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

Evidence from a UK Tax Relief[*]

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We estimate the corporate investment response to a large subsidy targeted to individuals that make new non-controlling equity investments in young UK firms. Only 1% of eligible firms issue equity in response to a subsidy that includes a tax rebate of £1 for every £2 invested. However, firms invest eight times the amount of equity raised. Equity owners fund the marginal investment in the form of unsubsidized debt. The results imply that the marginal capital structure for high-growth young firms is highly levered, and are consistent with large financing costs due to conflicts of interest between founders and outside investors.

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A non-trivial amount of government resources is devoted to subsidizing the cost of capital of young businesses. In the United Kingdom, for example, cost-of-capital subsidy expenditures exceed the fiscal budget of the police and nearly match that of all public universities (Hughes, 2008). Despite the common perception amongst policymakers that young firm investment is hindered by high external financing costs, the role of the cost of outside capital in shaping young business behaviour is hotly debated and is yet to be well understood (see Hurst and Pugsley 2011). The importance of understanding this role is highlighted by a new stylized fact: young firms account for a disproportionate fraction of aggregate investment. Although the disproportionate contribution of young firms to employment growth has been well established (Haltiwanger, Jarmin, and Miranda 2012; 2016), measurement of these firms' investment contribution has been hindered by data limitations. Using firm population data for the UK between 2009 and 2011, we document that firm births contribute 29% of the aggregate corporate asset formation—even though nascent firms account for less than 2% of the economy's total corporate assets (Figure 1).[1]

In this paper, we investigate how sensitive young firm investment is to the cost of outside equity provided by individual investors, defined as the expected return by individual equity investors other than the founders who have no control over the firm. Studying investment by individual investors is relevant in practice because business angel financing is the primary source of external seed and early stage financing in many countries (OECD 2011), and several studies estimate that such financing roughly doubles the institutional venture capital market in size (Wong, Bhatia, and Freeman 2009).[2] The focus on outside equity is also relevant from a corporate theory perspective: outside equity is the most expensive source of financing due to conflicts of interest between firm insiders and outside investors (e.g., Jensen and Meckling 1976; Myers 1984; Myers and Majluf 1984). With few exceptions (see Fluck 1998; Myers 2000), finance theory offers no rationale for seeking equity from non-controlling shareholders when managers can divert cash flows. Despite the practical and theoretical

[1] Using population data for limited firms, we calculate aggregate investment (i.e., the sum of the change in book assets) for the subpopulation of firms that experience book asset growth between 2009 and 2011.

[2] For example, in 2000 the National Venture Capital Association assessed the size of the angel market at $100 billion in the United States, while the institutional venture capital market was estimated at less than half of this at $48.3 billion (Venture Economics press release, January 2000, see www.ventureeconomics.com).

relevance, the use of outside equity by young firms remains understudied given the scarcity of data on business angel investments (see Kerr, Lerner, and Schoar 2014; Lerner, Schoar, Sokolinski, and Wilson 2015).

We attempt to answer several related questions empirically. Holding firm productivity, risk, and investment opportunities constant, what proportion of young firms would issue new equity if the expected return by outside equity investors drops by 50%? How much new equity (and debt) would they raise? Would investment increase, and if so, by how much? The answers to these questions provide new insights into the relevance and magnitude of the frictions that make outside equity costly for young firms.

We begin by producing a set of new stylized facts about the population of young firms that are related to the issuance of outside equity. 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. We identify outside equity issuances as those that increase the number of equity investors in the firm. Although measured with some noise, this is the first measure of outside equity issuance for a *population* of young firms. Three stylized facts emerge. First, consistent with survey data (see Berger and Udell 1998; Robb and Robinson 2016), issuing equity to new investors is rare among young firms: only one out of every five equity issuance events during the first three years of incorporation involves attracting new equity investors. Second, young firms that attract new equity investors invest more and grow faster. On average, young firm assets grow £1 for every £1 of inside equity raised, but they grow £4 for every £1 of outside equity issued. This suggests a strong complementarity between outside equity issuances and corporate liabilities such as debt. Moreover, young firms in the top 1 percentile of asset growth attract four times more new equity investors than young firms in any other percentile of the asset growth distribution. Thus, attracting new equity investors is an outstanding feature of high-growth young businesses.

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 by individuals. The potential magnitude of the subsidy was economically important from the investors' perspective: a business angel investor would receive a £1

personal tax rebate for every £2 invested, among other tax benefits.[3] It was also large relative to eligible firms' size: firms that had only been trading for two years or less with less than £200,000 in assets were eligible to raise up to £150,000 of subsidized equity.[4] The launch of the relief program in 2012 introduces time-series variation and the eligibility rule introduces cross-sectional variation in the expected return by outside equity investors.[5] We use a difference-in-differences approach that compares outcomes by eligible and non-eligible firms as determined by the asset requirement—albeit with assets near the £200,000 threshold—before and after the SEIS launch. We use firms that are ineligible due to their age to perform placebo tests.

We find that the propensity to issue outside equity among young firms is very insensitive to changes in the expected return to outside investors: Only 1% of eligible firms issue equity in response to the subsidy. Expressed as an elasticity, our estimates imply that a 50% decline in the cost of capital induces a 17% increase in the probability of issuing equity. Relative to non-eligible firms, eligible firms, on average, issue an additional £1,800 of equity and increase the number of owners by 0.07. Scaling up the average value of equity issuance response by the equity issuance rate indicates that marginal firms—those that issue equity in response to the subsidy—issue the maximum amount of equity allowed by the scheme (£150,000) and attract five new investors (from a baseline average of two).

When we turn to investment we find that the equity subsidy is inframarginal: the average investment response is £15,000—8.3 times larger than the average new equity issuance. Thus, young firms use sources other than the subsidized outside equity to fund the marginal investment. We use a subsample of the data that contains detailed information on the funding sources to characterize the marginal funding of young firms. Implementing the same estimation approach in this subsample, we find that firms use debt or debt-like securities to fund the investment in excess of the new outside equity

[3] The other two tax benefits were: a capital gains exemption and the allowance to deduct capital losses at the (higher) income tax rate (see Section 2)

[4] Her Majesty's Revenue and Customs (HMRC) considers that a company is trading if it has engaged in any business activity, defined as carrying on a trade or profession, or buying and selling goods or services with a view to making a profit or surplus. Newly incorporated companies many not be active for Corporation Tax purposes yet may still carry out "pre-trading" activities. Examples of these pre-trading activities include: writing a business plan or negotiating contracts. For more details, see: https://www.gov.uk/guidance/corporation-tax-trading-and-non-trading.

[5] Because we do not have data on the price at which the new equity is sold, we cannot assess the incidence of the subsidy to outsiders and insiders.

(as opposed to liabilities related to operations, such as accounts receivables), and that the debt is funded by investors that also own equity in the firm (as opposed to being funded by banks or other outside lenders).

The results lead to two new insights on the financing of investment by young firms. The first is that for the vast majority of young firms, investment is insensitive to large drops in the cost of issuing equity to outside individual investors. This implies that most young firms operate at a scale at which they face steeply declining returns to marginal investment funded with outside equity. This could be due to real frictions (e.g., absence of profitable investment opportunities, lumpy investments, transaction costs of issuing equity), or due to financing frictions related to the issuance of outside equity to individuals (e.g., conflicts of interest between inside and outside investors). We find suggestive evidence consistent with the latter in the cross-sectional variation of the subsidy's impact. The take-up rate is higher and the ratio of the investment response to the equity issuance response is 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 with professional managers (as opposed to firms managed by the founders), 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 estimated effect does not vary in the cross section with respect to asset tangibility, a variable typically associated with the cost of debt but that has no direct bearing on conflicts of interest between inside and outside equity investors.

The second insight is that for young firms with high growth prospects the marginal capital structure is highly levered (i.e, involves a very high debt-to-equity ratio). This result is consistent with the prevalence of securities that exhibit features of debt and equity, such as preferred stock and convertible debt, in private equity deals (e.g., business angels, see Gaston 1989; Shane 2005, 2008; Wong 2010; Hoberg et al. 2012; venture capital, see Sahlman 1990; Gompers 1997; Kaplan and Stromberg 2003).[6] Although theory provides several potential explanations for this finding, many cannot

[6] Gaston (1989) shows that 41.2 percent of the money received by companies from informal equity investors in the U.S. took the form of debt. Shane (2005) reports that in focus groups on angel investing sponsored by five Federal Reserve regional banks, several highly sophisticated angels reported that they made investments as large as $150,000 in unsecured debt. Using a variety of sources, Shane (2008) finds that highly sophisticated accredited

explain the observed marginal capital structure or reconcile all our results. For instance, the fact that the *same* investors provide equity and debt is not consistent with explanations based on a conflict of interest between debtholders and shareholders. That is, the results cannot be driven by equity alleviating adverse-selection or risk-shifting concerns of outside debtholders (e.g., banks). In addition, the trade-off theory of capital structure, which posits that debt is cheaper than equity due to the corporate tax deductibility of interest payments, cannot explain the high leverage of young high-growth firms because these firms rarely pay any corporate taxes. Finally, the high fixed transaction costs of issuing equity—relative to issuing debt—are better suited for explaining extensive margin capital structure choices (whether to issue equity) than the intensive margin capital structure choices (how much debt and how much equity given that both are issued) that we document with our findings.

The class of models that best fits the findings are capital structure theories where debt-like securities are better at mitigating conflicts between firm insiders and outside investors with no control over the company, such as business angels, family, and friends (see Stein 1992; Gompers 1993). Related work shows that a combination of debt and equity can also mitigate conflicts between entrepreneurs and inside investors such as venture capitalists (see Bergemann and Hege 1998; Casamatta 2003; Cornelli and Yosha 2003; Repullo and Suarez 2004; Schmidt 2003; and Yang and Zeng 2017).

Taken together, the evidence indicates that financing frictions play an important role in young firms' investment decisions that are financed with outside equity. 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 *one-fifth* of the frictionless benchmark.

angel investors affiliated with organized angel groups report using debt instruments, particularly convertible debt, when investing in seed stage companies. Wong (2010) has information on 215 investment rounds made by angel investors in 143 companies from 1994 to 2001. While 39% of angel-only rounds (152) use common equity, the remaining rounds use more complex securities that combine both equity-like and debt-like features: preferred equity (22%), convertible note (8%) and convertible preferred (30%). Hoberg et al. (2012) use a sample of 182 Series A preferred stock rounds and show that angels almost always take preferred shares, often alongside VC investors.

This paper contributes to several strands of the literature in economics and finance. First, it relates to research on the contribution of young firms to output growth. Our results are consistent with the large extent of heterogeneity across young firms documented by prior work (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.[7] We also estimate the effect of frictions affecting the issuance of outside equity on aggregate investment by young 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), Panier et al. (2014), and Heider and Ljunqvist (2015), 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 work on the *marginal* capital structure of young firms complements existing work on their *average* capital structure using survey data from the US (Berger and Udell 1998 and Robb and Robinson 2016). It also complements 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 1998; Cummins et al. 2004). Our contribution provides an estimate that is free of modelling assumptions (e.g., as regards the "user cost" formula; cf. Schaller 2006).[8]

Finally, our work relates to a central question for policy makers: how to identify and incentivize investment in *transformational* ventures that can spur economic growth (cf. Schoar 2010). Our results

[7] The importance of young firms in UK total corporate asset creation that we document is higher than prior estimates based on survey data from the Annual Capital Expenditures Survey (ACES) in the US, which has a very limited coverage of young firms (for more details see Appendix 2 and Becker, Haltiwanger, Jarmin, Klimek, and Wilson 2005).

[8] 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, for example, Banerjee and Munshi (2004) and Banerjee and Duflo (2014).

indicate that the vast majority of young firms in the UK offer very low marginal returns to outside investors, a result consistent with findings in developing economy settings (e.g., De Mel, McKenzie and Woodruff 2008). 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 the paper.

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 and Michaely and Roberts 2011).

Our original extract from FAME encompasses a 6-year period from 2009 to 2014. We exclude firm-year observations with missing or negative values of total assets, and restrict the sample to limited companies that amount to 93% of the observations in the original extract.[9] Limited companies include private limited businesses (99.8%) and public firms.[10] 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.

[9] The legal forms excluded are: Guarantee, Industrial/Provident, Limited Liability Partnership, No Companies Act, Unlimited, and Other.

[10] There are five types of public firms in the data: Public in the Alternative Investment Market (AIM), Public Investment Trust, Public Quoted Off Exchange (OFEX), Public—Not Quoted, and Public—Quoted (see: https://www.legislation.gov.uk/ukpga/2006/46/part/15/chapter/1/crossheading/quoted-and-unquoted-companies).

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, the reporting of a 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. While the tax incentive defines young firms as those within two years of starting "trading," we measure firm age against the year of incorporation, as we only observe incorporation dates. In particular, we define young firms as those within 3 years of incorporation to allow for at most one year of "pre-trading" activities, such as writing a business plan or negotiating contracts, as defined by the tax authority in the UK (HMRC).[11] It is possible that some firms take more than one year to start trading, in which case we would misclassify these firms and exclude them from our main analysis in Section 3, which is restricted to young firms. Against the relative importance of this potential misclassification, in our robustness checks in Section 5, we analyze older firms and find no significant effects on firm behavior following the tax relief launch.

We measure equity and investment using several balance sheet accounts with comprehensive coverage in FAME. 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. We have two main proxies for equity issuance: the year-to-year change in issued equity—Δ *issued equity*, and an indicator variable for positive changes in issued equity—$D(\Delta\ issued\ equity > 0)$. For a detailed example on the construction of these proxies see Appendix 7. We also report firms' *Total equity*, which corresponds to the FAME account shareholders' funds, and equals the sum of issued

[11] For more details see: https://www.gov.uk/guidance/corporation-tax-trading-and-non-trading.

capital, share premium account, and retained earnings over time. The variable *equity-to-assets* ratio is calculated as the ratio between total equity and total assets.

To produce the stylized facts in Section 1.2 we must distinguish between inside and outside equity issuances (post-incorporation). Since the filings do not distinguish between inside and outside equity, we use an equity issuance that increases the number of equity investors in the firm as a proxy for an outside equity issuance. The causal analysis in Section 3 does not rely on this proxy because the tax scheme that we use as a source of variation explicitly targets outside investors.

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.[12] Non-equity capital issuances correspond to the year-to-year changes in liabilities, Δ *total liabilities*.

For firms that disclose the structure of liabilities, roughly 15% of the original data extract (see Appendix 1), we measure year-to-year changes in three broad types of liabilities: Δ *other debt*, Δ *owners' debt,* and Δ *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.

We measure firm investment with the year-to-year changes in total assets: Δ *total assets*. In Appendix 8, we also present results using the more traditional investment proxy: year-to-year changes in fixed assets. We rely on total assets as our main investment proxy because the vast majority of young

[12] 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.

firms in our sample have no fixed assets. For young firms, 0 is the median tangibility ratio, defined as the ratio between fixed assets over total assets (see Table 1). By using total assets we are able to capture other types of investments that are especially important for young firms, such as working capital, and especially cash for research and development, which is notoriously hard to measure otherwise, as firms are not generally required to report such expenditures in their filings.

Finally, in Sections 3 and 5, we also use logarithmic transformations of our outcome variables (e.g., Δ *ln (total assets +1)*) in order to mitigate the potential impact of outliers.

1.2. Stylized Facts: Young-Firm Equity Issuance and Investment

In this section we provide descriptive statistics and new stylized facts on equity issuance and investment for young firms that motivate the subsequent analysis.

Figure 1 provides the first new stylized fact derived from the population data of firms between 2009 and 2011 (the year prior to the SEIS launch): young firms disproportionately contribute to asset creation relative to the tiny fraction of corporate assets they represent. The figure shows that new and young firms within 3 years of incorporation account for close to 50% of asset creation, even though they contribute to less than 15% of the aggregate asset value.[13] The role of firm births in capital formation is particularly prominent, as births contribute 29% of total corporate asset growth, while they represent only 2% of the value of assets. New firms also disproportionately contribute to job creation and output, as reported by Haltiwanger et al. (2016), business start-ups in the US constitute 10.2% of firms, but contribute to 14.8% of output and 24.8% of job creation. Figure 1 plots the contribution of firms of different age to total assets, asset creation, and asset destruction during the analysis period. We use definitions of asset size, asset creation, and asset destruction that parallel the definitions of total employment, job creation, and job destruction in Davis and Haltiwanger (1992). A detailed explanation on the sample construction and variable definitions is summarized in Appendix 2.

