



The availability of business angel and venture capital for startups after the 2008 financial crisis.

To what extent can tax incentives and co-investment funds close the financing gap?

Master Thesis

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Abstract

Private and institutional investors became more risk averse after the 2008 financial crisis and refused to fund startups because they are associated with higher investment risk. As a result, European entrepreneurs faced a financing gap – their capital demand for startup formation was not met. Because startup formation leads to social and economic benefits through the channels of innovation, competition and employment, many European governments intervened in their financial markets. Tax incentives and co-investment funds were introduced to increase the risk appetite of business angels and venture capitalists, private investors with a particular interest in startups. This study investigates the effect of these policy measures on the improvement of startups' financial situation over the past years (2009-2017). A pooled OLS analysis of firm-level data finds that tax incentives are an effective measure to stimulate startup funding while co-investment funds are not. Business angels' and venture capital firms' investment decisions seem to be sensitive towards profit-maximizing (tax relief) rather than risk-sharing (co-investment) tools. The tax incentive effect is not conditional on policy design features, such as the tax generosity level or target group specialization. For policymakers, the findings imply that private investments can be “nudged” by means of tax advantages at a minimum cost of foregone tax returns.

1. Introduction

The 2008 financial crisis changed the financial environment of European small and medium-sized enterprises (SMEs) and startups in particular (ECB, 2013a). Startups are high-growth micro and small businesses, younger than ten years, with new business models. Before the crisis, banks were their main external financier (European Commission, 2017a). But the crisis increased the risk aversion of banks and they became more hesitant to provide loans to startups. As a result, startups faced a so-called financing gap (Wilson, 2015). Their demand for funding was no longer met by banks so that they became more reliant on non-bank finance, i.e. private equity (European Commission, 2017a). Many European governments assigned startups a critical role in the private sector-led recovery from the crisis because they bring forth innovation and create employment, which leads to social stability and economic growth. They intervened in their domestic financial markets and introduced a variety of supply-side policy measures to help startups overcome the financing gap. They focussed on business angels and venture capital firms – the primary providers of private equity – and incentivized investments in startups through the use of tax advantages and/or co-investing (European Commission, 2017a; OECD, 2018). Business angels are wealthy individuals, often with entrepreneurial expertise, who directly invest their private capital in startups. Venture capital firms invest private capital in startups on behalf of their primary sources, such as banks, pension funds, individuals or enterprises. Alongside the funding, both venture capital firms and business angels provide immaterial support such as strategic guidance, know-how and business contacts with the investee. Tax incentive schemes and co-investment funds to stimulate such investments are studied in this research paper (OECD, 2017a). Governments intervene in markets when they fail to allocate resources efficiently. The literature distinguishes between different types of market failures, one of them is associated with asymmetric information. The startup financing gap belongs to this category. Startups cannot provide a “track record” and their founders, often young entrepreneurs, lack a reputation. Therefore, investors who provide finance to startups experience greater uncertainty over their financial return than when investing in more mature firms. Because investing in startups is associated with higher risk, the funding level for startups is below its social optimum (Wilson, 2015). The rationale behind the two types of government intervention is in line with the market failure argumentation. Tax incentives are meant to increase investors’ risk appetite to a degree where they are willing to accept the information asymmetries. Co-investment funds not only aim at increasing their risk appetite, they are also constitute a risk-sharing tool. In sum, the two measures target the decision-making process of private equity investors (which are venture cap and angel investors) in order to facilitate the

access to their capital for startups. Today, a decade after the crisis, startups in many EU member states report an improvement of their financial situation (OECD, 2017a). In fact, business angels became the main external financier of European startups, closely followed by venture capital firms (Kollmann et al., 2016).

1.1 Research question

The objective of this study is to identify the effect of tax incentive schemes and public co-investment funds on the development of the startup financing gap.

The research question is: *To what extent can tax incentives and co-investment funds foster business angel and venture capital investment in startups?*

1.2 Justification

Knowing the effects of tax incentive schemes and co-investment funds on the flow of business angel and venture capital into startups is important for a number of reasons.

Firstly, from a societal perspective, it is important to learn more about ways to influence private investors' decision-making. Governments all over the world face complex challenges – the United Nations Sustainable Development Goals provide an overview¹ – and private investors may be a “helping hand” to them. The literature suggests that many business angels experience personal satisfaction from “helping” startups, strong enough for them to overlook startups high risk nature (Mason et al., 1994). The financial sector is also increasingly aware of not only the necessity but also the profitability of corporate social responsibility. *Impact Investing* and *Green Finance* are examples of the many initiatives to integrate financial returns for the investor and non-financial returns for society (Berry et al., 2013).

If tax incentive schemes and co-investment funds are found to be effective in facilitating startups' access to private equity, governments could use these measures to further “exploit” their potential and “nudge” them into funding firms with social benefits, e.g. ecological sustainability. Can tax schemes or co-investment funds tap their altruism for greater purposes? The incentive mechanisms are also particularly interesting from a Public Administration perspective, a discipline in which *governance* plays a key role. Governance is defined as “the action or manner of governing—that is, of directing, guiding, or regulating individuals,

¹ The United Nations Sustainable Development Goals (UN SDGs) are a list of seventeen complex societal goals, e.g. affordable and clean energy, decent work and economic growth, agreed-upon by all member states to transform the world into a better place for future generations. All goals are listed on the UN SDG website:

<https://www.un.org/sustainabledevelopment/sustainable-development-goals/>.

organizations, or nations in conduct or actions” (Lynn, 2010, p. 671). It takes place at any public-private policy nexus when private stakeholders are steered by the government to fulfill the government’s purposes (Robicheau, 2011). As they become involved in achieving public policy goals, private stakeholders become empowered. This applies to public co-investment funds, which are often managed by private investors. Further insights into this form of public-private partnership to achieve economic growth will contribute to knowledge of governance. On a more general note, the study is interesting for Public Administration scholars because it studies the role of business angels and venture capital firms as vehicles for social welfare and economic growth (via startups).

From a methodological perspective, the added value of the study is twofold. Firstly, though tax incentives and co-investment funds to stimulate business angel and venture capital investment have been studied in isolation, they have never been assessed in relation to one another in a medium- to large-N design (European Commission, 2017a (European Commission, 2017)). The effect of tax incentives has been studied in a large-N design for the EU and other OECD countries (European Commission, 2017a) and co-investment funds have been studied in single case and small-N designs (Owen et al., 2017; Swedish Agency for Growth Policy Analysis, 2013). This research conducts a comparative quantitative analysis in a large-N design for all EU member states.

Secondly, an evaluation of such supply-side policy measures was, so far, hindered by a dependent variable problem. Private equity provision, especially in the form of business angel investments, is often realized in an informal setting. Business angels act independently, their investments are not captured by national databases (Kersten et al., 2017). Their low visibility leads to measurement problems and a frequent underestimation of business angel start-up funding in the small and predominantly descriptive literature (Wilson, 2015). This research largely overcomes the dependent variable problem. It uses micro-level data from the ECB Survey on Access to Finance for Enterprises (SAFE), which makes the development of the SME and startup financing gap after the crisis measurable. (ECB, 2017a; European Commission, 2017).

