.28*** (0.068)	0.01*** (0.004)	0.08*** (0.022)	0.17*** (0.038)
Observations	59,810	59,810	59,180	121,264	121,264	121,264
R-squared	0.38	0.27	0.38	0.365	0.253	0.369
Mean Dep. Var.	0.06	0.08	0.20	0.06	0.09	0.21
Mean $Small_i$	0.83	0.83	0.83	0.72	0.72	0.72

The table presents results from estimating equation (1) in different subsamples.  $Small_i$  is a dummy indicating whether the firm had total assets in 2011 below 200K pounds 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) (“late qualifiers”). Columns 1-3 in Panel E exclude from the sample all companies that reported total assets in 2011 between £140K and £260K. Columns 4-6 in Panel E reports results excluding from the sample all firms that reported total assets in 2011 rounded to the nearest multiple of 50,000. 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-EIS Analysis**

<b>Panel A—Summary Statistics EIS Sample</b>						
	obs.	mean	sd	p50	p75	p99
Total Assets in 2011 (£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
$\Delta$ Issued Equity (£M)	11,429	66.47	540.4	0	0	9,990
D( $\Delta$ Issued Equity)	11,429	0.142	0.349	0	0	1
$\Delta$ 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

<b>Panel B-Regression Results</b>						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	D( $\Delta$ Issued Equity>0)	$\Delta$ Ln( Issued Equity)	$\Delta$ Ln(Total Assets)	D( $\Delta$ Issued Equity>0)	$\Delta$ Ln( Issued Equity)	$\Delta$ 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 assets in 2011 below £15M.  $Post_t$  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 12- Distribution of After-tax Return on Investment in Outside Equity with and without the Relief**

After-tax Return on Investment in Outside Equity (ROI)	Mean	Standard deviation	Minimum	Maximum	Median
ROI without the relief	0.06	0.37	-20.20	2.70	0.05
ROI with the relief	0.12	0.40	-20.20	3.75	0.10
$\Delta$ ROI implied by relief	0.06				
% $\Delta$ ROI implied by relief	113				

The table presents after-tax return on investment in outside equity (ROI) with and without the relief. *ROI without* the relief correspond to the ratio between cash flow to equity holders and total assets for eligible firms (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). *ROI 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 13—Elasticity of Young Firm Investment to the Cost of Outside Equity**

	(1)	(2)
	Actual	Neoclassical Benchmark (assuming 100% take-up, and no multiplier)
ROI without the relief	0.06	0.06
ROI with the relief	0.12	0.12
$\Delta$ ROI	0.06	0.06
% $\Delta$ ROI	1.13	1.13
% $\Delta$ Total Assets	0.17	0.89= £150K/£168
Elasticity	-0.15	-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 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 25<sup>th</sup> 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.<sup>1</sup> 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.<sup>2</sup>

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.<sup>3</sup> 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,

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<sup>1</sup> 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.

<sup>2</sup> 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.

<sup>3</sup> 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).<sup>4</sup> 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.<sup>5</sup> 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.<sup>6 7</sup> 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,

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<sup>4</sup> 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.

<sup>5</sup> 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.

<sup>6</sup> 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.

<sup>7</sup> 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).

in Section 1.3 we distinguish between inside and outside equity issuances (post-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:  $\Delta$  *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:  $\Delta$  *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:  $\Delta$  *trade credit*,  $\Delta$  *bank overdrafts*,  $\Delta$  *group loans*,  $\Delta$  *director loans*,  $\Delta$  *other loans*, and  $\Delta$  *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.<sup>8</sup> 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.<sup>9</sup>

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: ASSET SIZE, ASSET CREATION AND ASSET DESTRUCTION

We follow Davis and Haltiwanger (1992) to construct measures of asset size, creation and destruction. In particular we measure the asset size of a firm  $i$  at time  $t$ , denoted by  $x_{it}$ , as the simple average of firm asset size at time  $t$  and at time  $t-1$ . We define the time- $t$  asset growth rate of establishment  $i$ , denoted by  $g_{it}$ , as the change in firms asset size from  $t-1$  to  $t$ , divided by  $x_{it}$ . This growth rate is symmetric about zero, and it lies in the closed interval  $[-2,2]$  with deaths (births) corresponding to the left (right) endpoint.

Figure A.2.1 below plots the frequency distribution for the firm growth rate observations in the three-year pre-SEIS sample (2009-2011). The density is slightly asymmetric with central peaks in the interval surrounding zero and endpoint spikes corresponding to births and deaths. Roughly 25 percent of all firms in the sample, experienced a growth rate in the interval  $(-0.05, 0.05)$ . Births and deaths account for 16% of annual growth rate observations.

The asset creation and asset destruction measures we summarize in Figure 1 have a simple relationship to the frequency distribution of firm growth rates. We calculate asset creation by summing positive asset changes at expanding firms of a specific age (or for new firms). Similarly, we

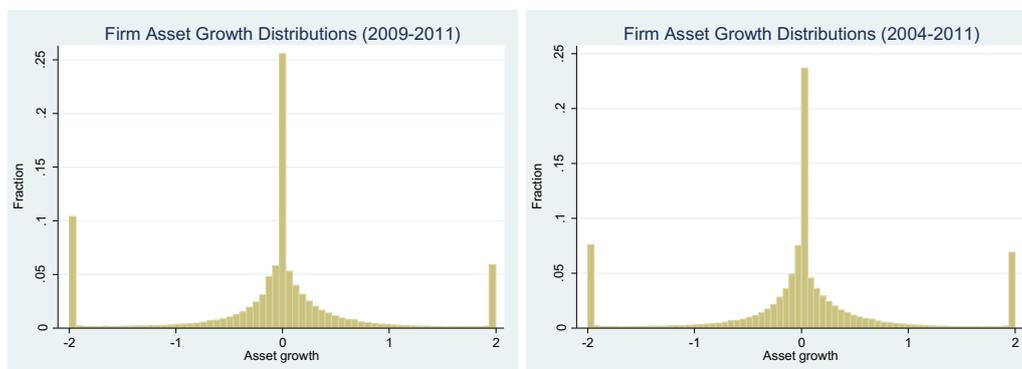
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<sup>8</sup> Medium sized and larger firms classify liabilities further, including: provisions (taxation or other), accruals and deferred income, and hire purchase and leasing. These accounts are missing for the vast majority of firms in our sample. 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.

<sup>9</sup> 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  $\Delta$  *group loans*,  $\Delta$  *director loans*,  $\Delta$  *other loans*, and  $\Delta$  *other liabilities* include changes in both current and long-term components.

calculate asset destruction by summing up negative asset changes at shrinking firms of a specific age (or for dying firms). To express these measures as rates, we divide by the asset size of the firms with that specific age.

**Figure A.2.1—Firm Asset Growth Distribution**



### APPENDIX 3: 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).

#### 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
<hr/>		
Less cost	£100,000	
<hr/>		
Reduced by Income Tax relief*	£ 20,000	£ 80,000
<hr/>		
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 4: 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) <b>New Equity (<math>\Delta</math> (3))</b>	<b>0</b>	<b>40,357</b>	<b>70,588</b>	<b>0</b>
(8) <b><math>D(\text{New Equity} &gt; 0)</math></b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>