[13] See also Table A.2.3 in Appendix 2.

We next show descriptive statistics of the subpopulation of young firms incorporated from 2009 onwards.[14] Figure 2 shows that the industry distribution of young firms is concentrated in service-related industries.[15] The top two NAICS2 industries are Professional, Scientific and Technical Services (Panel A; 17.6%) and Administrative Waste Management Remediation Services (17.1%). This distribution is similar to that of small businesses in the US: fifteen of the top 40 NAICS4 industries are among the top 40 industries with the largest shares of small businesses in the US (Panel B; Hurst and Wild 2011). The figure also shows that young firm characteristics at incorporation are heterogeneous across industries (Panels C-F).[16] The median equity-to-assets 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 0.25 (Panel E).

Figure 3 shows that the regional distribution of young firms is concentrated in London (26.3%), followed by South East England (16.0%) and North West England (10.0%) as shown in Figure 3 (Panel A). [17] 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 England, and Yorkshire and The Humber (Panel D).[18]

Table 1 presents summary statistics for key economic variables: Panel A presents median and interquartile ranges of key variables at incorporation, and panel B shows statistics at the time of new equity issuances within the first three years after incorporation.[19] Young firm size is heterogeneous: the median value and interquartile range of total assets at incorporation are £8,092 and £36,307,

[14] We note that the majority of firms in the data do not file Annual Accounts with non-missing assets the year of incorporation. For example, of the 246,903 firms incorporated in 2009 that filed non-missing assets at least once during the 2009-2011 sample period, only 79,239 (164,089) have their first Annual Account filing with non-missing assets in 2009 (2010). See also Appendix 2.
[15] We use the North American Industry Classification System (NAICS) at the two-digit and four-digit levels.
[16] In Figure 2, we sort the data in Panels B-G in terms of the industry distribution of the sample shown in Panel A for ease of reference.
[17] We use the Nomenclature of Territorial Units for Statistics (NUTS) codes of the United Kingdom. See http://geoportal.statistics.gov.uk/datasets/nuts-level-1-january-2018-names-and-codes-in-the-united-kingdom.
[18] In Figure 3, we sort the data in Panels B-F in terms of the regional distribution of the sample shown in Panel A for ease of reference.
[19] Medians and interquartile ranges (IQRs) provide a better characterization of the distribution than means and standard deviations due to the presence of outliers (for reference: the IQR in a normal distribution corresponds to 1.34 standard deviations).

respectively (Panel A, Column 1). Equity values are also heterogeneous: median equity value at incorporation is £100 (in contrast to other countries, such as Denmark, the UK requests no minimum equity for firms) and the interquartile range equals £4,414 (Panel A, Column 1). The median equity-to-assets ratio for the population of young firms is 0.34 (Panel A, Column 1), above the median of 0.27 for European private firms (cf., Bethmann, Jacob, and Muller 2016), but close to the average equity-to-assets ratio of 0.36 for US entrepreneurial firms in the Kauffman Firm Survey (cf., Robb and Robinson 2016).[20] The modest value of the equity-to-assets ratio, consistent with high leverage, occurs despite the low tangibility ratio of young firms (the median ratio of fixed assets to total assets at incorporation is 0.00; Panel A, Column 1).

Outside equity issuances—measured in this section as equity issuances that increase the number of equity investors in the firm—are rare events among young firms: 0.30% (1,155) of firms issue outside equity within 3 years after incorporation (Table 1, Panel B, Column 3). Only 23% of all post-incorporation equity rounds for young firms come with an increase in the number of equity investors (Table 1, Panel B, Columns 1 and 3; 1,155/5,037). This modest use of outside equity according to our proxy is consistent with survey data of UK firms: outside equity corresponds to 2% of financing sources in the small and medium-sized firms surveyed by the UK Finance Monitor (British Business Bank, 2017). It is also consistent with survey data of young firms in the US (Berger and Udell 1998; Robb and Robinson 2016).[21]

[20] Table 4 in Robb and Robinson (2016) reports average owner equity, outsider equity, total financial liabilities, and trade credit. We estimate the equity-to-assets 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. 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-to-assets ratio, defined as 1 minus the leverage ratio. For reference, the average equity-to-assets ratio for US public firms was 0.4 in 2010 (cf., defined as 1 minus the leverage ratio, from Figure 2 in Graham, Leary, and Roberts 2015).

[21] The primary source of Berger and Udell (1998) is the National Survey of Small Business Finances, and the focus is on non-farm, non-financial, non-real estate small businesses with less than 500 full-time employees. The 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 the 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, with 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).

The second new stylized fact is that outside equity rounds tend to occur together with disproportionately large investments (see Table 1, Panel B, Columns 3 and 2). When firms issue inside equity, firm assets grow by £1 for every additional £1 of equity. In contrast, when firms issue outside equity, firm assets grow by £4.27 for every additional £1 of equity (the difference is statistically significant, see Table 1, Panel B, Column 7). [22]

The third 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. In Figure 4, we plot the percentage change in the number of equity owners during the first three years of incorporation against the growth rate of the assets of the firms in the same period for the cohort of young firms incorporated in 2009. The percentage change in number of owners is four times larger for firms among the top 1% of asset growth than for any other group of firms in the asset growth distribution. A detailed explanation of the sample construction and variable definitions is summarized in Appendix 3.

The observed positive association between asset growth and outside equity issuance can occur for a number of reasons. It is most likely the case that high-growth young firms are different in observable and unobservable dimensions from other firms, a pattern that is already apparent from the stylized facts in Table 1. The objective of the rest of the paper is to establish empirically whether there is a causal link between the issuance of outside equity and young firm asset growth. To do so we exploit as a source of variation the eligibility for a tax-relief program in the UK that subsidized outside equity in young firms. 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. £13 billion is spent on such programs annually, more than the fiscal budget of the police and close to the universities' fiscal budget (Hughes 2008). Our focus is on the Seed Enterprise Investment Scheme (SEIS), the newest of

[22] Based on Hodges-Lehmann median differences.

such programs, which was launched in 2012. We now present a summarized overview of this tax relief program. For further details, see Appendix 6.

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, an income tax relief on 50% of the investment (e.g., for every £100 invested in a young firm, investors can deduct £50 from their personal income tax bill). Second, a capital gains and inheritance tax exemption (e.g., for every £100 in after-tax capital gains that an investor would have received in the absence of the subsidy, they receive £139 if the investment is SEIS eligible). Finally, in the case the investment results in a capital loss, investors are allowed to claim a tax credit at the income tax rate of 45%, instead of the standard capital gains tax rate of 28% (e.g., a £100 after-tax loss in the absence of the subsidy is reduced to a £76 loss with 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 share capital, voting power, rights on winding up, or, as having control of the company.[23] Loans are taken into account in the percentage ownership, given the control rights of debtholders upon liquidation, especially those with conversion rights (for example, to acquire shares or interest at a rate above the commercial rate).[24] In addition, shareholdings and voting rights held by the investor's associates are also taken into account.[25] Finally, outside investors, as well as their associates, cannot receive any compensation from the firms (such as a loan or

[23] 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 she takes an additional 20% stake, the investor has become connected, and the relief will be withdrawn.

[24] 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.

[25] 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.

wage) or be employed by the firm (except as directors) or any of its subsidiaries, after the SEIS shares are issued.

Investors must hold on to the shares for a period of at least three years and up to five years, after which tax exemptions and loss relief expires. 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, provided there is sufficient income tax liability against which to offset it.

Eligible firms correspond to sufficiently young, small, and private businesses that have been trading for less than 2 years, and with gross assets not exceeding £200,000 before the share issue.[26] These firms amounted to circa 2.0M businesses during 2009-2014, which corresponded to more than 50% of UK firms in that period.[27] Additional requirements include a permanent establishment in the UK, fewer than 25 employees, and independence: companies cannot be controlled by another company and must be in control of any subsidiaries.

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 any three-year period.[28] 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.

[26] There is no limit on assets after the issue. Where the SEIS company has subsidiaries, these pre-SEIS 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.
[27] During the 2009-2014 period, 3,350,267 firms filed at least one filing with non-missing assets at Companies House, of these, 1,997,220 where within three years of incorporation and had total assets below £200K.
[28] SEIS is a form of state aid under EU rules.

The SEIS is not unique to the UK: several European countries have similar programs, including Spain, Portugal, Finland, Belgium, France, Germany, and the Netherlands. Young firms, as well as UK investors, are likely aware of the program. While it launched in 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 consciously advertised the SEIS tax relief. For example, during its launch, the government partnered with Telefonica and sent all of the mobile company's users a text message inviting people to learn more about the SEIS. Crowd-funding equity platforms such as Seedrs[29] and Crowdcube[30] also aggressively promote the incentive. These platforms run educational campaigns about the tax relief and encourage their users to advertise their SEIS (and EIS) eligibility on their websites 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%) investing in SEIS (ERC 2015a).[31]

We estimate that the potential outside equity capital pool from the SEIS tax relief amounted to £1.8 billion in 2012. We summarize our estimation in Appendix 4. 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 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.,

[29] https://www.seedrs.com/

[30] https://www.crowdcube.com/

[31] One investor went as far as to say, "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/.

the investment value of private equity participants with incomes in the £150K-£199K threshold is £15,000.

The total amount of funds raised by young firms through the scheme from its launch in 2012 through 2015 was £433 million.[32] In 2013 alone, funds (number of investments) raised through SEIS amounted to £140 million (2,000) as shown in Appendix 5, which represents a small fraction of the total estimated capital pool in Appendix 4. The amount of outside equity raised through SEIS corresponds to roughly 2.3% of the value of venture capital investments, which in 2013 totalled £6,000 million (Appendix 5; British Business Bank 2016).

2.1. Subsidy Magnitude: Examples

To illustrate the magnitude of the subsidy, consider a business angel investor in a frictionless Modigliani-Miller world, where she can buy and sell equity at a fair value in a liquid secondary market. She invests £100 in a firm that has no debt and that generates a pro-rata profit that increases (decreases) the value of her equity stake in £10 after three years. She sells her shares for a price of £110 (£90). Assume the business angel 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%. Suppose the discount rate is zero for simplicity. Thus, in the absence of the SEIS subsidies, the after-tax return on the investment equals $\frac{(110-100)\times(1-0.28)}{100} = 0.07$ (in the case of a value loss, it equals $\frac{(90-100)\times(1-0.28)}{100} = -0.07$).

With the SEIS, the business angel: 1) receives in addition a £50 tax rebate, and 2) does not pay capital gains tax (in the case of a loss, the angel receives a tax credit at the higher income tax rate). Thus, the after-tax return with SEIS would equal $\frac{50+(110-100)*(1-0)}{100} = 0.60$, which corresponds to an additional £0.53 per £1 invested relative to the no-SEIS-relief case (in the case of a loss it equals $\frac{50+(90-100)\times(1-0.45)}{100} = 0.45$, which corresponds to an additional £0.53 per £1 invested, effectively turning the loss into a capital gain).[33]

[32] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/562937/October_2016_Commentary_EIS_SEIS_National_Statistics_final.pdf.
[33] For more examples, see: https://www.crowdcube.com/pg/eis-tax-relief-for-investors-44.

In a frictionless world, the large subsidy would unambiguously lead eligible firms to issue new equity up to the maximum subsidized amount. Investors would realize gains even if the firm is unprofitable, as long as they can trade the equity in a secondary market at a fair price once the three-year lock-in period vests. However, in the absence of a liquid market for trading stock equity of small young firms, it may be very difficult for an outside equity holder to realize these returns.[34] Suppose, for example, that the outside investors takes a SEIS-subsidized equity stake on a loss-making firm that is run by a founder who derives private benefits of control. An outside investor does not have control rights, so they cannot force liquidation. The investor will also not be able to find a buyer for the equity from another unrelated investor. The only potential buyer for the equity is the founder, whose willingness to pay for a non-controlling stake will be close to zero. In addition, the SEIS investor is impatient because the write-off subsidy expires at 5 years, which gives the founder all the bargaining power in the price negotiation. Thus, the selling price of the equity stake in this example would be negligible, in which case the return would be $\frac{50+(-100)\times(1-0.45)}{100} = -0.05$.

This discussion highlights that the expected return of the subsidy is not only dependent on the profitability and growth prospects of the firm, but on also on its governance and the motivation of the managers and founders. The subsidy can thus trigger very heterogeneous responses across eligible firms in the population.

3. Empirical Strategy

We exploit the launch of the SEIS program as a source of variation in the cost of outside equity for young firms, and the cross-sectional variation in access to the SEIS across young firms of different size to create a counterfactual for the equity issuance rate and investment in the absence of the subsidy. We

[34] Informal evidence suggests that private equity markets in the 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 (Pierrakis 2010). 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, while the time-to-IPO increased (BVCA 2013). Informal evidence points to a similar conclusion for US private equity markets: the average investment holding period for business angels is 4.5 years, with the bigger wins commonly taking up 9 to 10 years to complete (Wiltbank and Brooks 2016).

validate the approach using firms that are ineligible for the subsidy due to their age to run placebo tests. In this section, we describe the analysis sample and the empirical methodology. Results are presented in Section 4.

3.1. Sample

We classify firms in 2011 into two groups: eligible and non-eligible, according to their total assets reported in 2011—below or above £200K, respectively. For the classification, we use the value of the assets the year before the launch of the SEIS to minimize concerns of firms manipulating their assets to become eligible (we study below the extent to which such manipulation occurs). We restrict the analysis sample to young firms that report assets in 2011 ranging between £100K and £300K to ensure that we are comparing eligible and non-eligible firms of similar size (we verify that the results are robust to alternate sample definitions in section 5.2). 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).[35]

Table 2 presents summary statistics for the main firm-year sample used in the analysis. The average firm in the analysis sample has an average of £167,902 in total assets for 2011. 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 UK firms in 2011. Relative to the universe of young UK firms, the sample is slightly more concentrated 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 slightly less concentrated 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

[35] The analysis excludes 16 (66) firms (observations) with public legal status, as the incentive is only available to private firms; the results are unchanged if we include public firms in the sample.

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 difference-in-differences specification:

$$(1) \quad k_{it} = \alpha_i + \sum_j \gamma_t \times Industry_j + \beta Eligible_i \times Post_t + \varepsilon_{it}$$

where $Eligible_i$ is an indicator variable for eligible firms and $Post_t$ is a dummy equal to one in the years 2012-2014. We control for heterogeneity across firms with firm fixed-effects, α_i, and for industry shocks with year dummies for each industry using the 5-digit 2007 SIC classification.[36] Industry controls are important given the large heterogeneity in outside equity issuance (Panel G, Figure 2). The standard errors in all regressions are adjusted for heteroskedasticity and clustered at the firm level.

The coefficient of interest in (1) is β, which measures the average change in the outcome variable (k_{it}) after the SEIS launch for eligible firms, relative to firms that did not qualify for the tax incentive program in 2012 because their assets were £200,000 or above. A positive β would imply that the average of the outcome variable increased for eligible firms after the SEIS launch.

This difference-in-differences methodology identifies the causal effect of the subsidy on the cost of outside equity on firm outcomes as long as two assumptions are satisfied. First, that firms did not manipulate SEIS eligibility status during the program's launch in 2012. Second, that without the tax relief program, average outcomes for eligible and non-eligible firms would have evolved in parallel.

Two facts suggest that the first assumption is likely satisfied. First, firms have limited scope for eligibility manipulation. In our analysis, eligibility is measured against the value of assets one year before the program launch, which mitigates manipulation concerns. In addition, while there was an active discussion about the launch of the program prior to 2012, there was uncertainty about its final

[36] Results are unchanged if we use the NAICS4 classification.

approval, and the exact level of the qualifying threshold was not known by the public beforehand.[37] 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.[38] Figure 5 shows the distribution of total assets in 2011 for the young firms in the analysis sample (i.e., young firms with total assets in 2011 of between £100K and £300K that survived until 2012). With the exception of abnormally large masses of firms at round numbers, the distribution appears to be continuous. There is one such abnormally large mass of firms with £200,000 in assets which cannot be driven by asset manipulation to become eligible for the subsidy, since firms with £200,000 in assets were ineligible. A McCrary test at £200,000 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 discuss two alternative 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 additional eligibility requirements such as employment numbers, and the eligibility of changes of control firms after the relief launch in 2012. In the robustness section 5.2, we discuss these issues in more detail, and show suggestive evidence against their empirical relevance.