1.3 Structure of the thesis

Entrepreneurship and private equity play an important role for the governance of economic recovery and growth but familiarity with its terminology and market mechanisms is no prerequisite in the field of Public Administration.

The second chapter, therefore, introduces startups and private equity finance as well as their socio-economic importance. Governments intervene in markets when market failures exist. The imbalance between demand for and supply of startup finance is considered a result of the market failure “information asymmetries”. Both, tax incentives and co-investment funds constitute government interventions in financial markets. A literature review elaborates on the rationale behind these policy measures and clarifies their design as well as their expected outcome. The chapter culminates in the study’s research hypotheses. The third chapter explains the research design. It introduces the panel data used in the analysis and explains how they concepts underlying the research hypotheses were operationalized so that they can be measured with that data. Potential sources of omitted variable bias, the construction of control variables to rule out such bias, and limitations of the research design are discussed. The fourth chapter is devoted to the analysis. The empirical methodology, a variety of pooled OLS regression models, is discussed and the analysis results are reported as well as interpreted. The analysis findings are linked to the research hypotheses in order to answer the research question. As the fifth chapter concludes the study’s findings and contributions, it provides a brief recommendation for public policy as well as future research.

2. Theory

2.1 Startups and their role for the economy

What are startups?

In the European Union (EU), firms are classified so that governmental support can be targeted at specific firm types. The most common classification distinguishes firms along their size expressed in number of employees. Over 99% of all firms active in the EU are *small and medium-sized enterprises* (SMEs), an umbrella term for firms that are not “large” firms (0,2% in 2013) meaning that they have no more than 250 employees (ECB, 2013a; Eurostat, 2015; Eurostat, 2018a, European Commission, 2015; ECB, 2013a). According to the “SME Definition” of the European Union, SMEs can be further distinguished into three firm types; (I) *medium-sized firms* with between 50 and 249 employees, (II) *small firms* with between 10 and 49 employees, and (III) *micro firms* with up to 9 employees (ECB, 2013a, Eurostat 2018a). The vast majority of SMEs are micro firms (92% in 2013), less than ten percent of SMEs are small firms (6.7% in 2013) and only around one percent (1% in 2013) are medium sized firms (ECB, 2013a; Eurostat, 2015). But firms do not only come in different sizes, they also take on various “shapes”. This research focusses on “startups”. Most startups belong to the size class micro and small enterprises. The defining characteristic of a startup is the pursuit of a new business model.

A new business model can be the commodification of a new invention, which creates a completely new product market. But it can also be a more innovative production of a product for which a market already exists. A business is “started up” by an entrepreneur to fill a market or production niche, she² identified. As long as it is in its initial stages of growth, the business is referred to as a startup. Startups are never older than 10 years (Kollmann et al., 2016, ECB, 2013b, Wooldridge, 2009). In the EU, startups average age is 2,4 years (Kollmann et al., 2016, ECB, 2013b).

Why are startups beneficial to economy and society?

The literature associates startups with economic and social benefits. The various channels through which they contribute to economy and society are discussed below.

First of all, SMEs in general have several advantages over large firms in terms of resilience. Jean-Claude Juncker, President of the European Commission, refers to them as the backbone of Europe’s Economy (European Commission, 2015). As startups are a specific type of SME, they carry these relative SME-specific advantages, too.

Large firms account for a great share of nations’ economic output and are often highly integrated in international trade and finance (Eurostat, 2018a). While large firms have their unique strengths, their high degree of integration and the high reliance of national economies on them create two weaknesses. On the one hand, national economies turn vulnerable towards changes in consumer demand when they rely heavily on the performance of a few large firms. On the other hand, their high degree of integration makes them more pro-cyclical, meaning that their performance is strongly correlated with international business cycles. This makes them relatively vulnerable towards depressions abroad (Eurostat, 2018a). SMEs, on the contrary, protect national economies from such external threats. If the national economic output is generated by many competing SMEs, the bankruptcy of one firm, e.g. due to changes in consumer demand, will have a comparably small impact on that output (Eurostat, 2018a). For the same reason, SMEs increase economies’ resilience in terms of employment. Employment in SMEs is less affected by depressions than employment in large firms (Moscarini et al., 2012). Moscarini (2012), professor of Economics at Yale University, provides evidence that large firms in the US “on net destroy proportionally more jobs relative to small employers when unemployment is above trend, late in and right after a typical recession, and create more when unemployment is below trend, late in a typical expansion” (Moscarini et al., 2012, p. 2509).

² To incorporate gender neutrality into this research and not fall into a category, both, male and female individuals are ambiguously referred to when the writing requires a pronoun.

This finding, according to him, can be applied to different countries of different sizes (Moscarini et al., 2012).

Beyond the advantages that are generally associated with SMEs, startups carry a unique potential, which runs through three main channels, (I) job creation, (II) innovation and (III) competition.

(I) *Startups and job creation:*

“Startups are job engines” (Kollmann, 2015, p, 43). This quote is supported by the figures. In Europe, two out of every three jobs are created by SMEs (European Commission, 2015).

On average, a European startup creates thirteen jobs after 2,5 years (employees and founders) (Kollmann, 2015). An estimated 1 million jobs and €2 trillion of GDP could be created for the EU over the next 20 years, if the startup survival rate was levelled up to that of the United States (Startup Europe, 2016). 70% of the jobs created by startups are taken by citizens of the startup’s country of residence and 20,9% of the remaining employees are EU citizens (Kollmann, 2015). Startups are not only a tool for the EU to create more jobs, support of startups is also motivated by the quality of jobs they create (Startup Europe, 2016). Startups provide full-time jobs primarily but also often (77% of all startups) employ students and interns (Kollmann, 2015). Working arrangements are often more flexible and modern (Startup Europe, 2016). The combination of high growth character and flat staff hierarchies – due to their small size – make startups a great environment for young professionals to develop knowledge and careers (ibid., Kollmann, 2015). This point is particularly important for European governments, where economies have become knowledge-based. In knowledge-based economies, knowledge, technology and learning play a primary role for value creation and economic growth. Startups provide access to these assets for young professionals and, therefore, higher startup employment could contribute to the highly-skilled labour force, which will make a knowledge-based economy more competitive among other knowledge-based economies (OECD, 1996).

(II) *Startups and innovation:*

Start-ups are founded by entrepreneurs when they identify an unfulfilled market niche. As they occupy that niche, they bring forward new products or services. The innovative process behind new products, services is extremely beneficial for society. Joseph A. Schumpeter, one of the twentieth century’s most influential economists, was the first intellectual to connect entrepreneurship and innovation to economic wellbeing. Today, innovation reoccurs as the defining characteristic of the entrepreneur (Wooldridge, 2009). In his writing “Theory of

Economic Development”, he developed the theory of “creative destruction” (Schumpeter et al., 1988; Borbély, 2008). Innovation, in Schumpeter, is simply “the doing of new things or doing of things that are already done, in a new way” (Schumpeter, 1947, in Borbély, 2008). He refers to such doing as “new combinations” and points to entrepreneurs, who realize new combinations when they commodify new inventions. A saturated market does not drive economic growth. On the contrary, any economy depends on entrepreneurs to impulse new consumer demand by introducing new combinations. This mechanism of market disruption is called “creative destruction” in Schumpeter. Because innovation drives demand and demand drives economic growth, “creative destruction” constitutes *the* essential force of economic growth in Schumpeter. Innovation is closely tied to business cycles. Economic depressions are a “good cold shower” for the economic system because they facilitate “creative destruction”. In times of crisis, labour and capital is “released” from old firms and can, once released, be sourced to form “new combinations”. During his term as the Minister of Finance in Austria (1920’s), Schumpeter promoted the support of new enterprises as a strategy for economic development. He criticized the Austrian government for naively directing all its resources towards big firms and “killing entrepreneurship” (Schumpeter, 1942; in Wooldridge, 2009). Simultaneously, he assigned entrepreneurs a societal responsibility to keep capitalism alive by continuously introducing innovative products and services into the market (Borbély, 2008). In essence, to this day, entrepreneurs fulfil that role by “starting up” firms. Examples of startups that boosted the economy through disruptive innovation range from Microsoft, Apple, Google to Facebook (Sledzik, 2013; Schumpeter, in Wooldridge, 2009).