Finally, one last issue regarding the interpretation of the results. As is well-known, measuring the *aggregate* impact of policies using difference-in-differences estimates is challenging, as control firms may also be affected by the tax relief. For example, equity issuance by small firms may crowd out equity issuance of non-eligible companies. Partially because of these limitations, an evaluation of the SEIS relief is not our main objective. Rather, our aim is to use SEIS as an exogenous source of

[37] The government first announced a consultation of the Enterprise Scheme in its 2011 Budget (March): "…The Government will consult on options to provide further support for seed investment…" (see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/247483/0836.pdf). In the Autumn Statement of November 2011, the launch of SEIS was announced: "…As a result of the consultation the Government will introduce the new Seed Enterprise Investment Scheme (SEIS) to encourage investment in new start-up companies…" The announcement made no mention of the eligibility threshold for SEIS. (see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/228671/8231.pdf).

[38] 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).

potential differential growth in outside equity issuance *across* similar 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 3 summarizes the results from estimating equation (1). Panel A (B) presents estimates based on the main outcome variables in levels (in logs, to mitigate the potential impact of outliers). Panel C presents results from estimating a more flexible version of equation (1), where we include a full set of interactions between year dummies and the variable $Eligible_i$. Panel D 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.

4.1. Equity

The relief had a modest take-up rate among eligible firms. The probability of an equity issuance by young and small firms, relative to non-eligible firms, increased by 0.01 after the SEIS launch (Table 3, Column 1, Panel A). The estimated take-up rate of 1% appears low given the large size of the subsidy. The modest take-up rate is nevertheless consistent with official statistics: 2,900 individual companies had received an investment through the scheme by 2014 (which corresponds to less than 1% of the circa 1M young firms satisfying the asset threshold during 2012-2014). Since outside equity issuances are rare events among young firms, this modest take-up rate corresponds to a 16.67% increase over the sample mean (0.06).

The value of issued equity increases by £1,795 on average for eligible firms after the introduction of the subsidy (Table 3, Column 2, Panel A). Prior to the tax relief, there are instead no differences in equity issuances across eligible and non-eligible firms (Table 3, Panel C, Columns 1 and 2). The estimated equity increase is sizable: it represents a 128% increase over the sample mean of £1,401. The effect on average equity issuance is low relative to the maximum subsidy of £150K because of the low take-up rate. To measure the size of the equity issuance conditional on take-up, we obtain a

Wald estimate 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 (Table 3, Panel A, Column 2). The average conditional issuance roughly equals the maximum subsidy value and has a 95th confidence interval ranging between £53K and £514K (estimated using bootstrap; see Efron and Tibshirani 1986).[39] 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.

The subsidy also had a positive impact on the number of equity investors (Table 3, Column 3, Panel A). 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 is large compared to the analysis sample average of 1.89 equity investors before the subsidy. This increase in number of owners is also roughly consistent with official statistics: on average, 4 investors claimed SEIS tax relief for every firm that raised funds through the scheme in 2014.[40] The large effect on the number of investors (conditional on issuance) is expected given that firms issue £150,000 of new equity, almost three times the equity capital of eligible firms before the subsidy. The reason is that, in order to remain eligible to the subsidy, each individual investor cannot hold more than 30% of the firm's equity. For the average firm, with £50,000 of pre-subsidy equity, a minimum of three additional investors would have been required to maintain investor eligibility for the subsidy as measured by book-value. This constraint would not be binding if the market value of equity is very high. For example, if the market value of equity is £1.5 million before the new equity issuance, a single investor purchasing £150,000 of new equity would hold less than 10% of the total book value of the equity and remain eligible for the subsidy.

The results imply that the large majority of eligible firms do not react to the subsidy. Those that do issue equity in response to the subsidy issue the maximum subsidized amount. Given the generosity of the potential subsidy, this result implies that most young firms face very large fixed costs of financing

[39] 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

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

marginal investment with outside equity. These costs may be driven by financing (a gap between internal and external financing caused by conflicts between firm insiders and outside investors) or real (adjustment costs, investment irreversibility, or investment lumpiness) frictions. We can make some progress in distinguishing the type of frictions that most likely explains the findings by analyzing the investment response to the subsidy, which we discuss next.

4.2. Investment

Table 3, Panel A, Column 4 shows that the subsidy on the cost of outside equity elicited an average investment increase (measured as capital formation) of £14,951 by eligible firms, a 36.4% increase over the sample 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 D in Table 3). In addition, Panel C in the table shows no differences in investment across eligible and non-eligible firms prior to the relief (Column 4). Results summarized in Appendix 8 show that investment, as measured by changes in fixed assets, also significantly increase by £4,760, a 63.5% increase over the sample mean.

The average increase in assets is substantially larger than the average equity issuance response of £1,795 reported in Table 3 (Panel A, Column 2). The implied multiplier of the subsidized equity on investment, given by the ratio of the asset formation response to the equity response, is 8.33 and statistically significant (Table 3, Panel A, Column 6; confidence interval constructed using clustered bootstrap). This implies that for every £1 of new equity issued in response to the subsidy, eligible firms grew their assets by more than £8, and that the marginal investment was funded with unsubsidized liabilities (financial or operational). Appendix 8 shows the implied multiplier of the subsidized equity on investment in fixed assets is 2.65, which suggests that at least part of the marginal investment was funded with financial liabilities such as debt (we return to this point in Section 4.4 below). The marginal equity to asset ratio implied by the causal responses to the subsidy is 0.12 (1/8.33), which is lower than the equity-to-asset ratio of the analysis sample firms before the roll out of the subsidy (0.22). Thus, the marginal capital structure of the firm appears to be even more levered than the infra-marginal one.

In the discussion so far we have remained agnostic on whether the asset increase that occurs is conditional on issuing subsidized equity or not. In theory, it is possible that some firms grow their assets

in anticipation of taking up the subsidy in the future. This is unlikely in our analysis sample because even modest increases in assets would make many firms ineligible for the subsidy. It is thus reasonable to assume that the same subset of firms that issued equity also increased investment. Under this assumption we can obtain the implied multiplier of subsidized outside equity on investment using an instrumental variables (IV) estimation of the following specification:

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

instrumenting Issued Equity$_{it}$ with $Eligible_i \times Post_t$ (or the equivalent specification in logs). The IV estimates are shown in Table 4, together with the corresponding OLS and first-stage estimates. The investment multiplier is 8.33, very close to the ratio reported in Table 3 (Panel A, Column 6). OLS estimates are an order of magnitude smaller, indicating that only a small proportion of the average asset variation in the population of eligible firms is due to the subsidy (this is expected, given the low take-up rates). The multiplier, which is based on logarithmic transformations of investment and equity issuance, is also significant (Column 4). The F-tests reported in the last row of columns 2 and 4 suggest the instrument is somewhat weak, but the bootstrapped errors used to estimate the ratio in Table 3 (Panel A, Column 6) confirm that the result is not driven by weak instruments (cf., Young 2017).

The results imply that the subsidy to equity is infra-marginal, which has important implications for the economic interpretation of young firms' investment response to the subsidy. The first is that young firms' marginal source of funding are debt-like securities and operational liabilities (e.g., trade credit). This is not driven by the eligibility rules of the subsidy: an investor providing a substantial amount of debt to the firm would also be considered in control (contingent on financial distress or bankruptcy; see Section 2). Neither can the fact that debt is cheaper than equity in the margin be explained by high fixed transaction costs of issuing the common equity eligible for the relief (e.g., legal fees).[41] Once the firm has incurred in the fixed cost to issue equity, the reason to fund the marginal investment with something other than equity must lie elsewhere. The tax shield of debt is an unlikely candidate explanation, because young high-growth firms rarely pay corporate taxes. The plausible

[41] The transaction costs of 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.

explanations are related to conflicts of interest between owners, managers, and different types of investors. In the next section, we provide suggestive corroborating evidence from the heterogeneous response across firms with different observable measures of conflicts of interest.

The second implication is related to the potential complementarity between outside equity and debt, which was hinted by the stylized fact that, on average, firms that fund £1 of assets using outside equity fund another £3 using debt-like securities (Table 1, Panel B). Since outside equity issuances are infra-marginal, it is unclear whether the subsidy to equity affects the marginal cost of capital of the firm. One way a subsidy to equity can affect the cost of other financing sources is if more equity reduces the risk of risk-shifting and aligns the incentives of equity-holders and debt-holders. An alternative mechanism is that receiving the subsidy means that the firm receives a certification by the new outside investors and the government, which reduces asymmetric information problems with other outside investors, such as banks. We explore these issues further in the last subsection of Section 4, where we explore the provenance of the marginal funding.

4.3. Heterogeneity

We explore the heterogeneity of impact of the subsidy in Table 5 by adding interactions with firm level characteristics related to financing frictions.[42] This additional evidence is mostly suggestive because firm observable characteristics are endogenous to firms' innovation opportunities. Nevertheless, as motivated by the discussion in the previous subsection, it is of interest to understand how the magnitude of the effect of the subsidy varies across potential measures of conflict of interest between owners and investors, and between different classes of investors. Our prior is that firms that before the subsidy had unrelated outside owners, institutional owners, or were managed by a professional manager (as opposed to the owner) will be better governed and face fewer conflicts of interest between insiders and outsiders.[43] The point estimate of the subsidy take-up is indeed larger for

[42] In Appendix 9, we present the heterogeneity of results across industries and regions.
[43] 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.

these firms, although the difference is not always statistically significant (see Panels A, B, and C). The implied subsidized equity multiplier on assets is also lower for these firms.

Hurst and Pugsley (2011) provide a survey-based classification of industries based on whether private benefits of control are the main motivation behind business creation. We expect that industries ranked high in this list (more private benefits of control) will face stronger conflicts of interest between inside and outside investors. Table 5, Panel D shows that the take-up rate is essentially zero in industries where private benefits of control are the main motivation behind business creation, although again the estimates are noisy. This is consistent with survey evidence: most respondents of the 2013 SME Journey Towards External Finance Survey revealed they "have concerns regarding equity finance, as they do not want to give up control of their business to third parties."

Finally, we expect conflicts of interest between shareholders and debtholders to be ameliorated when the firm has more tangible assets that may serve as collateral. We do not find any difference in the take-up rates of equity multiplier across firms with different asset tangibility (Panel E).

Overall, the additional evidence from the cross-section is consistent with the idea that the low take-up and the high leverage in the margin are related to conflicts of interest between firm insiders and outside investors, but unrelated to conflicts of interest between shareholders and debt-holders.

4.4. How do firms finance the marginal investment?

The question that remains is how marginal firms finance the marginal investment. Table 6 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 and convertible debt, from the firm's owners (see Section 1 for a detailed explanation on the classification of non-equity liabilities). The results in Table 6 are for the group of 342 young firms in the analysis sample with detailed data on the structure on non-equity liabilities.[44] As explained in Section 1, FAME's coverage

[44] This subsample amounts to less than 1% of the firms in the analysis sample (342 out of 34,885). By contrast, firms that report the structure of non-equity liabilities correspond to 15% of the original data extract. The underrepresentation of "reporting" firms in the analysis sample is explained by a combination of two factors: (1) size restrictions of the analysis sample (e.g., young firms with assets below £300,000 in 2011), and (2) size-based filing requirements at Companies House (see Appendix 1).

for the structure of non-equity liabilities is limited, as small firms in the UK can file abbreviated statements with Companies House.

Columns 5-6 in Table 6 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 6 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.

The additional evidence from this subsample corroborates the interpretation of the cross-sectional analysis. Conflicts of interest between firm insiders and outside investors are the most likely explanation for why high-growth firms are highly levered in the margin. The marginal funding is provided by the same investors that provide equity, but in the form of debt. As pointed out above (and in Section 2), this result is not mechanically driven by restrictions of the tax relief program, because investors' SEIS eligibility criteria (i.e., no substantial interest in the company) also takes into account debt-like securities. And the other discussed alternative interpretations (certification, taxes, fixed costs of equity issuance) cannot explain this finding.

5. Identification Tests and Robustness

Having estimated young firms' investment response to the relief, we now provide in Tables 7 and 8 a battery of tests using different controls, subsamples, and specifications. We divide the tests into threegroups: 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: (1) the potential manipulation of SEIS eligibility in 2012, and (2) the violation of the equal-time-effects (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-differences estimation compares trends in outcomes across treatment and control firms during the pre-treatment period. Panel C in Table 3 shows the results from estimating a more flexible version of equation (1), where we include a full set of interactions between year dummies and the variable $Eligible_i$. The table shows no significant differences across treatment and control groups before 2012. However, because the SEIS relief is only available for firms that have been trading for less than two years, we can only estimate one pre-policy period (2011), and thus cannot compare pre-trends across treatment and control firms.

To address this limitation of the standard test, we use complementary placebo and falsification exercises. First, we estimate 200 regressions using randomly selected placebo eligibility thresholds between £600K and £800K (so as not to include any data from the actual analysis) and define treatment and control firms as in the main analysis but using the placebo threshold instead of the actual one. Specifically, we restrict the sample to firms whose asset size in 2011 fits within a £100K window on either side of the placebo threshold, and classify firms into eligible and non-eligible if their assets in 2011 are below or above it, respectively. A summary of the results are presented in Panel A of Table 7. 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 spuriously driven by differential trends in equity issuance or investment across firms of different size.

Second, we run a falsification test using older firms in our data. In particular, we replicate the analysis for companies with assets in 2011 that were 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 7 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 spuriously driven by differential trends across larger and smaller firms when 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 7 we show that

the results continue to hold (both statistically and economically) in two alternative subsamples. The first subsample is based on a £70K (instead of £100K) bandwidth around the threshold; the second is 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 that our results hold in a larger subsample that is based on a larger bandwidth of £125K rather than £100K.

A second concern is that biases may arise from defining eligible firms based only on the asset threshold rather than also on other eligibility requirements: companies with assets between £100K and £200K (our treatment group) may actually not 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 there may be 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 subsample of 719 firms in our data that report employees in the pre-SEIS period. Columns 1-3 in Panel D of Table 7 present the results from the estimates of equation (1) on this subsample and define $Eligible_i$ in terms of both the asset and employment eligibility thresholds. We find similar results (although they are not significant given the small sample size).

A third concern is the potential bias from dynamic misclassification of firms that were non-eligible in 2012, but decreased their assets in later years in order to qualify for the program (if they still could—which depends on when they traded). Against this concern, columns 4-6 in Panel E of Table 7 show that firms ineligible due to their size in 2012 but eligible in 2013 do not drive the take-up rate. The take-up rate is 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 the control firms (but not the treatment ones) that decrease investment are by construction excluded from the subsample.

To present additional evidence against bias due to dynamic misclassification, in columns 1-3 of Panel E in Table 7, 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 about the substitution of investments away from non-eligible firms and towards small firms are more pronounced the closer that firms are to the eligibility threshold. Finally, columns 4-6 in Panel E of Table 7 show that results are robust to dropping from the sample all firms that report assets rounded to the nearest £50,000. The results from this robustness check mitigate 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 the results are setting-specific. For example, the modest take-up we estimate is not due to costs of outside equity issuances but instead to lack of SEIS awareness, the burdensome red tape of the tax relief, or more generally, government aversion to taxpayers 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 in funds have been raised. Appendix 5 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.[45] Relief is at 30% of the cost of the shares, rather than at 50% for SEIS investments. Maximum relief per individual investor in one year is £300K, and the maximum amount a firm can raise per year through the scheme is £5M.[46]

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 6 shows that 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 within newly eligible firms with assets in 2011 that were closely below the £15M threshold to those of 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 8.

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

$$(2) \quad k_{it} = \alpha_i + \gamma_t \times Industry\ FE + \beta Med_i \times Post_t + \varepsilon_{it}$$

where Med_i is an indicator variable for firms with asset value in 2011 below £15M and all other variables remain the same as in equation (1). The standard errors in all regressions are adjusted for heteroskedasticity and clustered at the firm level. Results are summarized in Panel B of Table 8. We

[45] 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.

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

report results using only the logarithmic transformation of the continuous variables to mitigate the impact of outliers.

Columns 1 and 2 show that 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. 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 gaming, however, the results point to underuse rather than overuse of the relief. In addition, in a media search we found no cases denouncing abuse of the relief, which is in contrast to 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 evaluative 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 question posed in 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, faced by young firms.

For this exercise, we will purposefully ignore the large heterogeneity in eligible firms' responses that we documented in Section 4, as is common in this type of exercise. Moreover, the

calculation does not account for the separate potential impact of the tax relief on non-eligible firms, given that our difference-in-differences 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 outside equity return response with the regression results of Section 4, which provide our estimate of the investment response. Next, we estimate a neoclassical benchmark against which to compare our sensitivity estimate. Finally, we discuss the 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 obtain this figure, we first restrict the sample to eligible firms during the 2009 and 2011 period—prior to the launch of the tax relief (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 the counterfactual after-tax outside equity returns *with* the relief. The results are summarized in Table 9.

After-tax outside equity returns *without* the relief average 0.06: absent the relief, outside equity investors in eligible firms receive 6 pence (net) for every £1 in total assets on average (first row, Table 9). These returns correspond to the ratio between cash flow to equity holders and total assets for eligible firms. Cash flow to equity holders amounts to after-tax profits (i.e., profits adjusted by the capital gains tax; the capital gains tax equals 0.28). Most of the sample firms do not report income statements (they are exempt given their small size). For these firms who do not report profits, we measure their annual profits as the difference in the Profit and Loss Account in the capital statement of the balance sheet (which is 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 the resulting after-tax outside equity returns *without* the relief is summarized in the first row of Table 9.

After-tax outside investor returns *with* the relief average 0.12; that is, with the relief outside equity investors in eligible firms receive 12 pence (net) for every pound in total assets, on average (see the second row of Table 9). We estimate this counterfactual return by adjusting the calculation of the

cash flow to equity holders in three ways. First, we add the income tax rebate to the equity cash flows, 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 the 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 9 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 (see the third row of Table 9), which corresponds to a 113% (see the fourth row of Table 9) 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 to be -0.15, as shown in Table 10. 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 that investment increased 17% in response to the relief (see Column 2 in Panel B of Table 3). In section 6.1., we estimated that 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 difficult to interpret. We provide a simple neoclassical benchmark to better interpret the estimated sensitivity.[47] In a frictionless economy, young firm investment would

[47] 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

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 (see Section 2). 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 3).

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

What are the broader implications of our estimate of the sensitivity of young firm investment to outside equity? Our main results on the low sensitivity of young firm investment to the cost of outside equity and heterogeneity across young firms likely hold in other settings. Prior work has found that investment by all investors is unresponsive to changes in rates of return, and particularly to interest rates (see Caballero 1999). Sharpe and Suarez (2014) report that 68% of the firms would not increase investment for *any* decrease in the interest rate (Duke University/CFO Magazine Global Business Outlook survey).[48] There is also abundant evidence of lack of investment in the presence of high marginal returns in emerging markets. For example, Goldstein and Udry (1999) find that only 18% of the land in Ghana is cultivated with pineapple despite the estimated 1,200% returns that pineapple

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, 1999), 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.

[48] 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.

farming generates. Duflo, Kremer, and Robinson (2003) finds that only 15% of maize farmers in Kenya use fertilizer despite an estimated return of 100%. In addition, the skewness in young firms' growth is a well-documented fact in the economics literature (Haltiwanger, Jarmin, and Miranda 2012; 2016). Concerns about the public's *short-term* unawareness of SEIS are unlikely to explain the low take-up rate that we estimate within three years of its launch: by 2017, the total number of companies that had raised outside equity through SEIS still totalled less than 10,000.[49]

The types of results that are likely limited to our setting include the dispersion of ownership across multiple new outside investors. The SEIS restricts investors' control over the firm (as measured by ownership via their equity stake, by their rights at liquidation via their debt claims, or by their voting power), even three years after the investment. With no such restrictions, it is possible that firms may attract more capital per new outside investor, and altogether fewer new business angels. The SEIS is also special in that it is only open to outside individual investors, rather than specialized funds. Business angels may have different preferences for risk than funds do, and as such it is difficult to extrapolate our results beyond business angel investors.

7. Conclusions

This paper estimates the sensitivity of young firm investment to the cost of outside equity. To establish a causal link between outside equity and investment, we exploit differences across firms in eligibility to a new tax relief program for outside equity investors in the UK. We find that, on average, investment increases 1.5% 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 the information asymmetry costs that young firms face. In a frictionless market, all firms would have adjusted their investment until marginal productivity equals the cost of capital. If young firms only faced

[49] See https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/710986/May_2018_Commentary_EIS_SEIS_SITR_National_Statistics.pdf

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 that 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 greater in the absence of these frictions.

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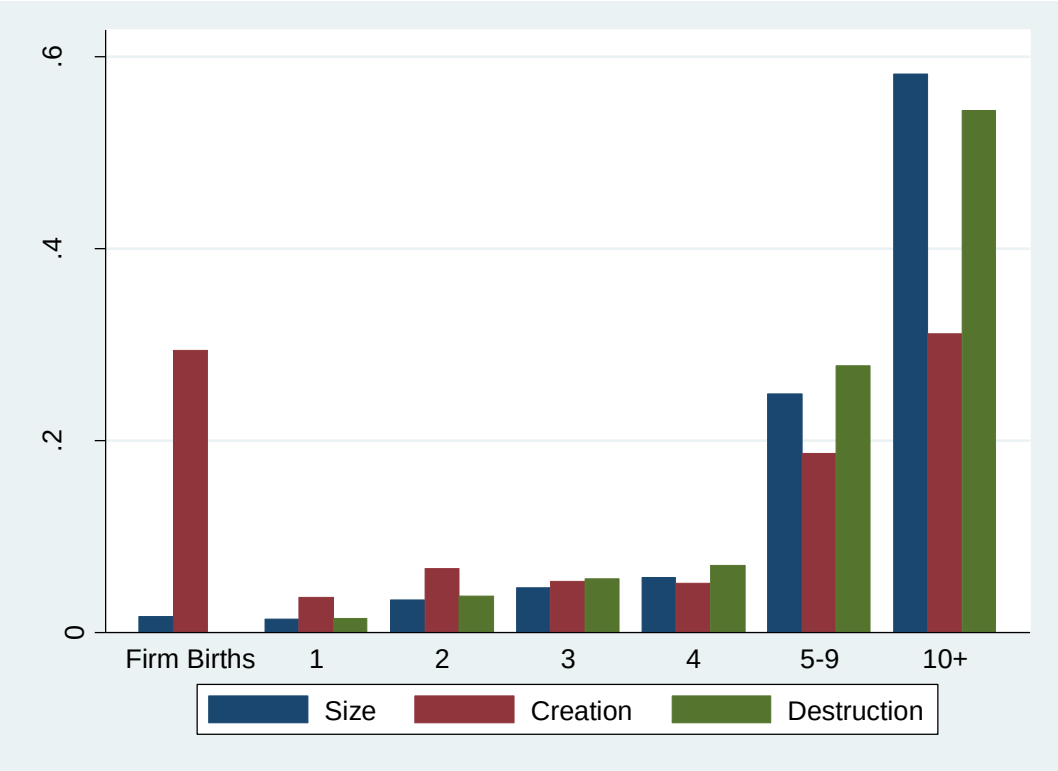
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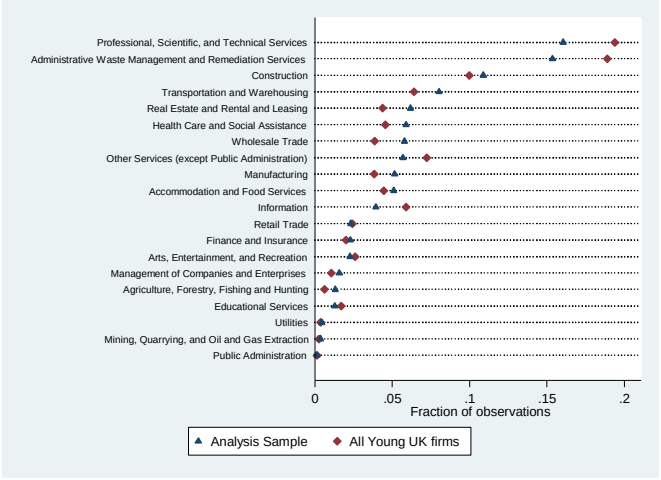
Figure 1— Shares of Asset Size, Asset Creation, and Asset Destruction by Firm Age: Annual Average Rates, 2009-2011



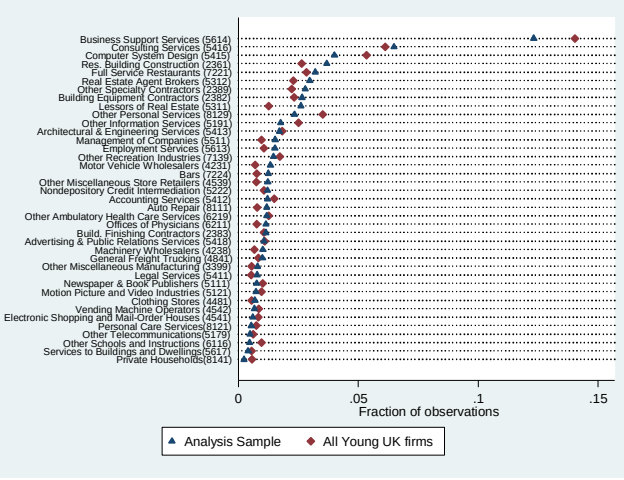
The figure plots the shares of asset size, asset creation, and asset destruction by firm age during the 2009-2011 period (see Table A.2.3 in Appendix 2). Asset size corresponds to the value of total assets in firms. Asset creation (destruction) corresponds to positive (negative) changes in total assets during the period. We measure firm age relative to year incorporation. Firm births include firms aged 0 years, and firms aged 1 year with no filings with non-missing assets the year of incorporation. See Appendix 2 for more details on the sample construction and variable definitions.

Figure 2—Industry Distribution of Young Firms: 2009-2011

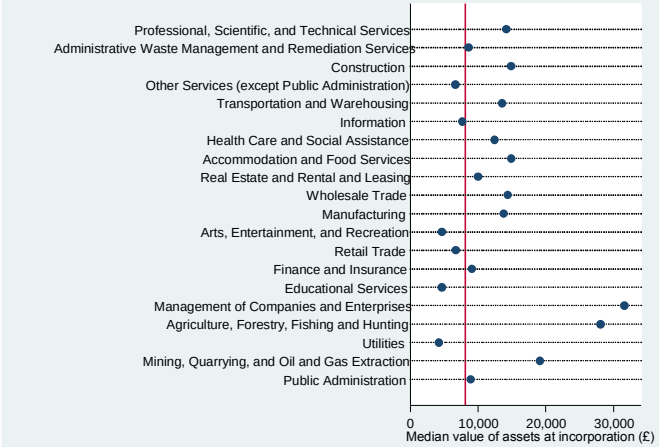
Panel A—Industry Distribution (NAICS 2-digit)



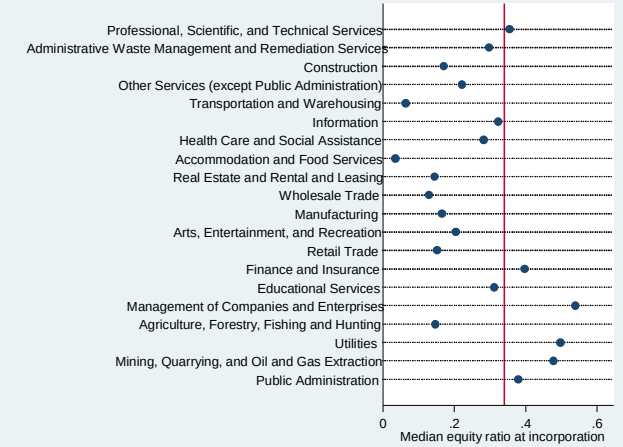
Panel B—Top 40 Industries (NAICS 4-digit)



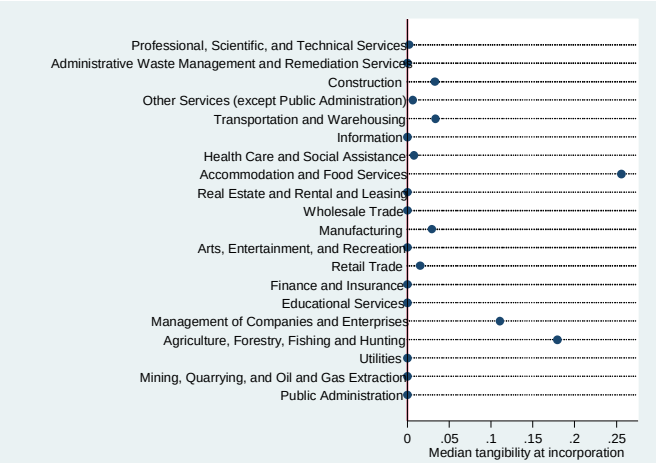
Panel C—Median Value Total Assets



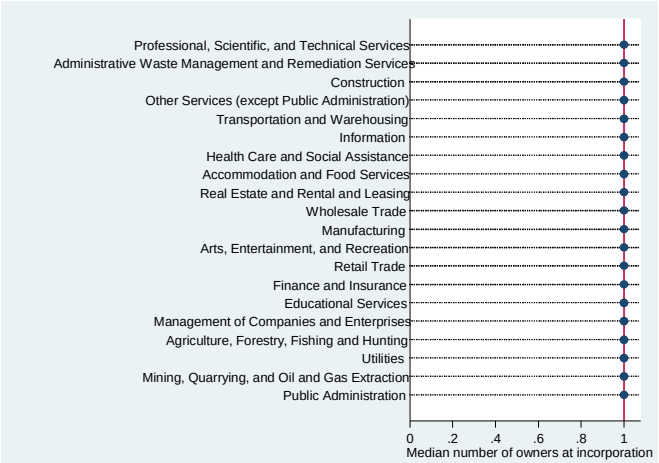
Panel D—Median Equity-to-Assets Ratio



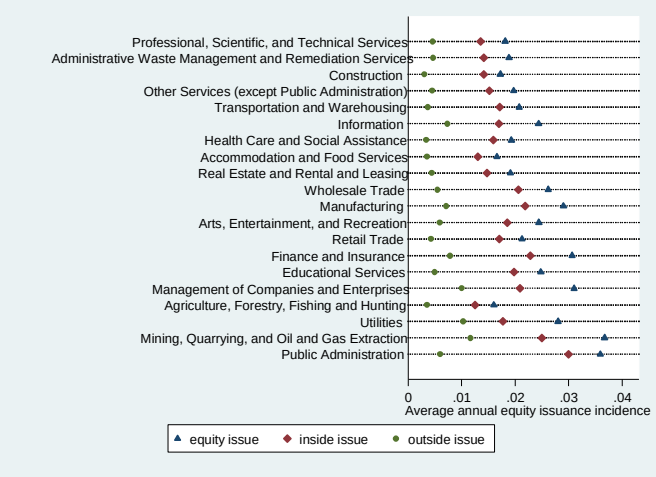
Panel E—Median Tangibility Ratio



Panel F—Median Number of Owners



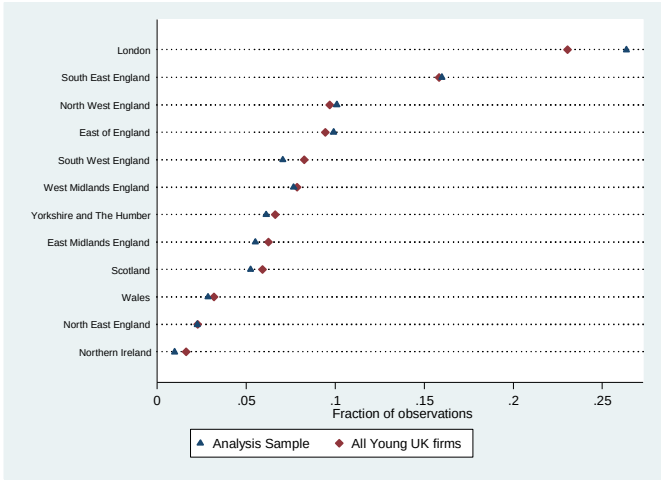
Panel G—Post-incorporation Average Annual Equity Issuance Incidence



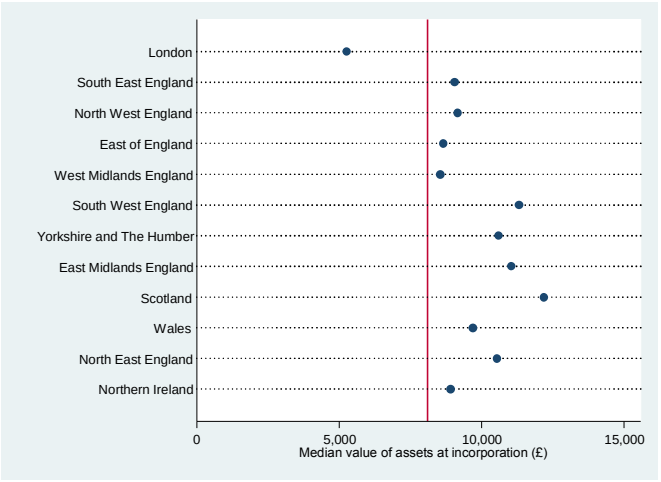
The figure shows the distribution of young UK firms across NAICS 2-digit (Panel A) and NAICS 4-digit industries (Panel B) during the 2009-2011 period. Panels C-F plot, respectively, the medians at incorporation of asset value, total equity-to-total assets ratio, tangibility ratio, and number of owners, by industry. Panel G plots the average incidence of new equity issuances post-incorporation, by industry. In panels C-F we sort data according to the industry distribution in Panel A. See notes in Table 1 for a detailed explanation of the sample construction.