(III) Startups and competition:

While employment growth and the introduction of new, innovative products into the market are direct effects of startup formation, startups’ competition effects are more indirect (Fritsch, 2008). When startups enter the market, they do so as new competitors to well-established firms, also called incumbents (ibid.). Startups’ introduction of new, often more productive, products or services can affect consumer demand and prices. If this is the case, incumbents are forced to lower their output or exit. It is important to note that even if a startup is not successful and cannot drive incumbents out of the market, the mere possibility of such scenario puts pressure on incumbents (Fritsch, 2008). The competition effect of potential and actual startup formation benefits the consumer because operating firms are constantly forced to be innovative and efficient (ibid.).

In practice, the effect of startups on economy and society is not always as straightforward as the literature review suggests. The most important deviations from the ideal-type effect is that direct and indirect effects interplay. They can be mutually reinforcing but they may also cancel each other out. To give an example for mutually reinforcing effects – when innovation increases consumer demand, the employment effect of startups may be reinforced. However, if startups increase competition and eliminate less productive firms, they may lead to the loss of (less productive) jobs have an indirect negative effect on employment (Fritsch, 2008).

The estimation of a net effect of these complex dynamics are beyond the scope and focus of this research. Most scholars and policymakers agree that supporting startups is a promising tool to achieve economic growth for the reasons discussed above (Fritsch, 2008). This research, therefore, considers startup formation and funding as desirable. In line with Schumpeter, it is also assumed that the post-2008-financial crisis circumstances increased the positive effects of startups because labour was abundant and competition was weakened (cf. Schumpeter; Fritsch, 2008). Lastly, the European economies are considered favourable for the effects of startups because they are knowledge-based (OECD, 1996).

Given the importance of startups for European economies and societies, it can be pre-concluded that startup formation and, hence, the funding of startups is desirable. Supporting startups and startup funding is advantageous for governments as it will strengthen the beneficial effects of startups.

2.2 The financing gap – a market failure

The startup financing gap:

A necessary condition for entrepreneurs to start up new businesses – and fulfil the role Schumpeter assigned to them – is access to funding.

Since 2009, startups have a particularly hard time raising capital. After the crisis, they were facing a so-called “financing gap”. The term “financing gap” refers to the imbalance between finance supply and demand (ECB, 2017a). On the demand side, entrepreneurs were seeking capital while, on the supply side, institutional and private investors were unwilling to provide that finance (Wilson, 2015). The problem with startups is their high-risk character. They often lack a track record and reputation, so that their profitability and performance is hard to predict (Moscarini, 2012). Risk monitoring, after investments are made, is relatively costly because most startups have not (yet) gone public, so that they are not subject to the strict financial reporting regulations that apply to stock listed companies (ECB, 2013b). These uncertainty costs deter investors and hinder the flow of funds to startups. The disincentive effect intensified

after the crisis. In 2009, *The Economist* wrote: “risk, the lifeblood of the entrepreneurial economy, is becoming something to be avoided” and that startups had a hard time “standing up to the worldwide economic downturn” (Wooldridge, 2009). Banks – once their main financier – “backed off” because they were held accountable for the crisis, closely watched, and because they suffered from public pressure to be parsimonious (Duchin et al., 2010; ECB, 2013b). Banking sectors, globally, had just been forced to pay the “costs” of taking too much risk. In 2013, only 40% of startups received bank loans (ECB, 2013b). In 2017, banks still preferred financing large firms over smaller enterprises (Wooldridge, 2009; ECB, 2017b). To compensate for the sharp cut-off in funding by banks, startups became more reliant on private equity funding (ECB, 2013b). Unfortunately, however, business angels and venture capital firms – the primary providers of private equity – were waiting out the crisis and observing banks (OECD, 2009a). Policymakers in Europe believed that market intervention was necessary to close the financing gap for startups.

The financing gap as a market failure:

Governmental market intervention is traditionally justified with the notion of market failures (Lodge et al., 2011, p. 19). The concept of *market failures* stems from neoclassical economics, where market mechanisms are ascribed the potential of allocating goods to an equilibrium point. At the equilibrium point, *pareto efficiency* is achieved. Pareto-efficient allocation of goods does not allow for one party to be better off, without putting another party worse off (Walckirch, 1998, p. 16). With regards to startup funding, the pareto-efficient allocation of capital is that which benefits society as a whole to the furthest possible point (Endres, 2007). In 2015, the Center for Economic Policy Research (CEPR) analyzed the startup funding gap in the Netherlands, Germany, France, Poland and Romania and estimated the difference between demand and supply for funding to amount 3% of national GDP (European Commission, 2017a). In the presence of such a significant gap, an equilibrium point is certainly not achieved by the market itself. Investment levels are sub-optimal because the benefits of startup formation remain unrealized (ibid.). The neoclassical theory of market failures refers to such unrealized potential as unreleased *positive externalities*. A positive externality is a benefit that is enjoyed by third parties who do not have to come up for the costs of enjoying that benefit (Endres, 2007). The primary social benefits associated with startup formation were already worked out. Startup density enhances the resilience of national economies and employment towards international business cycles and changes in consumer demand. Innovation and competition benefits the consumer by means of new and more efficient products and services. Other welfare

gains are, for instance, more sustainable production processes, health innovations and enhanced efficiency in transportation sector to name a few. Society would be better off if the positive externalities of startup formation were unlocked (European Commission, 2017a). The supply of funds for startups deviated from a pareto efficient allocation in the crisis aftermath.

Information asymmetries:

The literature links this market failure to information asymmetries. Because the risk-type of startups is unknown to investors, the investee (the entrepreneur) has an asymmetric, advantaged power situation. The entrepreneur has superior knowledge over her capacities and intentions. Startups don't have a "track record", probabilities of bankruptcy are therefore unknown or, at least, less known than in the case mature firms (Wilson, 2015).

Joseph E. Stiglitz, winner of the Nobel Prize for Economic Sciences (2011), studied the effect of imperfect information in capital markets. According to him, information asymmetries leads to a principal rejection of capital supply (Stiglitz, 1981). Though he illustrates the market failure for banks ("lenders") and firms in general ("borrowers"), he points out that the rationale behind the undersupply of capital ("credit") is applicable to any type of "lender-borrower relationship", where the borrower holds superior information as opposed to the lender. His theory is therefore illustrated with reference to private investors and startups below.