Figure 3—Regional Distribution of Young Firms: 2009-2011

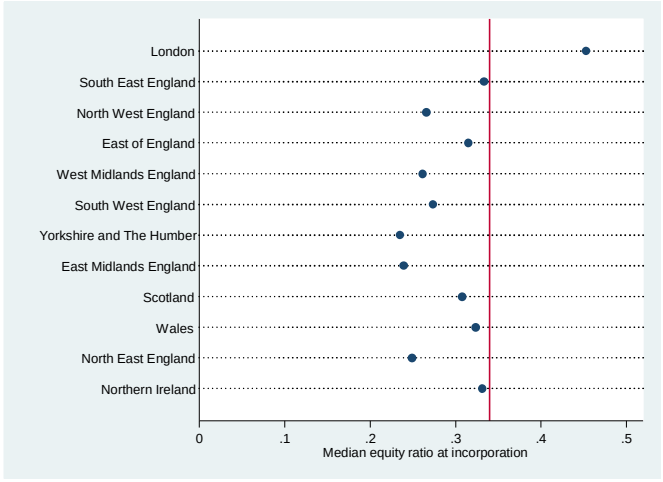
Panel A—Regional Distribution



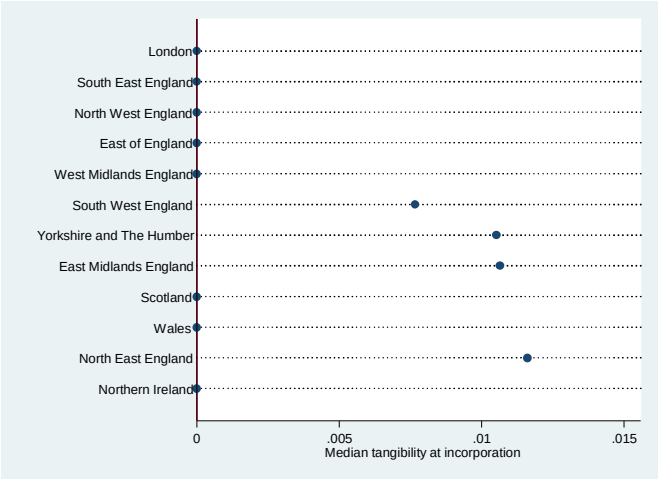
Panel B— Median Value Total Assets



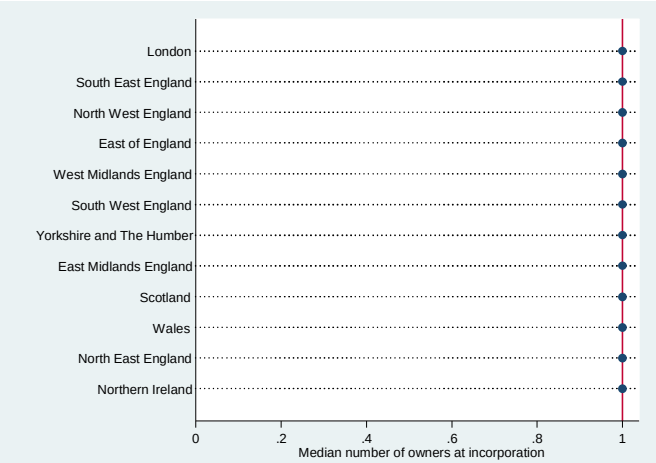
Panel C— Median Equity-to-Assets Ratio



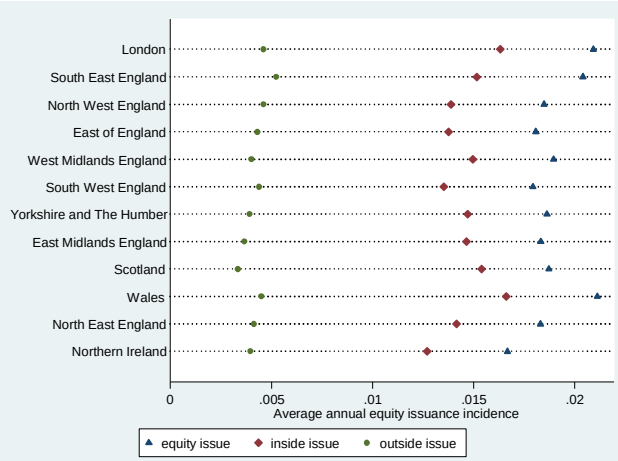
Panel D— Median Tangibility Ratio



Panel E— Median Number of Owners

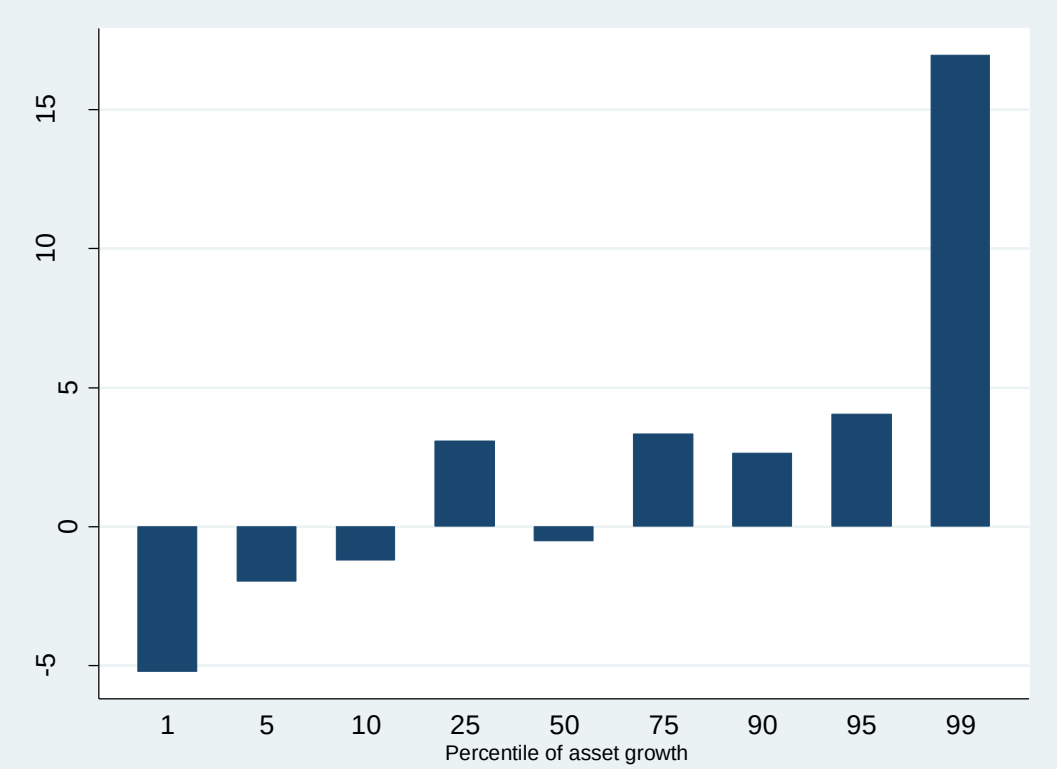


Panel F—Annual Equity Issuance Incidence



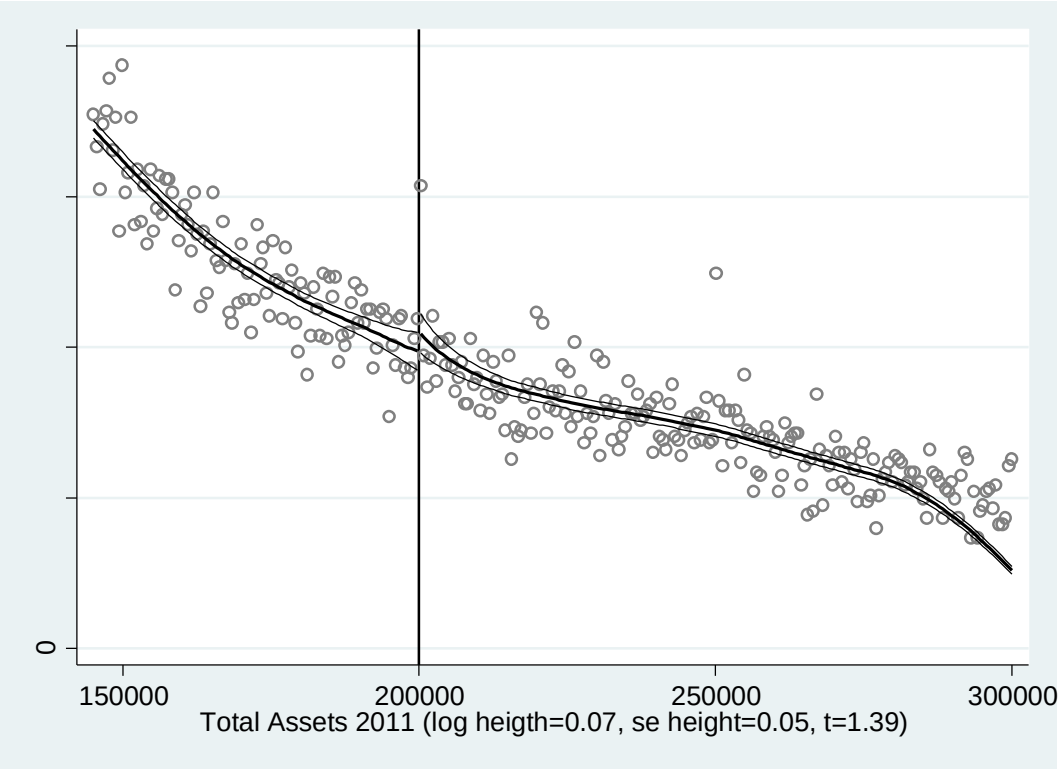
The figure shows the distribution of young firms across UK regions (Panel A) during the 2009-2011 period. We use the Nomenclature of Territorial Units for Statistics (NUTS) codes of the United Kingdom. Panels B-E plot, respectively, the medians at incorporation of asset value, equity-to-assets ratio, tangibility ratio, and number of owners, by region. Panel F plots the average incidence of new equity issuances post-incorporation by UK region. See notes in Table 1 for a detailed explanation of the sample construction.

Figure 4—Growth and Number of Owners in Young Firms: 2009 Cohort



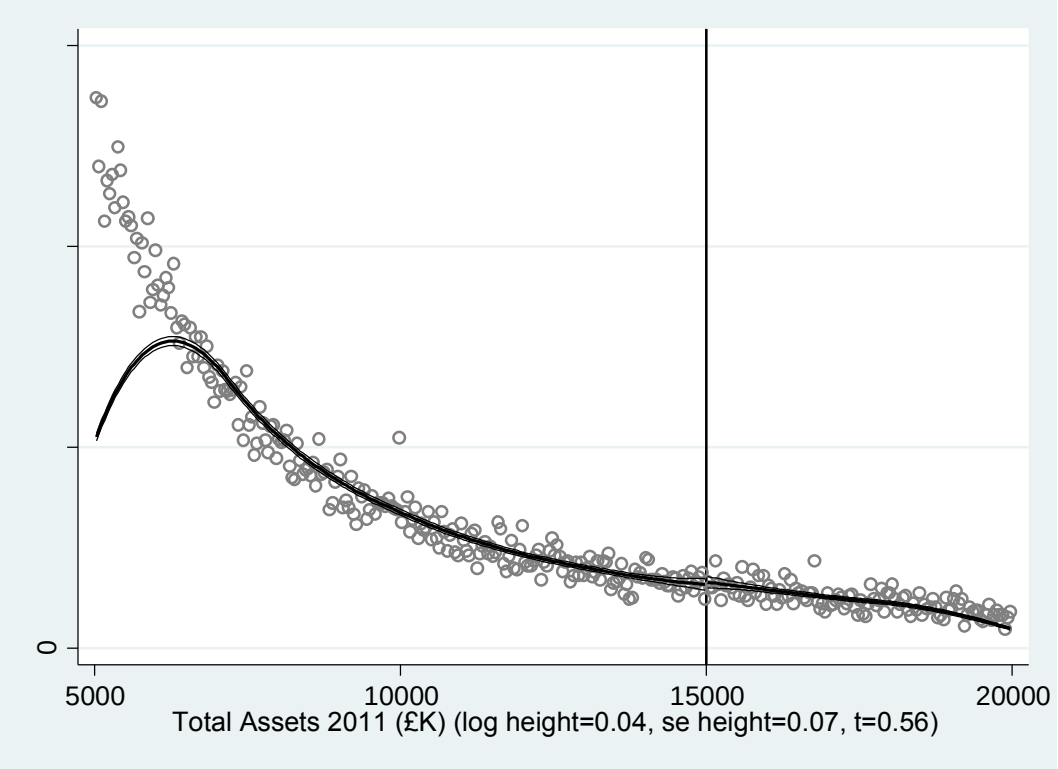
The figure plots the average percentage change in number of owners between incorporation and 2011 against percentiles of asset growth for UK firms incorporated in 2009 that survived until 2011. See Appendix 3 for more details on the sample construction and the definition of the variables.

Figure 5—Distribution of Total Assets in 2011 for SEIS Analysis Sample



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 a standard error of 0.05.

Figure 6—Distribution of Total Assets in 2011 for EIS Analysis Sample



The figure plots the distribution of total assets in 2011 for the firms in the EIS analysis 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)
Total assets (£)	8,092	8,083	8,984	6,812	21,369	29,944	29,681	157,460	154,482	197,071	1.00	4,837***
	(36,307)	(36,153)	(53,022)	(44,591)	(89,467)	(1,349,140)	(157,555)	(1,290,029)	(1,292,493)	(1,349,140)		
Total equity(£)	100	100	100	100	100	127	125	543	1,786	1.50	-1.00	3.00
	(4,414)	(4,391)	(6,564)	(5,050)	(15,080)	(82,602)	(12,402)	(87,796)	(86,219)	(82,602)		
Total equity/	0.34	0.34	0.41	0.47	0.25	0.02	0.02	0.03	0.04	0.00	0.00	-0.024
Total assets	(0.99)	(0.99)	(1.00)	(1.00)	(1.03)	(0.57)	(0.46)	(0.47)	(0.46)	(0.87)		
Tangibility	0.00	0.00	0.00	0.00	0.01	0.12	0.12	0.22	0.21	0.27	0.00	0.00
	(0.17)	(0.17)	(0.20)	(0.20)	(0.21)	(0.79)	(0.63)	(0.69)	(0.66)	(0.79)		
Number of owners	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	2.00	1.00***	0.00
	(2.00)	(2.00)	(1.00)	(1.00)	(1.00)	(2.00)	(1.00)	(1.00)	(1.00)	(2.00)		
Total liabilities						21,156	20,862	139,106	139,106	184,927		
						(1,094,438)	(134,769)	(1,260,485)	(1,510,186)	(1,094,438)		
Outside debt						0.00	0.00	0.00	0.00	3,340		
						(126,232)	(4,800)	(60,000)	(60,000)	(126,232)		
Inside debt						25.00	17.00	6,883	6,883	9,972		
						(109,455)	(14,081)	(120,000)	(124,107)	(109,455)		
Trade debt						5,352	5,435	27,470	24,506	41,273		
						(359,362)	(37,653)	(208,515)	(178,956)	(359,362)		
Assets>£200K	0.08	0.08	0.11	0.10	0.16	0.23	0.23	0.48	0.47	0.5		
£100≤Assets≤£300K	0.08	0.08	0.10	0.09	0.14	0.11	0.11	0.13	0.13	0.09		
Firms	428,427	423,396	5,031	3,876	1,155	16,526	16,379	145	113	32		
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	5,037	3,882	1,155	150	117	33		
Fraction firm-year obs.	0.01	0.01	0.003	0.01	0.01	0.002		
Number of firms	5,031	3,876	1,155	148	115	33		
Fraction of young firms	0.01	0.01	0.003	0.01	0.01	0.002		
Δ Issued equity (£)	99	99	100	1,000	1,000	4,800	8***	402
	(997)	(996)	(20,992)	(78,380)	(59,182)	(88,025)		
Δ(Total assets) (£)	2,917	1,385	15,929	14,200	8,685	62,100	8,416***	36,839
	(37,885)	(26,282)	(98,482)	(428,699)	(295,437)	(869,538)		
Δ Total assets/ Δ Issued equity	1.00	1.00	4.27	5.14	3.66	12.37	1.23***	3.22
	(311)	(252)	(670)	(321)	(309)	(338)		
Δ(Total liabilities) (£)				11,962	5,945	104,074		101,994***
				(262,107)	(115,609)	(707,406)		
Δ(Outside debt) (£)				0.00	0.00	0.00		0.00
				(3,293)	(1,994)	(37,769)		
Δ(Inside debt) (£)				0.00	0.00	0.00		0.00
				(33,633)	(24,959)	(46,412)		
Δ(Operational liabilities) (£)				7,560	5,000	42,181		32,062***
				(104,532)	(68,922)	(140,365)		

The table presents summary statistics for young firms in UK during the 2009-2011 period. Observations are at the firm-year level. Young firms amount to 0.5 million during the 2009-2011 period and correspond to 21% of all incorporated firms in UK during the period.[1] The table shows median values and reports interquartile ranges in parenthesis. Outside equity issuance events correspond to equity issuance events with simultaneous increases in number of owners.

[1] The starting point for the sample used in the table are the 2,535,198 firms that have filings at Companies House with non-missing assets during 2009-2011. We restrict the data to 585,797 limited young (i.e., within 3 years of incorporation) firms incorporated during the sample period (limited firms correspond to 93% of all firms see Section 2). We retrieve information at incorporation for these firms from their Annual Accounts. For firms that have no Annual Accounts filings with non-missing assets their year of incorporation, we use the information in the following year's filing. We excluded all firms that have no Annual Accounts filings within two years of incorporation. Information on owners at incorporation comes from firms' Annual Returns filings at Companies House. For firms with no Annual Returns filings the year of incorporation, we use the information in the following year's filing. Firms that have no Annual Returns filings within two years of incorporation are excluded from the sample. The final sample includes information on 428,427 young firms.

Table 2- Summary Statistics Analysis Sample

	obs.	mean	sd	p50	p75	p99
Total Assets in 2011	158,279	167,902	54,709	153,159	206,340	294,688
Total Equity	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
Equity-to-assets ratio	158,279	0.181	0.903	0.241	0.620	1
Issued Equity	158,279	9,132	64,471	100	100	250,000
Number of Owners	135,934	2.008	2.175	2	2	8
Non-equity liabilities	154,455	164,490	509,438	110,000	187,059	1.022e+06
Δ Issued Equity	123,096	1,422	36,526	0	0	37,500
D(Δ Issued Equity)	123,096	0.063	0.243	0	0	1
Δ Fixed Assets	123,096	7,640	159,119	-46	1,364	222,085
Δ Total Assets	123,096	41,081	303,081	11,090	62,495	603,527
Δ Number of Owners	102,123	0.071	0.959	0	0	2
Δ Non-equity liabilities	119,329	25,806	417,611	1,162	31,533	549,000
$Eligible_i$	158,279	0.726	0.446	1	1	1
$Post_t$	158,279	0.615	0.486	1	1	1
$Eligible_i \times Post_t$	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. The variable equity-to-assets ratio corresponds to the ratio between Total Equity and Total Assets. Variable definitions are described in Section 1.1.

Table 3- Outside Equity Issuance and Investment

Panel A—Basic Results

	(1)	(2)	(3)	(4)	(5)	(6)
						Implied Multiplier
Dep. Var.	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Number of Owners	Δ Total Assets	Δ Total Liabilities	Δ Total Assets/ Δ Issued Equity
$Eligible_i \times Post_t$	0.01***	1,795***	0.07**	14,951***	16,320***	8.33
	(0.004)	(611.864)	(0.029)	(3,335.085)	(2,911.040)	[4.04 – 26.93]
Conditional Coefficient		145,055	5.30	1,207,981	1,318,602	
95th Confidence interval		[53,279 – 514,348]	[-267 – 32]	[537,771 – 7,058,572]	[677,645 – 10,020,000]	
Observations	121,598	121,598	100,308	121,598	121,598	
R-squared	0.365	0.261	0.415	0.357	0.308	
Mean Dep. Var.	0.06	1,401.7	0.07	41,047.6	23,004.2	

Panel B—Logarithmic Transformation

	(1)	(2)	(3)
Dep. Var.	Δ ln(Issued Equity)	Δ ln(Total Assets)	Δ ln(Total Liabilities)
$Eligible_i \times Post_t$	0.08***	0.17***	0.22***
	(0.022)	(0.038)	(0.049)
Observations	121,598	121,598	121,586
R-squared	0.254	0.368	0.326
Mean Dep. Var.	0.09	0.21	0.2

Panel C—Dynamic Results

	(1)	(2)	(3)	(4)	(5)
Dep. Variable	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Number of owners	Δ Total Assets	Δ Total Liabilities
$Eligible_i \times D_2011$	0.01	1,558	-0.02	15,502	11,662
	(0.011)	(1,586.652)	(0.253)	(10,338.038)	(7,598.026)
$Eligible_i \times D_2012$	0.02	2,569	0.03	31,735***	25,579***
	(0.011)	(1,587.443)	(0.252)	(10,354.693)	(7,504.366)
$Eligible_i \times D_2013$	0.01	1,955	0.04	30,215***	26,593***
	(0.011)	(1,667.477)	(0.252)	(10,293.879)	(7,600.171)
$Eligible_i \times D_2014$	0.03***	5,047***	0.06	20,964*	25,378***
	(0.010)	(1,659.758)	(0.252)	(11,311.390)	(8,011.733)
Observations	121,598	121,598	100,308	121,598	121,598
R-squared	0.365	0.261	0.415	0.357	0.329

Panel D—Collapsed Sample

	(1)	(2)	(3)	(4)	(5)
Dep. Var.	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Number of owners	Δ Total Assets	Δ Total Liabilities
$Eligible_i \times Post_t$	0.01***	1,905***	0.06**	16,836***	18,124***
	(0.005)	(638.496)	(0.029)	(3,407.824)	(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). $Eligible_i$ 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); and we report 95th confidence intervals. The implied equity multiplier in the last column corresponds to the ratio between the estimates of Δ Total Assets and Δ Issued Equity (columns (4) and (2), respectively); the standard error is estimated using bootstrap (clustered at firm level), and we report the 95th confidence interval. Panel B presents estimates using logarithmic transformations of the main outcome variables. In Panel C, 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. Panel D presents the 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 4—Instrumental Variables Estimate of Subsidized Outside Equity Multiplier

	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
Dep. Var.	Δ Total Assets	Δ Total Assets	Δ Ln(Total Assets)	Δ Ln(Total Assets)
Δ Issued Equity	0.66***	8.33**		
	(0.17)	(3.29)		
Δ Ln(Issued Equity)			0.13***	2.28***
			(0.009)	(0.768)
Observations	121,598	121,598	121,598	121,598
First-stage				
$Eligible_i \times Post_t$		1,795***		0.08***
		(611)		(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 Δ Total Assets on Δ Issued Equity and Δ Ln(Total Assets) on Δ Ln(Issued Equity), respectively. All columns include firm fixed effects and separate year effects for each 5-digit 2007 SIC industry. Columns 2 and 4 present results from instrumental variables regressions, where Δ Issued Equity and Δ Ln(Issued Equity) are instrumented using $Eligible_i \times Post_t$, 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 5- Heterogeneity

Panel A—Unrelated Outside Owners

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

Panel B—Institutional Owners

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

Panel C – Owner Managers

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

Panel D – Motivations for Starting a Business

	(1)	(2)	(3)	Implied Multiplier
	D(Δ Issued Equity>0)	Δ Issued Equity	Δ Total Assets	Δ Total Assets/ Δ Issued Equity
I. Private benefits of control				
$Eligible_i \times Post_t$	-0.01	-58	3,988.	-69.20
	(0.014)	(1,194.245)	(6,271.587)	(-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	
II. Growth				
$Eligible_i \times Post_t$	0.01	2,091	28,835***	13.00
	(0.013)	(1,749.000)	(8,435.228)	(-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	
III. Other				
$Eligible_i \times Post_t$	0.02***	1,966***	14,163***	7.20
	(0.005)	(716.015)	(3,963.816)	(2.53, 30.48)
Observations	95,290	95,290	95,290	
R-squared	0.359	0.258	0.362	

Panel E – Asset Tangibility

	(1)	(2)	(3)	Implied Multiplier
	D(Δ Issued Equity>0)	Δ Issued Equity	Δ Total Assets	Δ Total Assets/ Δ Issued Equity
III. High tangibility				
$Eligible_i \times Post_t$	0.01**	2,548***	14,830***	5.82
	(0.006)	(726.391)	(3,681.400)	(1.33, 14.24)
Observations	59,105	59,105	59,105	
R-squared	0.380	0.271	0.417	
IV. Low tangibility				
$Eligible_i \times Post_t$	0.01*	855	15,244***	17.82
	(0.006)	(944.331)	(5,639.842)	(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. $Eligible_i$ is a dummy indicating whether the firm had total assets in 2011 below 200K pounds, $Post_t$ is a dummy equal to one in the years 2012-2014, and the dependent variable is specified in the top of the column. Unrelated outside owners indicates whether the company has at least one individual owner whose last name differs from that of the owners included at incorporation. 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, where 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 6- Financing the Subsidized Outside Equity Multiplier

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Var.	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Total Assets	Δ Total Liabilities	Δ Other debt	Δ Owners' debt	Δ Operational Liabilities
$Eligible_i \times Post_t$	0.04	1,023	17,113	30,724.70	-18,248	80,292	2,402
	(0.06)	(929)	(19,624)	(24,037.756)	(25,725)	(65,872)	(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
Difference with Δ Other debt						98,540**	20,651
95% Confidence Interval						[943 - 461,475]	[-37,238 - 121,857]

The table presents results from estimating equation (1). $Eligible_i$ 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 firms (222 eligible and 119 control) 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 7-Robustness Checks

Panel A- Placebo Tests

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

Panel B – Older Firms

	(1)	(2)	(3)
Dep. Var.	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Total Assets
$Eligible_i \times Post_t$	-0.00	539	-1,220
	(0.004)	(550.839)	(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 $Eligible_i$	0.7	0.71	0.71

Panel C – Alternative Samples

	(1)	(2)	(3)	(4)	(5)	(6)
Alternative Sample	£75K bandwidth			Symmetric window (£145K-£300K)		
Dep. Var.	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Total Assets	D(Δ Issued Equity >0)	Δ Issued Equity	Δ Total Assets
$Eligible_i \times Post_t$	0.01*	1,678**	8,400**	0.01**	1,497**	8,653**
	(0.005)	(717.128)	(3,636.046)	(0.005)	(715.660)	(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 $Eligible_i$	0.7	0.7	0.7	0.5	0.5	0.5

Panel D – Potential Misspecification

	(1)	(2)	(3)	(4)	(5)	(6)
	Including employment restrictions			Excluding late qualifiers		
Dep. Var.	D(Δ Issued Equity>0)	Δ Ln(Issued Equity)	Δ Ln(Total Assets)	D(Δ Issued Equity>0)	Δ Ln(Issued Equity)	Δ Ln(Total Assets)
$Eligible_i \times Post_t$	0.001	0.05	0.36	0.01**	0.06**	0.01
	(0.026)	(0.130)	(0.249)	(0.005)	(0.026)	(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 $Eligible_i$	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(Δ Issued Equity>0)	Δ Ln(Issued Equity)	Δ Ln(Total Assets)	D(Δ Issued Equity>0)	Δ Ln(Issued Equity)	Δ Ln(Total Assets)
$Eligible_i \times Post_t$	0.02***	0.09**	0.28***	0.01***	0.08***	0.17***
	(0.008)	(0.040)	(0.068)	(0.004)	(0.022)	(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 $Eligible_i$	0.83	0.83	0.83	0.72	0.72	0.72

The table presents results from estimating equation (1) in different subsamples. $Eligible_i$ 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 the sample to firms that have 2011 assets within a window of £100K to the right and £100K to the left of the random threshold. We classify firms into "placebo eligible" 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 restricts 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 report 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 8-EIS Analysis

Panel A—Summary Statistics EIS Sample

	obs.	mean	sd	p50	p75	p99
Total Assets in 2011 (£M)	13,509	14,968	581.9	14,949	15,475	15,780
Equity (£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
Equity-to-assets ratio	13,492	0.380	0.326	0.455	0.620	0.746
Issued Equity (£M)	13,509	468.8	805.8	1.277	616	1,844
Δ Issued Equity (£M)	11,429	66.47	540.4	0	0	9.990
D(Δ Issued Equity)	11,429	0.142	0.349	0	0	1
Δ Total Assets (£M)	11,429	1,981	6,371	36	1,264	14,285
Med_i	11,687	0.525	0.499	1	1	1
$Post_t$	11,687	0.263	0.440	0	1	1
$Med_i \times Post_t$	11,687	0.500	0.500	1	1	1

Panel B-Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	D(Δ Issued Equity>0)	Δ Ln(Issued Equity)	Δ Ln(Total Assets)	D(Δ Issued Equity>0)	Δ Ln(Issued Equity)	Δ Ln(Total Assets)
$Med_i \times Post_t$	0.000	-0.056	0.081**	0.00	-0.04	0.08
	(0.012)	(0.081)	(0.040)	(0.013)	(0.089)	(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 Med_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 an 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 9- Distribution of After-tax Return on Investment in Outside Equity

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
ΔROI implied by relief	0.06				
%ΔROI 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* the relief" differs from "*ROI without* the relief", 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 10—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
ΔROI	0.06	0.06
%ΔROI	1.13	1.13
%Δ 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 25th of every year). Accounts are prepared in accordance with United Kingdom accounting standards, and all statements with annual sales exceeding 1,000,000 pounds are audited.

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

In the UK, large firms are required to file detailed financial statements, while small firms may only report selected financial information. The Large and Medium-sized Companies and Groups (Accounts and Reports) Regulations 2008 and The Small Companies Regulations 2008 specify the filing requirements for UK firms according to size.[2] 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.[3]

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.[4] 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,

[2] 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.

[3] 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.

[4] 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).[5] 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.[6] 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.[7] [8] 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 $D(new\ equity > 0)$ that equals one if the year-to-year change in issued equity is positive. Appendix 7 includes a detailed example on the construction of these proxies for equity issuance based on Storemates, a London-based start-up that issued equity through the SEIS tax relief program. Finally, in Section 1.3 we distinguish between inside and outside equity issuances (post-

[5] 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.

[6] 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.

[7] 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.

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

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

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

For firms that disclose the structure of liabilities, we measure year-to-year changes in five broad types of non-equity liabilities: Δ *trade credit*, Δ *bank overdrafts*, Δ *group loans*, Δ *director loans*, Δ *other loans*, and Δ *other liabilities*. Detailed information on the structure of non-equity liabilities is only available for firms that file standard accounts (see Section 1.1), where non-equity liabilities are grouped as: bank loans and overdrafts, inside loans, trade creditors and other creditors, and described in the balance sheet notes.[9] 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.[10]

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.