Private investors prefer "good borrowers", startups with a high likelihood of being profitable, over "bad borrowers", those with a low likelihood to succeed. The investor provides capital to startups because he hopes for investment returns, which can only be realized by "good borrowers" (Stiglitz and Weiss, 1981, p. 393). The investor is in two ways threatened by her imperfect information over the startups' likelihood to succeed; (I) adverse selection and (II) moral hazard.

- (I) *Adverse selection* takes place between startups and investors when the entrepreneur conceals the startup's riskiness and embellishes its probability of success in order to get funded (Barr, 2012).
- (II) *Moral hazard* occurs on the side of the startups. As the "borrower has limited control over the lender", monitoring the entrepreneur's conduct is difficult and expensive. More risky and negligent business conduct may intentionally be adopted by entrepreneurs after capital was granted (Barr, 2012; Stiglitz and Weiss, 1981). "The effort of the entrepreneur is unobservable to the investor" and he or she may

manipulates risk, e.g. through the adoption of risky strategies, once finance is granted by the investor (European Commission, 2017a, p. 58; Barr, 2012).

To minimize adverse selection and moral hazard costs, the investor with imperfect information will provide capital to only a few of “observationally identical” startups (Stiglitz et al., 1981, p. 408). This principal rejection of supply is called “credit rationing” in Stiglitz’s work (1981). It leads to demand disequilibria. Demand disequilibria are intensified in times of exogenous shocks, when the overall demand for capital maximizes and lenders become more risk averse (Stiglitz et al., 1981). The under-supply of funds for startups after the 2008 financial crisis reflects Stiglitz’s theory.

An additional disincentive for investors to invest in startups are spill-over effects. Innovative startups, especially in the tech sector, often face high initial costs for research and design. Investment in research and design may benefit competitors, who can copy production processes and services from the investing entrepreneur (Bishop & Walker, 2010). Such by-effects are called *knowledge externalities*. The result of knowledge externalities is that the private rate of return to the investor is below the social rate of return. The investor can only partly reap the benefits of his or her investment. The expected rate of return is what determines the initial funding size (OECD, 2010).

In sum, without intervention, the markets fails to optimally allocate investment to startups. This market failure manifested itself after the financial crisis in Europe with the emergence of the startup funding gap.

2.3 Private equity finance – business angels and venture capital

Before discussing the policy measures that were introduced to enhance the availability of private equity for startups in Europe, the two main suppliers of private equity are portrayed in this section: (I) business angels and (II) venture capital firms. This section also provides an idea of the role of these private equity investors in the EU. *Business angels* and *venture capital* are agreed-upon terms across all EU member states (European Commission, 2015).

1. *Business angels:*

Business angels are wealthy individuals who invest their private capital in young enterprises, mostly startups. They are not friends or family of the startups’ founders. They either invest alone or in alliance with other business angels, in so-called business angel networks where one

business angel takes the lead role. They often have entrepreneurial expertise themselves so that their investment typically goes hand in hand with so-called “intangible assets”. Intangible assets can be any form of immaterial assistance to the investee, e.g. strategic advice, guidance or business contacts. The business angel becomes a mentor to the entrepreneur as he provides not only finance but also time and know-how (European Commission, 2015). Beyond financial returns, the main motivation for business angels to invest in startups is the personal satisfaction they experience when supporting young entrepreneurs (Mason et al., 1994). Business angel capital is one form of private equity capital³.

2. Venture capital firms:

Venture capital is the other form of private equity. It is provided by venture capital firms – financial firms that are specialized in investing in startups. Venture capital firms invest on behalf of primary sources of finance, such as pension funds, banks, enterprises or wealthy individuals. Because venture capital firms are specialized in startup funding, they provide funding together with intangible assets (know-how, business contacts and guidance), too (European Commission, 2015).

What should be concluded at this point is that, compared to institutional investors, the main differentiating characteristic of private equity investors is their personal involvement in the investee’s undertaking. Furthermore, their willingness to take risk is relatively high and the motivation to invest in startups goes beyond a financial return (Mason et al., 1994).

Business angels and venture capital firms in Europe:

Startups rely heavily on business angels and venture capital firms. Private equity investors accounted for 77,3% of external startup funding in 2015 (Kollmann, 2015). Yet, the literature suggests that venture capital and business angel finance is underdeveloped in the EU. This becomes apparent when comparing the United States (US) and the European private equity ecosystem. In the US, in 2015, USD 79.3bn of venture capital flowed into SMEs whereas the EU member states reached an accumulated EUR 5.3bn of investments in 2015 (European Commission, 2017a). Of the private equity capital flow in Europe, the share of angel investment is greater than venture capital share (Wilson, 2015).

³ The term “private equity” broadly refers to any type of private ownership, as opposed to stock ownership. The private equity market is dominated by private investors, i.e. business angels and venture capital firms (Amadeo, 2018).

2.4 Government intervention: a typology of supply-side policy measures

So far, the literature review has worked out why business angel and venture capital investment in startups is desirable. There clearly are economic rationales for government intervention. Asymmetries in risk information and knowledge externalities lead to the undersupply of startup funding, a market failure that prevents the release of socio-economic benefits. Without intervention, business angel and venture capital investment levels are below the socially desirable level (Wilson, 2015). Tax incentives and co-investment funds have been introduced in most EU member states to overcome this market failure (OECD, 2017a). The majority of schemes were introduced in the first three years (2009-2013) after the crisis hit European economies (ibid.). The former rewards investors for funding startups by means of tax advantages. The latter offers public-private partnerships to investors, which enable the maximization of capital and therefore larger investment projects. Both aim at stimulating venture capital and business angel investment in startups, in distinct ways. To increase the supply of finance, policy makers must either decrease the risk for suppliers, e.g. through information provision, or increase the “risk appetite” of investors (European Commission, 2017a). Tax incentive schemes reward investments in startups with tax advantages that are generous enough to increase the risk appetite of investors. Co-investment funds invite investors to share risk with a governmental partner when investing in startups. Supply-side measures are an important criterion to investors’ evaluations of potential investments (Cox et al., 2017). They stand in contrast to demand-side policy measures, which predominantly ease the access to finance by means of training and assistance of the entrepreneur, e.g. enhance their fund raising skills (Wilson, 2015).

A positive example from the US is The Section 1202 tax exclusion, which was introduced by the Obama Administration in 2010. It offers investors, who fund startups, a tax break of up to 100% on capital gains below 10 million USD. Policy evaluations found that such government intervention could significantly increase the size of private equity investment deals (Wilson et al., 2013).

This section works out a typology of the two measures (I) tax incentives, (II) co-investment as well as the policy environment created by a (III) combination of the two instruments. This typology serves the construction of the independent variables for the regression analysis.

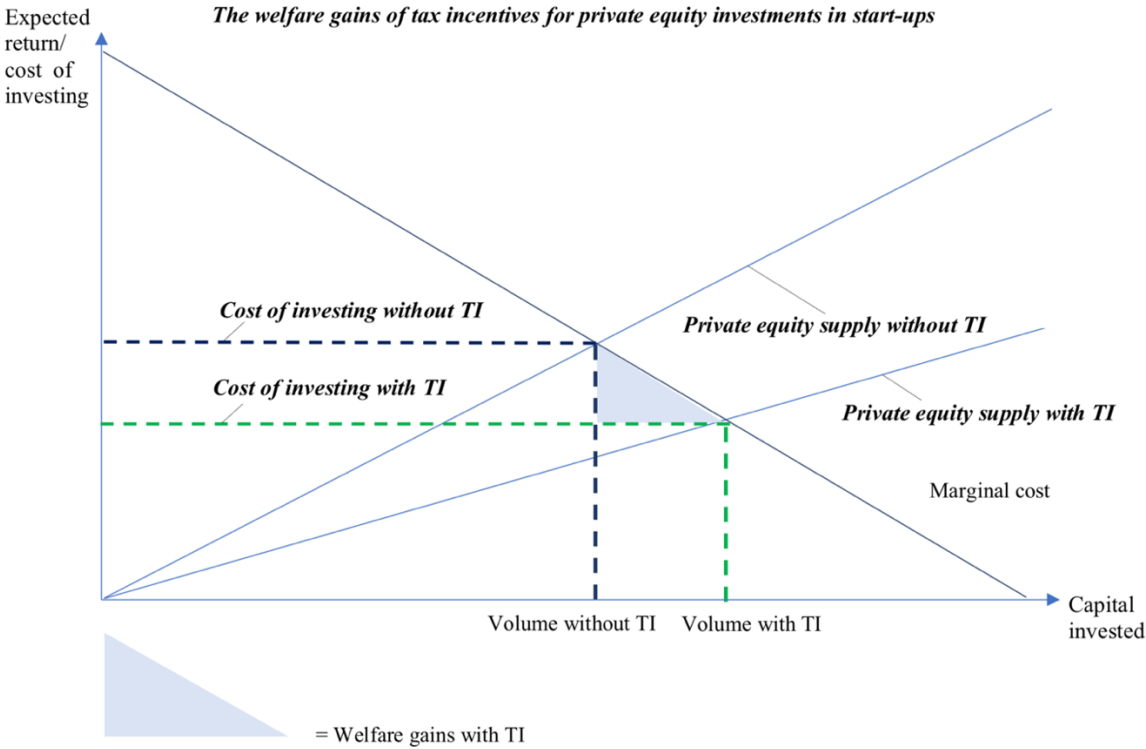
2.4.1 Tax incentives

Tax incentives for investment in young and innovative enterprises benefit business angels and venture capital firms with tax advantages. Four forms of benefits are typically offered, alone or in combination; (a) tax exemptions, (b) tax credits, (c) tax deductions or loss relief and (d) tax deferrals (European Commission, 2017a). The variation among states with respect to design details is more extensively discussed in the data section, where incentive forms are operationalized into measurable variables. In different ways, all incentive forms reduce the amount of taxes, which would otherwise be due on investment returns (Easson et al., 2002, p. 24). Whatever the form(s) of benefit applied, the tax incentive schemes under consideration in this study all reduce the effective marginal cost of investing in startups for business angels and venture capital firms⁴ (European Commission, 2017a). Tax incentives' shared rationale is that the tax benefits influence the investor's decision-making. Their risk appetite determines whether or not they accept or reject an investment offer. It is assumed that tax advantages can enhance their risk appetite so that information asymmetries are less of a barrier. Greater risk-taking is encouraged (European Commission, 2017a).

Graph 1. below illustrates the tax incentive effect. Reducing the effective marginal cost of investing in startups increases the investors' willingness to supply capital to firms (European Commission, 2017a). The demand curve demonstrates the constraint opportunities to invest. The supply curve of private equity is upward sloping because the willingness of venture capitalists to invest money increases as the expected rate of return available on such investments increases. Investment opportunities with higher expected returns receive more funding capital (represented on the right) than those with a lower expected return, e.g. due to higher risk (those represented on the left). Gompers and Lerner (1999) argue that the supply curve for venture capital should be elastic (i.e. relatively flat) given the ready availability of alternative investment opportunities" (European Commission, 2017a). In theory, any tax advantage that reduces the effective marginal cost of investing "should move the supply curve down" (ibid., p. 63). More funds are invested at a lower expected return. Consequentially, (higher-risk) the availability of funding for startups should be increased by the tax incentive.

⁴ It should be noted that tax deferrals, as opposed to the other three incentive forms, reduce the effective tax burden only temporarily. Details are discussed in the 3.1 Data section of the research.

Graph 1. The welfare gains of tax incentives for private equity investments in startups



(Source: own computation, based on European Commission, 2017a)

Tax incentives also address the positive external effects of startup funding. The tax advantage functions as a reward to the investor for the social value her investment created (knowledge spill-over, better jobs etc.). Startup funding often has a social value greater than the investor’s private rate of return. By increasing the effective rate of return on investments in startups, the government enables the investor to appropriate a larger share of the investment’s social value. Tax incentives are an instrument to internalize the positive external effects of innovation, which will affect the level of innovation positively (OECD, 2010). The foregone tax returns (as the government waives off income tax) can be seen as a way of “putting a price tag” on the positive externalities of startup funding (European Commission, 2017a).

In sum, tax incentives increase the expected effective rate of return as they decrease the effective cost of investing. They also internalize the positive externalities associated with investing. Therefore, it can be expected that tax incentives increase business angel and venture capital flow into startups. This assumed effect is captured by the first hypothesis below (H1).

2.4.2 Co-investment funds

Public co-investment funds are partnerships between the government and business angels or venture capital firms, for the sake of investing in startups. In such funds, the investments are made on a *pari-passu* basis. This means that, once allied, the fund is managed either by public authorities or by the business angel or venture capitalist but the parties co-invest, under equal terms and conditions (EBAN, 2016). Most commonly, the public finance is provided to startups via the business angel or venture capital firm (Kersten, 2017). The rationale behind co-investment funds is that they, like the tax incentive schemes, make investing in startups more attractive. The private equity investment is accompanied by public investment capital. This creates new possibilities to investors, because the additional capital allows them to invest in “bigger deals” than otherwise possible (Baldock et al., 2016).

It can be expected that co-investment funds increase business angel and venture capital flow into startups. This assumed effect is captured by the second hypothesis below (H2).

2.4.3 Policy combination

In many countries, not one of the two instruments – tax incentive vs co-investment fund – but a combination of both is in place (Wilson, 2015). In countries where tax incentive schemes and co-investment funds are combined, investors can choose to (a) fund a startup independently and take advantage of the tax benefit or (b) maximize the joint investment capital by co-investing with the government and realize larger investments, with the objective of higher returns while sharing the risk with the government. In theory, offering various instruments is preferable over offering a single instrument, because target groups vary. Private equity investors differ in their degrees of risk aversion and availability of investment capital among other characteristics. The success of incentives may vary according to such capacities and preferences (Lodge et al., 2011).

It can be expected that a combination of tax incentives and co-investment funds enhances the single instruments’ respective positive effect on business angel and venture capital flow into startups. This assumed effect is captured by the third hypothesis below (H3).