[9] 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.

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

APPENDIX 2: ASSET CREATION AND ASSET DESTRUCTION BY FIRM AGE DURING 2009-2011 IN UK

The data covers all firms that have filings with non-missing assets in Companies House during 2009 and 2011 (pre-SEIS sample period). There are 6,117,692 firm-year observations for 2,534,224 firms.[11]

For any given year *t*, we classify firms into "entrants", "exiters", and "continuers" according to their current and one-year lagged filings. In particular, a firm is classified as an entrant in *t* if it has (does not have) a filing with non-missing assets in year *t* (*t-1*). Similarly, a firm is classified as an exiter in *t* if it does not have (has) a filing with non-missing assets in year *t* (*t-1*). Finally, continuers have filings with non-missing assets in both years.

For any given year *t*, we also classify firms relative to firm age, as measured against year of incorporation. The distribution of firms by entrants, exiters and continuers, as well as age is summarized in Table A.2.1. The table shows the correspondence between entrants and firms births is not perfect: 32% of entrants are aged 0 years, but 58% of entrants are aged one year, and the remaining and 10% of entrants have more than year of age.[12] In total, 4.2% of the observations correspond to firm births and 13.1% of the observations are classified as firm entrants. In what follows, we refer to observations of entrant firms that are not aged 0 as "late entrants".

In order to compare our findings to prior work that focuses on the role of firm births in output and labor dynamics, we define as "firm births" all firms aged 0 as well as all late entrants aged 1 year. For these firms we are certain that no filings with non-missing assets exist the year of incorporation, so they correspond to truly new reporting entities. For other late entrants we cannot check whether they have filings with non-missing assets prior to the analysis period as our data extract from Companies House begins in 2009.

We note that our classifications of firms present some other conceptual and measurement challenges. For example, restructured firms can be erroneously classified as entrants and even as firm births: a new firm identifier can arise through a merger of two pre-existing companies. In addition, temporary underreporting of firms can be classified as firm exits—we have no identifier for firm liquidations in our data. These conceptual challenges imply that our analysis may overestimate the role of new firms in asset creation and the role of deaths in asset destruction. We are thus careful with the terminology and refrain from referring to exiters as dead firms and to entrants as new firms.

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*. Asset size by firm age is defined analogously. We define the time-*t* asset growth rate of firm *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 exits (entry) corresponding to the left (right) endpoint. Mean growth rates excluding (including) late entry for 2010 and 2011 are -10.9% (8.3%) and -8.2% (10.0%), respectively.

Figure A.2.1 plots frequency distributions for the firm growth rate observations during the sample period. Panel A (B) depicts the shape of the empirical density over the 4,581,302 (4,172,457) annual observations (excluding late entry) for the years 2010 and 2011 on g_{it}. Panel C (D) depicts the shape of the empirical density over the size weighted observations (excluding late entry).[13] Both the

[11] We exclude 23 (55) firms (observations) missing the year of incorporation, and 826 (826) firms (observations) with filings in Companies House before incorporation.

[12] One potential explanation for the preponderance of one year firms among entrants is the mismatch between calendar and fiscal years.

[13] To plot the weighted densities we round firm size.

weighted and unweighted densities are slightly asymmetric with central peaks in the interval surrounding zero and endpoint spikes corresponding to exits and entry.

On an unweighted basis, Panel A shows that roughly 46 percent of all firms in the sample, experienced a growth rate in the interval (-0.2, 0.2), and, entry and exits account for roughly 25 percent of annual growth rate observations. Also on an unweighted basis, Panel B shows that entry and exit account for 17 percent of observations once we exclude late entry.

The mass of the size-weighted distribution is much more concentrated about the center and much less concentrated in the tails as shown in Panels C and D. On a size-weighted basis, Panel C shows that roughly 76 percent of the annual growth rate observations fall in the interval (-0.2, 0.2); and entry and exit account for roughly 8 percent of annual growth rate observations. Once we exclude late entry, Panel D shows that entry and exit account for circa 6% of observations.

Two caveats should be borne in mind when interpreting the importance of the extensive margins of the size-weighted distribution. First, the size metric x_{it} assigns only half as much weight to observations on entry and exit as would a conventional size metric. Second, although entry and exit account for a small fraction of the size-weighted firm growth rate observations, they account for a much larger fraction of asset creation as destruction as we discuss next.

Using the size-weighted frequency distribution of firm growth rates, we then construct asset creation and asset destruction measures. We calculate asset creation by summing positive asset changes at expanding firms of a specific age (except entrants). Similarly, we calculate asset destruction by summing up negative asset changes at shrinking and exiting firms of a certain age.

To express these measures as rates, we divide by the asset size of the firms for all age groups. The asset creation and asset destruction measures at time *t* by firm age *a*, can be expressed as $POS_{at} = \sum_{\substack{i\epsilon F_{at}, \\ g_{it}>0}} \left(\frac{x_{it}}{X_{at}}\right) g_{it}$ and $NEG_{at} = \sum_{\substack{i\epsilon F_{at}, \\ g_{it}<0}} \left(\frac{x_{it}}{X_{at}}\right) |g_{it}|$, where F_{at} is the set of firms with age *a* at time *t*.

As these formulas indicate, the size-weighted frequency distribution determines the weight to attach to each growth rate value in the calculation of asset creation and asset destruction rates. Finally, we also calculate a net asset growth rate by subtracting the asset destruction rate from the asset creation rate (by firm age).

Table A.2.2 summarizes different measures of asset activity during the 2009-2011 period for different classifications of firms. Panel A classifies firms into entrants, and separately continuers and exiters by firm age. Panel B excludes late filers from the sample, so in that panel all entrants are aged 0. Panel C classifies firms according to age, so in that panel the different age classifications include observations from late entrants in addition to those of continuers and exiters. Panel D uses our classification of firm birth, so in that panel, the age classifications above one year include observations from late entrants in addition to those of continuers and exiters. Figure 1 in the text depicts columns 6-8 of Panel D.

The table shows two striking features about asset creation in young firms. First, entrants and young firms with less than 3 years of age disproportionately contribute to asset creation. A comparison between columns 6 and 8 show that the fraction of asset creation explained by entrants and young firms exceeds their contribution to asset size. This is true specially for entrants, which contribute to 42% of asset creation, even though they account for 2% of corporate assets (13% of firms), as shown in Panel A. Panel B shows that the disproportionate contribution of entrants is not an artefact of late entrants. The panel shows that once we exclude late entrants from the sample, entrants aged 0 explain 20% of asset creation even though they account for roughly 1% of corporate assets (5% of firms). Panel C shows the importance of 0-year and 1-year firms in explaining the role of entrants. The panel shows that firms younger than two years of age contribute to 35.5% of total corporate asset creation, although they account for less than 4% of total corporate assets (and 15% of firms). This is as expected: Table

A.2.1 shows that 90% of entrants are younger than 2 years. Finally, Panel D presents our estimate of the disproportionate importance of firm births to asset creation: firm births explain 32% of asset creation although they account for 2% of total corporate assets (12% of firms).

This first feature about asset creation in UK is consistent with the importance of young firms in output and job creation in the US as reported by Haltiwanger, Jarmin and Miranda (2017). Firm births explain 14.8% and 24.8% on average of output creation and job creation, respectively, although they account for 10.2% of firms during the 1996-2000 and 2003-2013 periods in the US. However, it is in contrast to the estimated importance of young firms in asset creation in the US as reported by Becker, Haltiwanger, Jarmin, Klimek and Wilson (2005). Using data from the Annual Capital Expenditures Survey (ACES) between 1993 and 2000, the authors find that young firms account for less than 3 percent of total investment (the analogue to our measure of asset creation). Several potential explanations exist for the difference in results. First, at the time of writing, the ACES was still in early development, and as reported by the authors, had enormous sample rotation, especially for smaller business, and underrepresented young businesses. Especially important for measuring the role of firm births, new firms seemed to enter the ACES with some lag. The ACES had very limited coverage of age 0 and 1 firms. Second, as we already mentioned, our definition of firm birth and age has conceptual difficulties, in particular, it is possible that merged firms obtain a new firm identifier, and we cannot distinguish these observations from de novo new businesses.[14]

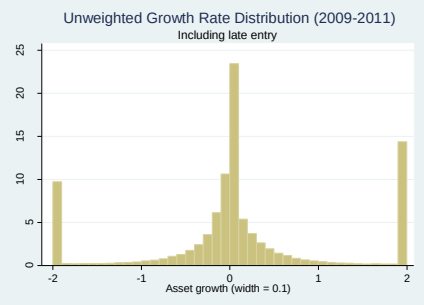
The second striking feature in the table is that firms older than 2 years are net asset destroyers. Across all panels, the asset creation rate in column 10 exceeds the asset destruction rate in column 11. This implies that young firms grow their assets rapidly on average, while older firms shrink their assets on average. These results are comparable to prior work on the distribution of job creation and job destructions rates by firm age. Davis and Haltiwanger (1992) show that firms older than 3 years of age are net job destroyers in their sample.

In Table A.2.3 we repeat the exercise by restricting the sample to limited firms, including: private limited companies and public companies (92.7% and 0.21% of observations in the sample used for the analysis in this Appendix, respectively). The legal forms excluded are: Guarantee, Industrial/Provident, Limited Liability Partnership, No companies Act, Unlimited and Other. Public firms include: Public in the Alternative Investment Market (AIM), Public Investment Trust, Public Quoted Off Exchange (OFEX), Public—Not Quoted, and Public—Quoted. In the table, we use the same firm-birth definition used in Panel D of Table A.2.2. The two features about asset creation in young firms we highlighted for the whole sample continue to hold. Firm births explain 29.2% of asset creation among private limited firms and constitute 1.7% of total corporate assets. Private limited firms older than 2 are also net asset destroyers.

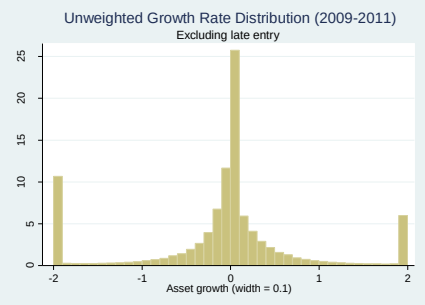
[14] In unreported analysis, we explore the role of spinoffs in explaining the importance of firm births in asset creation. Using information on the first register of owners of the firms, we classified 7,648 of firm births into spinoffs. A new firm as a spinoff if among the owners in the first register 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. Classified in this manner, spinoffs do not explain the importance of firm birth in asset creation. After excluding spinoffs, firm births still contribute to 30% of total asset creation.

Figure A.2.1—Firm Asset Growth Distribution

Panel A



Panel B



Panel C



Panel D

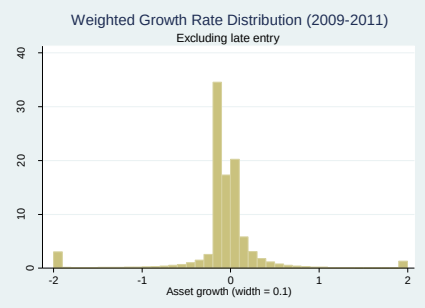


Table A.2.1 Distribution of Firms by Type and Age

Age\Type	Entrants	Exiters	Continuers
0	193,198	-	-
1	348,347	27,552	143,585
2	11,521	77,245	369,008
3	7,487	57,251	349,467
4	5,760	45,262	325,505
5	18,037	117,208	1,137,312
10	17,693	83,882	1,245,982
Total	602,043	408,400	3,570,859

The table shows the distribution of observations by firm type and firm age as measured relative to year of incorporation. Firms are classified as entrants, exiters, and continuers relative to filings with non-missing assets—see details in Appendix 2.

Table A.2.2 –Asset Creation, Destruction and Size by Firm Type and Age: (Average) 2009-2011

Panel A—Full Sample Classified According to Firm Type

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Firm Type	Firm Age	Asset creation (£M)	Asset destruction (£M)	Net asset creation (£M)	Asset Size (£M)	Number	Share asset creation	Share asset destruction	Share asset size	Share number	POS	NEG	NET
Entrants		59,329	-	59,329	29,665	301,022	0.42	-	0.02	0.13			
Continuers and Exiters	1	5,131	-3,141	1,990	18,765	85,569	0.04	0.02	0.02	0.04	0.27	0.17	0.10
	2	8,413	-7,912	502	44,683	223,127	0.06	0.04	0.04	0.10	0.19	0.18	0.01
	3	6,805	-11,311	-4,506	60,796	203,359	0.05	0.06	0.05	0.09	0.11	0.19	-0.07
	4	6,319	-13,964	-7,644	73,293	185,384	0.04	0.07	0.06	0.08	0.09	0.19	-0.10
	5-9	21,475	-53,042	-31,567	302,692	627,260	0.15	0.28	0.25	0.27	0.07	0.18	-0.10
	10 +	34,934	-98,253	-63,319	677,514	664,932	0.25	0.52	0.56	0.29	0.05	0.14	-0.09

Panel B—Excluding Late Filers

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Firm Type	Firm Age	Asset creation (£M)	Asset destruction (£M)	Net asset creation (£M)	Asset Size (£M)	Number	Share asset creation	Share asset destruction	Share asset size	Share number	POS	NEG	NET
Entrants	0	20,360	-	20,360	10,180	96,599	0.20	-	0.01	0.05			
Continuers and Exiters	1	5,131	-3,141	1,990	18,765	85,569	0.05	0.02	0.02	0.04	0.27	0.17	0.10
	2	8,413	-7,912	502	44,683	223,127	0.08	0.04	0.04	0.11	0.19	0.18	0.01
	3	6,805	-11,311	-4,506	60,796	203,359	0.07	0.06	0.05	0.10	0.11	0.19	-0.07
	4	6,319	-13,964	-7,644	73,293	185,384	0.06	0.07	0.06	0.09	0.09	0.19	-0.10
	5-9	21,475	-53,042	-31,567	302,692	627,260	0.21	0.28	0.25	0.30	0.07	0.18	-0.10
	10 +	34,934	-98,253	-63,319	677,514	664,932	0.34	0.52	0.57	0.32	0.05	0.14	-0.09

Panel C—Full Sample Classified According to Firm Age

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Firm Age	Asset creation (£M)	Asset destruction (£M)	Net asset creation (£M)	Asset Size (£M)	Number	Share asset creation	Share asset destruction	Share asset size	Share number	POS	NEG	NET
0	20,360	0	20,360	10,180	96,599	0.14	-	0.01	0.04			
1	30,206	-3,141	27,066	31,303	259,742	0.21	0.02	0.03	0.11	0.97	0.10	0.86
2	9,925	-7,912	2,013	45,439	228,887	0.07	0.04	0.04	0.10	0.22	0.17	0.05
3	7,966	-11,311	-3345	61,376	207,103	0.06	0.06	0.05	0.09	0.13	0.18	-0.05
4	7,374	-13,964	-6590	73,820	188,264	0.05	0.07	0.06	0.08	0.10	0.19	-0.09
5-9	25,190	-53,042	-27852	304,550	636,279	0.18	0.28	0.25	0.28	0.08	0.17	-0.09
10+	41,385	-98,253	-56868	680,740	673,779	0.29	0.52	0.56	0.29	0.06	0.14	-0.08

Panel D—Full Sample Distinguishing Firm Births and Classifying Non-births by Firm Age

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Firm Age	Asset creation (£M)	Asset destruction (£M)	Net asset creation (£M)	Asset Size (£M)	Number	Share asset creation	Share asset destruction	Share asset size	Share number	POS	NEG	NET
Births	45,436	-	45,436	22,718	270,773	0.32	-	0.02	0.12			
1	5,131	-3,141	1,990	18,765	85,569	0.04	0.02	0.02	0.04	0.27	0.17	0.10
2	9,925	-7,912	2,013	45,439	228,887	0.07	0.04	0.04	0.10	0.22	0.17	0.05
3	7,966	-11,311	-3,345	61,376	207,103	0.06	0.06	0.05	0.09	0.13	0.18	-0.05
4	7,374	-13,964	-6,590	73,820	188,264	0.05	0.07	0.06	0.08	0.10	0.19	-0.09
5-9	25,190	-53,042	-27,852	304,550	636,279	0.18	0.28	0.25	0.28	0.08	0.17	-0.09
10+	41,385	-98,253	-56,868	680,740	673,779	0.29	0.52	0.56	0.29	0.06	0.14	-0.08

The table shows annual average asset creation, destruction, net asset creation, asset size, and number of observations by firm type and age for the 2009-2011 sample period. Share of asset creation corresponds to the annual average ratio of asset creation by firm age (or firm type) over total asset creation. Shares of asset destruction, size, and number are defined analogously. POS, NEG, and NET correspond to the rates of asset creation, asset destruction, and net asset creation as defined in Appendix 2. Panel B excludes late filers (entrants with firm age different from 0) from the sample. Panel C classifies firms according to firm age only. Panel D distinguishes firm births from other firms, and classifies non-births by firm age.