2.5 Hypotheses

Stiglitz argued that “if there is decreasing absolute risk aversion, wealthier individuals undertake riskier projects” (Stiglitz et al., 1981, p. 404). It can be expected that the supply-side policy measures, by means of tax benefits and risk sharing, have a positive effect on the

availability of private equity finance for startups, which is hindered by asymmetric information without government intervention.

The literature review arrives at the following main hypotheses:

The research hypotheses:

- (H1) Tax incentives to stimulate venture capital and business angel investment in startups have a significant positive effect on the availability of finance for startups.*
- (H2) Public co-investment funds for venture capital and business angel investment in startups have a significant positive effect on the availability of finance for startups.*
- (H3) A combination of tax incentives and co-investment funds significantly enhances the respective positive effect on business angel and venture capital flow into startups.*

3. Research design

Empirical policy evaluations try to determine whether or not a policy measure could achieve its intended outcome. This research evaluates two supply-side policy measures to increase the availability of private equity finance for startups. To draw conclusions over their effect, the research must determine whether a change in the policy environment for the suppliers of private equity (tax incentive schemes, co-investment funds or a combination of both) caused a change in the financing gap for startups. The “gold standard” for policy evaluations is the randomized controlled trial (RCT), where the policy measure is a “treatment” which is allocated to a “treatment group” and its effect is established by comparing the group’s outcome to that of an untreated control group (Kersten, 2017; Angrist et al., 2014). Such experimental manipulation is unavailable for the topic of this research.

Therefore, causal inference is achieved in a pooled, large-N quantitative research design. (Toshkov, 2016). The effect of the policy measures is essentially established by comparing a large number of firms across countries and over time. Econometric regression models are applied to the observations. The regressions hold factors other than the main explanatory variables constant and, in doing so, can determine whether a firm-level change was caused by the policy measures (Wooldridge, 2010). The analysis findings are then linked to the hypotheses that were worked out in the literature review above. The research is positivist and explanatory.

3.1 Data

More specifically, the research hypotheses are tested by means of a pooled Ordinary Least Squares (OLS) analysis. It uses panel data, which consists of repeated, six-monthly, observations of the same firms since 2009, right after the 2008 financial crisis. The panel data is derived from three primary sources, namely the European Central Bank (ECB), the European Commission (EC) and the European Business Angel Network (EBAN). The ECB data was used because it provides the best available indicator to measure the startup funding gap. It differentiates private equity funding from other types of funding and distinguishes firm classes. How this data was used to operationalize the availability of finance is discussed below. What should be noted here, is that using the ECB data enabled this study to overcome the dependent variable problem that has so far hindered more extensive evaluations of business angel and venture capital flows into startups. The EC data was used because it provides the most comprehensive information on tax incentive schemes and the EBAN data was used because it provides the most comprehensive information on co-investment funds in Europe. The control variables were derived from Eurostat and The World Bank. The EC, EBAN, World Bank and Eurostat data used in this research is publicly available. Access to the ECB data was granted on request.

It is important to point out that the level of observation differs from the level of analysis in this study. Observations are made on firm-level while the analysis is performed on the country level. This multi-level approach is most suitable because conclusions are drawn on country-level policy instruments (the independent variables), of which the effects manifest themselves on the firm level (the dependent variable) (Toshkov, 2016). Because this multi-level approach was chosen, the dataset contains variables that express both micro- and macro-level information. On the micro-level, it expresses firms' perception of the changes in the availability of finance. Macro-level information relates to the supply-side policy measures, the main explanatory variable.

This remainder of this chapter introduces the research sample, explains how the primary data was collected and how it was used to construct the dependent, independent and control variables that measure the concepts underlying the research hypotheses. Limitations of the research design are also addressed and some descriptive statistics are provided to give a first impression of the sample and to identify first trends and associations in the data.

3.2 Research sample

The data in the research sample covers all 28 EU member states from the beginning of 2009 until the end of the first half of 2017. The initial data was collected from 131990 firms in six-monthly waves by the ECB. The firms were randomly selected from the Dun & Bradstreet business register and a questionnaire was answered by their representatives. This means that each firm in the register had the same chance of being selected for the survey. This selection technique eliminates selection bias. The sample is balanced, there is no systematic difference between firms, and it represents the analysis population – European startups in this case (Toshkov, 2016).

Table 1. Temporal coverage of the research sample

| | | | | | | | | |
|--------------|--------|--------|--------|--------|---------------------|--------|--------|--------|
| Wave: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Year: | 2009H1 | 2009H2 | 2010H1 | 2010H2 | 2011H1 ⁵ | 2011H2 | 2012H1 | 2012H2 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 2013H1 | 2013H2 | 2014H1 | 2014H2 | 2015H1 | 2015H2 | 2016H1 | 2016H2 | 2017H1 |

The firms:

On behalf of the European Commission (DG International Market, Industry, Entrepreneurship and SMEs) and the ECB, this survey collects firm-level data on the financial situation of SMEs in the European Union every six months since 2009 (ECB, 2017a). Firms are randomly selected from the Dun & Bradstreet business register and their representatives are asked about various aspects of the entrepreneurial and financial situation they face. The sample is stratified by country, enterprise size class, age and economic activity⁶ (ECB, 2015).

Table 2 Firm size and age classes

| Size class | Employees | Code value | Firm Age | Code value |
|-------------------|------------------|-------------------|-------------------------------|-------------------|
| Micro | 1-9 | 1 | Created ten or more years ago | 1 |
| Small | 10-49 | 2 | Created 5 to 9 years ago | 2 |
| Medium | 50-249 | 3 | Created 2 to 4 years ago | 3 |
| | | | Created less than 2 years ago | 4 |

⁵ The majority of the schemes and co-investment funds were active by the time of the fifth wave. A dummy variable indicates the presence or absence of the respective scheme as from the year 2011.

⁶ The economic activity of firms in the sample is disregarded. Its inclusion may have enabled the identification of distinct policy effects per sector but the interpretation of such findings would have gone beyond the scope of this research.

Startups:

As this research focuses on startups, the data collected from large firms was dropped. According to the startup definition in the Theory section, a dummy variable “startup” was coded to limit the data to observations from micro and small firms, which are younger than 10 years old. The business models of the firms could not be taken into account. It was assumed that firms are only founded when an entrepreneur identifies a market niche (new products or new production processes) and that, therefore, all young micro and small firms in the survey may be considered startups. The share of firms that survived without a new business model should be negligibly small.

3.3 Variables

The causal effects, which the research hypotheses suggest, are tested statistically. This can only be done when the concepts they capture are operationalized into measurable variables. These variables are used in the regression models. On their left-hand side is the dependent variable, which measures the availability of private equity finance (business angel and venture capital) for startups. On their right-hand side are the explanatory variables. The main explanatory variables, here, are the two supply-side policy measures (I) tax incentive schemes, (II) co-investment funds and (III) an interaction of both instruments. To test the robustness of the regression models and omitted variables bias, the analysis also considers control variables. These control variables stem from the consideration of alternative explanations of both, a change in the availability of finance and the governmental choice of policy instrument. *What could explain a change in the availability of finance for startups and affect the choice of policy measures simultaneously?* Any such factor would cause a bias in the results.

The exact construction of the dependent, independent and control variables is explained below.

3.3.1 The dependent variables

The research studies the availability of finance for European startups, in relation to need, after the financial crisis. As was discussed in the Theory section, the term “financing gap” refers to the imbalance between finance supply and demand (ECB, 2017a). More specifically, the effect of the supply-side policy measures on the availability of business angel and venture capital finance is to be determined. The measures are implemented to “fill” or “close” the general startup financing gap with business angel and venture capital funding. Both, the overall financing gap (all financing instruments) and the private equity (business angel and venture capital) financing gap, as perceived by European firms, have been measured by the (ECB, 2017a).

The perceived financing gap indicators:

Based on the “Survey on the Access to Finance of Enterprises”, short SAFE, responses, the ECB constructs a longitudinal financing gap change indicator for different types of finance. These are “Bank loans”, “Trade credit”, “Equity”, “Debt securities issued”, “Credit line, bank overdraft or credits overdraft” (ECB, 2017a, pp. 13-14). Every six months, respondents – the firms’ founder or alternative representative – are asked the following two questions;

- (I) *For each of the following types of external financing, please indicate if your needs increased, remained unchanged or decreased over the past six months.*
 - (II) *For each of the following types of financing, would you say that their availability has improved, remained unchanged or deteriorated for your enterprise over the past six months?*
- (ECB, 2017c, p. 34).

The questions refer to the preceding six months (one wave). The responses are juxtaposed and turned into an indicator that expresses the perceived gap change for each of the types of external financing considered in the survey over the time period between two waves.

It can take a value⁷ between 1 and -1 where;

| <i>Value:</i> | <i>Interpretation:</i> |
|----------------------|---|
| 1 | The need increases, the availability decreases. → Strong financing gap growth |
| 0,5 | There is a one-sided increase in the financing gap. → Financing gap growth |
| 0 | No change. → No financing gap change |
| -0,5 | There is a one-sided decrease in the financing gap. → Financing gap decrease |
| -1 | The need decreases, the availability increases. → Strong financing gap decrease |

In sum, a negative financing gap change value expresses that the observed firm experienced a decline of the financing gap during the preceding six months. So, though maybe counter-intuitive, a negative value stands for a positive development in the availability of finance. A positive value expresses that the firms experienced a financing gap growth during the preceding six months. It stands for a negative development in the availability of finance (ECB, 2017b).

⁷ “Values are multiplied by 100 to obtain weighted net balances in percentages” (ECB, 2017a, p. 15).

The equity gap indicator:

Among the “types of external financing”, of which the firms were asked to share their perceived change in need and availability, is “equity”. The questionnaire comes with definitions for the interviewee, in case he or she has difficulties in understanding financial terms (ECB, 2015). Equity capital is defined as capital, which is provided by “venture capital and business angels” (ECB, 2017a, p. 20).

The equity gap indicator is the main dependent variable in this study. It measures the perceived difference between the firms’ need for business angel and venture capital funds and the availability of such funds (ECB, 2017c). A positive value of this indicator stands for negative development of the availability of business angel and venture capital finance. A negative value of this indicator stands for a positive development of the availability of business angel and venture capital finance (ECB, 2017c). The indicator is available per firm and per wave. Development refers to the development during the preceding six months, perceived by firms.

Composite financing gap indicator:

Additionally, the composite financing gap indicator is used as the dependent variable in some of the regression models. This one combines all forms of capital investment asked for in the survey; “Bank loans”, “Trade credit”, “Equity”, “Debt securities issued”, “Credit line, bank overdraft or credits overdraft” as a weighted average (ECB, 2017a, pp. 13-14).

Strengths and weaknesses of the financing gap indicators:

Survey data should always be treated with caution because it stems from individual’s perception of the reality and suffers from potential micro-level bias. An example of micro-level bias is reporting bias, where survey participants don’t give an objective answer but an answer they think is desired by the researcher (Toshkov, 2016). The financing gap indicator reflects the perceived change of the availability of finance for enterprises. It neither expresses the financing gap’s actual size nor its actual change (Kersten et al., 2017). Nonetheless, the indicator is a meaningful reflection of the actual financing gap change. It is a sound operationalization of the concept “availability of finance” for various reasons. First of all, the two underlying survey questions are straightforward and will most definitely not be misinterpreted. The reported development can also be expected to be objective because there is no rationale for the entrepreneur to give a biased response. On top of that, the random sampling technique minimizes the risk of micro-level bias in the sense that, even if one type of firm’s perception does not at all reflect reality, the sample can balance out that single source of bias. The

responses are highly comparable on both firm and country level. Even if the perceived availability of finance did not accurately reflect the actual availability of finance, the indicator would still be useful as a dependent variable to evaluate the policy measures because their ultimate goal is the facilitation of entrepreneurship. The measures can be considered successful if and only if the entrepreneurs experience an amelioration of their financial situation – an effect that is captured by their perception of the financing gap change.

Overall, the indicator is superior to previous approaches to measure the availability of equity finance on firm level. Business angel investments are usually made individually and not captured by national or commercial databases. The visibility and measurement of business angel finance – and so equity finance as a whole – suffers from this “informal” character (Wilson, 2015, p. 11). Using the ECB’s equity financing gap indicator overcomes this problem as it focusses on the recipient of business angel and venture capital finance instead of the actual flow, e.g. transactions.

What should lastly be noted is that policy effects often manifest themselves with a time lag (Plümper et al., 2005). It may take some time for business angels and venture capital firms to learn about and familiarize themselves with the advantages the policy measures offer, or for the enterprises to feel the change in the availability of finance. This may lead to an underestimation of the policy effect size.

3.3.2 The independent variables

The study aims to determine to what extent changes in the dependent variable(s) were caused by two specific supply-side policy measures; tax incentives and co-investment funds. In the EU, these two measures came either (I, II) alone or (III) in combination. They are the main explanatory variables for the analysis.

Main explanatory variables:

- (I) Tax incentive schemes (European Commission, 2017)
- (II) Co-investment funds (EBAN, OECD)
- (III) Combination of tax incentives and co-investment funds (European Commission, 2017; EBAN, OECD)

They will be referred to as (I) *TI*, (II) *CIF*, (III) *TI*CIF* when abbreviations are needed.

The supply-side policy measures as dummy variables.

First, the policy measures are coded into binary dummy variables, where value one 1 stands for the presence and value zero 0 stands for the absence of a policy measure in the observed firm’s

country of residence. It is a firm-level variable which entails macro-level information. The dummy variable acts as the “treatment” that allocates firms into “treatment groups” (those firms with value one) and “control groups” (those firms with value zero). As the regression analysis holds all else constant, differences in the firms’ outcome variable may be linked to the “treatment”, the policy measure. (European Commission, 2017; Toshkov, 2016).