Table A.2.3 –Asset Creation, Destruction, and Size by Firm Type and Age Among Private Limited Firms: (average) 2009-2011

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Firm Age	Asset creation (£M)	Asset destruction (£M)	Net asset creation (£M)	Asset Size (£M)	Number	Share asset creation	Share asset destruction	Share asset size	Share number	POS	NEG	NET
Births	35,650	-	35,650	17,825	254,585	0.29	0.00	0.02	0.12			
1	4,415	-2,345	2,070	14,811	80,067	0.04	0.01	0.01	0.04	0.30	0.16	0.14
2	8,117	-6,204	1,912	36,396	213,981	0.07	0.04	0.03	0.10	0.22	0.17	0.05
3	6,475	-9,271	-2,796	50,033	192,906	0.05	0.06	0.05	0.09	0.13	0.18	-0.05
4	6,265	-11,536	-5,272	60,972	174,516	0.05	0.07	0.06	0.08	0.10	0.19	-0.09
5-9	22,660	-45,560	-22,900	265,178	592,349	0.19	0.28	0.25	0.28	0.09	0.17	-0.09
10+	37,781	-89,138	-51,357	620,114	620,731	0.31	0.54	0.58	0.29	0.06	0.14	-0.08

The table shows annual average asset creation, destruction, net asset creation, asset size, and number of observations by firm type and age for limited firms during the 2009-2011 sample period. Share of asset creation corresponds to the annual average ratio of asset creation by firm age (or firm type) over total asset creation. Shares of asset destruction, size, and number are defined analogously. POS, NEG, and NET correspond to the rates of asset creation, asset destruction, and net asset creation as defined in Appendix 2. The table distinguishes firm births from other firms, and classifies non-births by firm age.

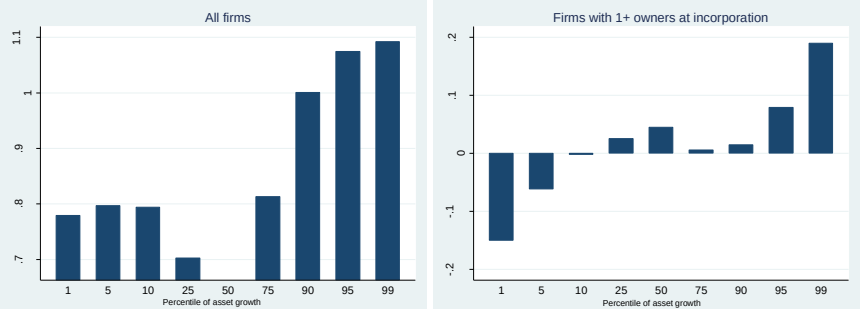
APPENDIX 3: CHANGES IN OWNERS AND ASSET GROWTH FOR 2009 COHORT

The starting point are 505,212 firm-year observations for 246,903 firms that have filings with non-missing assets in Companies House during 2009 and 2011 (pre-SEIS sample period) and that were incorporated in 2009. Of these firms, 79,239 (164,089) have their first filing with non-missing assets in 2009 (2010). We exclude 3,575 firms with no filings with non-missing assets for both 2009 and 2010. We also exclude 50,975 firms that do not survive until 2011, and 7,998 firms with no information on number of owners in 2011. The final sample includes 192,353 firms.

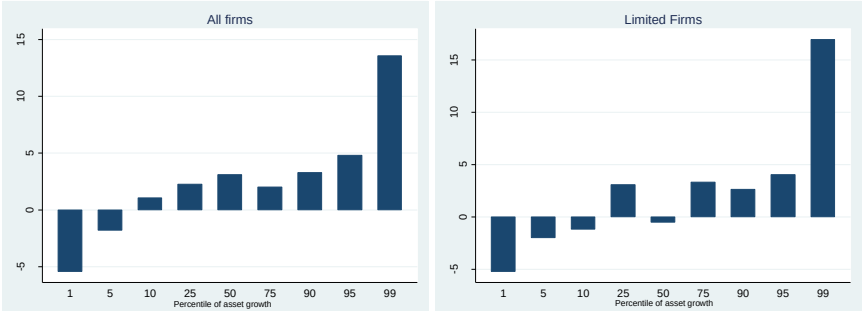
We calculate changes in owners and in assets between incorporation and 2011. For firms that have no Annual Accounts filings with non-missing assets in 2009, we use the information in their 2010 filing to measure assets at incorporation. Information on the number of owners comes from firms' Annual Returns filings at Companies House. For firms with no Annual Returns filings in 2009, we use the information in their 2010 filing to measure number of owners at incorporation. The average asset size at incorporation is £186,393 and the average number of owners is 0.68. The small average number of owners at incorporation is explained by the large number of firms with zero number of owners at incorporation (65.26%). In the analysis below we present results with and without firms with zero assets at incorporation. Average number of owners at incorporation is 1.96 (median is 2) for the subset of 66,814 with non-zero number of owners at incorporation.

We classify firms according to their percentile of asset growth. We plot the average (percentage) change in number of owners in Panel A (Panel B) for firms in selected percentiles of asset growth (top and bottom: 1%, 5%, 10%, 25%, 50%). In Panel A we plot the average change of owners by percentile of asset growth for all firms as well as for the subsample of firms with one or more owners at incorporation. In Panel B we plot the average percentile change of owners by percentile of asset growth for all firms as well as the subsample of limited firms (private and public)—which amount to 94.87% of firms in the 2009 cohort. The legal forms excluded are: Guarantee, Industrial/Provident, Limited Liability Partnership, No companies Act, Unlimited and Other.

Figure A.3.1—Change in owners and asset growth for 2009 cohort
Panel A—Average change in number of owners



Panel B—Average percentage change in number of owners



The figure plots changes in number of owners against percentiles of asset growth for firms incorporated in 2009.

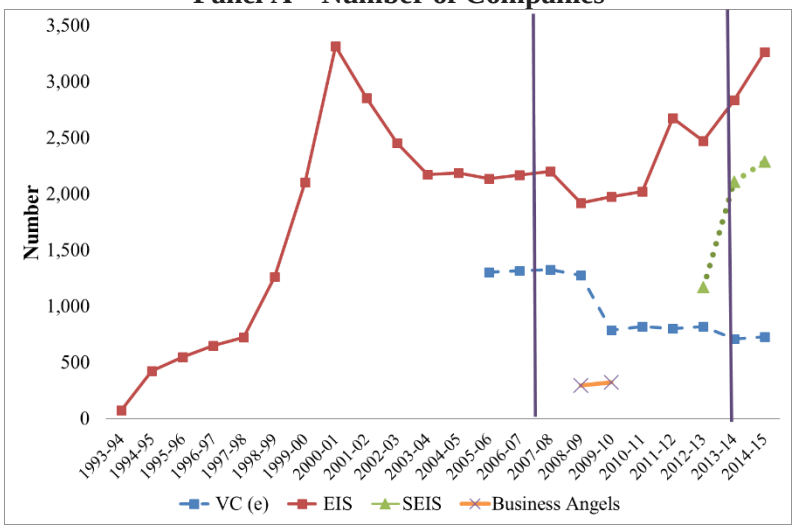
APPENDIX 4—POTENTIAL EQUITY CAPITAL POOL FOR SEIS ELIGIBLE COMPANIES

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

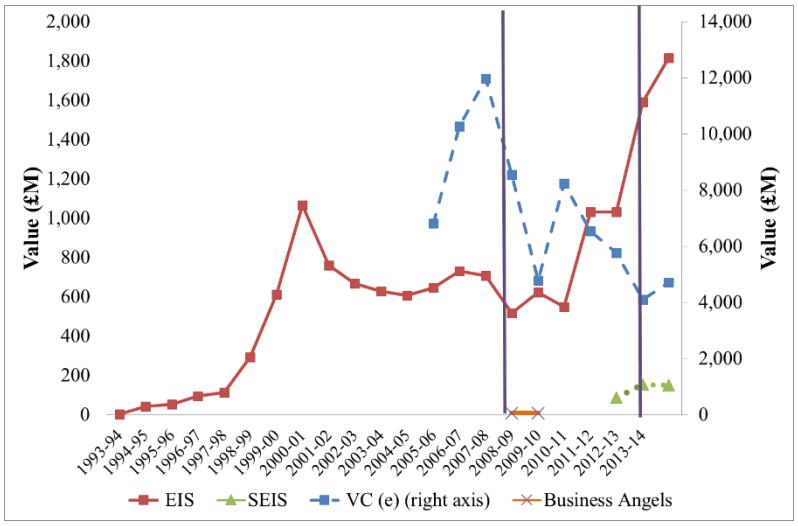
The table presents estimates of the potential equity capital pool for eligible companies based on average tax liabilities for UK citizens in different income thresholds. We assume that only individuals with a total annual income higher than 100,000 invest in private companies, and that the investment 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.

APPENDIX 5 – USE OF UK TAX RELIEF PROGRAMS AND PRIVATE EQUITY ACTIVITY IN UK

Panel A – Number of Companies



Panel B – Value of Investments



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).

APPENDIX 6: 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
Less cost	£100,000	
Reduced by Income Tax relief*	£ 20,000	£ 80,000
Allowable loss		£(20,000)

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

Example 2 – part-disposal

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

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

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

A.4.1. How to claim the losses

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

- be made in a return, or

- be made in an amendment to a return.

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

APPENDIX 7: 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 $D(New\ Equity > 0)$ used in the empirical analysis and calculated based on rows (1)-(5).

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

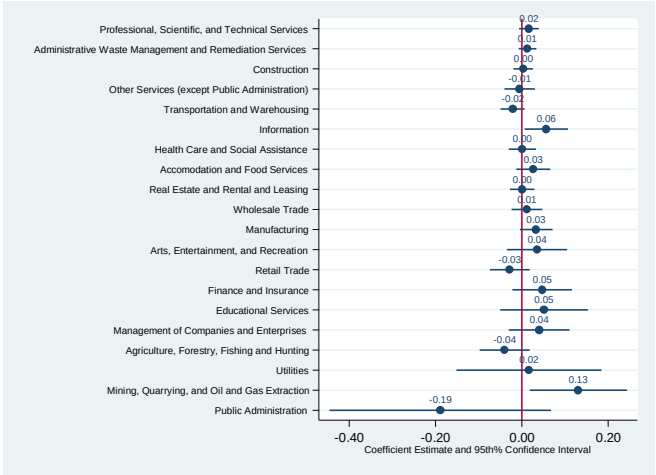
APPENDIX 8—EFFECT ON FIXED ASSETS

	(1)	(2)	(3)
			Implied Multiplier
Dep. Var.	Δ Fixed Assets	Δ ln(Fixed Assets)	Δ Fixed Assets/ Δ Issued Equity
$Eligible_i \times Post_t$	4,760***	0.27***	2.65
	(1,442)	(0.054)	[1.14 – 9.02]
Conditional Coefficient	384,618***		
95th Confidence interval	[140,854-1,828,496]		
Observations	121,598	121,598	
R-squared	0.286	0.308	
Mean Dep. Var.	7,500	0.252	

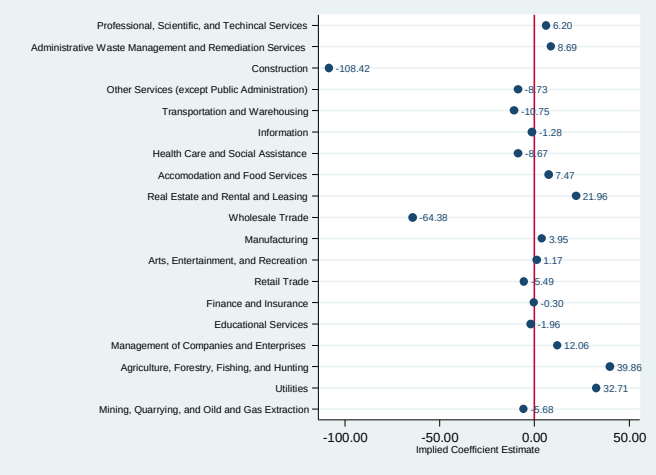
The table presents results from estimating equation (1). $Eligible_i$ is a dummy indicating whether the firm had assets in 2011 below 200K pounds and $Post_t$ is a dummy equal to one in the years 2012-2014. The dependent variable is specified in the top of the column. All columns include firm fixed effects and separate year effects for each 5-digit 2007 SIC industry. The conditional coefficients are the ratios between the dependent variable and the dummy indicating equity issuance (Table 3, Panel A, Column 1). Standard errors for these ratios are estimated using bootstrap (clustered at the firm level); we report 95th confidence intervals. The implied equity multiplier in the last column corresponds to the ratio between the estimates of Δ Fixed Assets and Δ Issued Equity (Table 3, Panel A, Column 2); the standard error is estimated using bootstrap (clustered at firm level), and we report the 95th confidence interval. 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.

APPENDIX 9—HETEROGENEITY IN RELIEF TAKE-UP AND SUBSIDIZED EQUITY MULTIPLIER ACROSS INDUSTRIES AND REGIONS

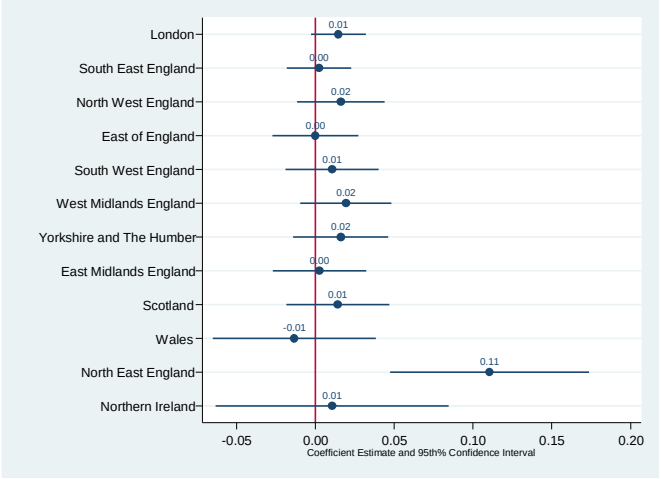
Panel A--Equity Issuance Across Industries



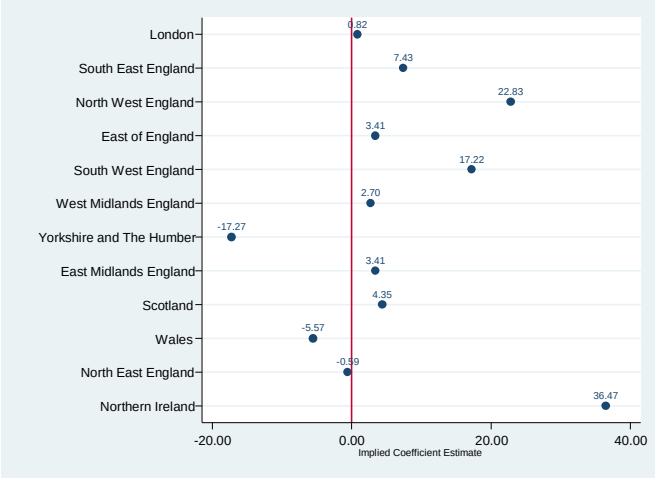
Panel B—Implied Subsidized Equity Multiplier Across Industries



Panel C--Equity Issuance Across Regions



Panel D—Implied Subsidized Equity Multiplier Across Regions



The figure presents the estimates of equity response and subsidized implied multiplier to the relief based on equation (1), across different industries and regions. We sort results in Panels A-B (C-D) according to the industry (regional) distribution of UK young firms plotted in Panel A of Figure 3 (4).