Such a dummy variable was constructed for the three policy environments that can be created by the two measures: tax incentive schemes, co-investment funds, and a combination of both. The combination of both measures was constructed as an interaction term “TI*CIF” so that it takes on value one as soon as both, a tax incentive scheme and a co-investment fund was in place in the firm’s country of residence. A fourth reference environment is the absence of any supply-side policy measure to foster business angel and venture capital investment in startups. The majority of the schemes and co-investment funds were active by the time of the fifth wave. The dummy variables below indicate the presence or absence of the respective policy environment as from the year 2011.

| <i>Supply-side policy measure:</i> | TI | CIF | TI*CIF |
|------------------------------------|----|-----|--------|
| Tax incentive schemes | 1 | 0 | 0 |
| Co-investment funds | 0 | 1 | 0 |
| Policy combination | 1 | 1 | 1 |

Turning the TI dummy into a continuous variable

When governments decide to intervene in the financial market with tax incentives, they have a broad discretionary space with respect to policy design details. On the one hand, they can choose between different incentive forms, which all have a distinct effect on the net tax relief offered to the investor. The choice of incentive form determines the generosity level of the policy. On the other hand, governments can choose to run a number of specialized schemes with different target investors as opposed to one, broad holistic scheme for all investors. It may be that investors’ risk appetite can only be enhanced with a certain generosity level. Or that investors only feel addressed when a scheme is designed for their specific financing type. It is important to capture any potential design effect to avoid an over- or underestimation of the general effect of tax incentives.

Tax incentive generosity score:

Tax incentives vary considerably along their level of generosity. Different tax incentives provide different benefits to investors. Inspired by Easson and Zolt (2002), the continuous variable “tax incentive generosity score” was constructed to find out whether the generosity of tax incentives affects the outcome variable. The rationale behind the scoring approach is that different forms of investment tax incentives have different reduction effects on the effective tax burden (Easson et al., 2002). The greater the reduction, the stronger the incentive effect, the greater the effect on the availability of finance. Four incentive forms are found in the schemes under consideration, (a) tax exemptions, (b) tax credits, (c) tax deductions or loss relief and (d) tax deferrals.

(a) *Tax exemptions:*

Tax exemptions are the most generous incentive form because they imply that returns generated by an investment are free from tax (European Commission, 2017). Normally, when an investor gains capital, he or she pays taxes on this income according to the corporate income tax rate or capital gains tax rate. Tax exemptions reduce the corporate income tax rate to zero percent for certain projects, in this case the investment in SMEs (Zee et al., 2002; European Commission, 2017). The tax incentive schemes to foster venture capital and business angel investment in certain SMEs, reduce the entire tax base for the return of those investments (European Commission, 2017).

(b) *Tax credits:*

The second most generous tax incentive form are tax credits, which remove the cost of investing (European Commission, 2017). The investor is allowed to deduct a certain percentage of the amount invested from his or her taxes. This percentage is larger than the baseline tax system affords (Zee et al., 2002; European Commission, 2017).

(c) *Loss relief:*

Losses suffered from an investment may be offset against returns made in the same year or future years. The capital loss from one investment is then partly (up to 45% in the UK) deducted from the taxes issued on capital gains from another investment (Brookes et al., 2015). However, this incentive form is less generous than tax exemptions and tax credits because “their impact on effective tax rates is diluted by the rate of tax applied to the particular tax base” (European Commission, 2017).

(d) *Tax deferrals:*

Tax deferrals allow the investor to delay the payment of his or his corporate income tax or capital gains tax (Zee et al., 2002). Tax referrals are the least generous of the four incentive forms found in the EU because the effective tax reduction is not permanent” (European Commission, 2017).

Table 3. Tax incentive forms and generosity points

| <i>Incentive form:</i> | Tax exemptions | Tax credits | Loss relief | Tax deferrals |
|----------------------------------|-----------------------|--------------------|--------------------|----------------------|
| <i>Generosity points:</i> | 4 | 3 | 2 | 1 |

The score reflects the maximum tax incentive generosity level found in a country. The generosity of different schemes in one country cannot be added up because there is no double-application of tax advantages on the same investment. The maximum tax advantage an investor can enjoy is the advantage offered by the most generous scheme. If one scheme offers a combination of advantages, e.g. a relief on both returns and losses, however, they apply simultaneously. Therefore, generosity points are added up within schemes. For clarification; firms in the UK are assigned ten generosity points because the Enterprise Investment Scheme (EIS), which combines all four incentive forms in one scheme, is the most generous instrument the government offers to stimulate business angel and venture capital investing (see *Table 1.1*). Information on the policy design details, i.e. which of the four incentive forms are used, was found in an extensive research project conducted by the European Commission (European Commission, 2017, p. 98). The construction of the range score is displayed in *Box A.1*. in the Appendix. The range scores per country are summarized in *Table 4*. below.

Tax incentive range score

Governments can choose to introduce a range of independent tax incentive schemes as opposed to a single one. In Europe, for instance, six tax incentive countries implemented only one tax incentive scheme for business angels and venture capital firms. The other six countries chose to run various schemes, all with their own rules and administration. France and UK show the broadest range of tax incentives, with each country having six distinct tax incentive schemes for business angels and venture capital funding of startups in place. Schemes can have different target groups. For example, the France Wealth Tax (ISF) was introduced to reward non-resident

business angels and venture capital firms for investing in French startups. Another example are Spain and Portugal, where one scheme is targeted at business angels and another one is targeted at venture capital (European Commission, 2017). However, the same target groups (business angels and venture capitalists, residents and non-residents) may effectively be reached with one broad national scheme. To find out whether having a range of tax incentive schemes, each of which is designed to address specific investors, affects the general effect of tax incentive schemes, a continuous range score variable was constructed. The score simply expresses how many tax incentive schemes are active in the firm’s country of residence. For example, every French startup in the dataset was assigned six range score points, because France has six different tax incentive schemes in place to foster business angel and venture capital investment in startups. Startups in countries where only one single tax incentive scheme is active were assigned one range score point. The construction of the range score is displayed in *Box A.1.* in the Appendix. The range scores per country are summarized in *Table 4* below.

Table 4 Summarized tax incentive generosity and range scores per country

| <i>EU Member State:</i> (TI*CIF; TI) | <i>Tax Incentive Score</i> | |
|---|----------------------------|---------------|
| | <i>Generosity:</i> | <i>Range:</i> |
| Belgium (BE) | 4 | 4 |
| France (FR) | 7 | 6 |
| Germany (DE) | 3 | 1 |
| Ireland (IE) | 3 | 1 |
| Italy (IT) | 7 | 3 |
| Malta (MT) | 3 | 1 |
| Poland (PL) | 4 | 1 |
| Portugal (PT) | 4 | 2 |
| Slovenia (SI) | 4 | 1 |
| Spain (ES) | 3 | 2 |
| Sweden (SE) | 3 | 1 |
| United Kingdom (UK) | 10 | 6 |

Table 4 summarizes the range as well as the generosity score points that were assigned to firms. The generosity score indicates how generous the tax advantages in the firm’s country of residence were. The range score indicates how broad the range of tax incentive schemes was in the firm’s country of residence. It should be noted that these two explanatory variables were

constructed to achieve a more in-depth understanding of the tax incentive effect. Neither of them is necessary to test the effect described by the hypotheses. The hypothesis, that tax incentives have a positive effect on the availability of business angel and venture capital for startups, can be rejected or accepted by means of the simple dummy variables. The continuous score variables give more nuance to the rejection or acceptance of the hypothesis.

Co-investment fund design details:

Co-investment funds differ in their design, too. However, variety is not as categorical as is the case for tax incentives and, therefore, no continuous variable could be constructed for co-investment funds in this research. It is only measured by the dummy variable for presence versus absence of the instrument.

3.3.3 The control variables

Countries, firms and investors are heterogeneous. Naturally, impediments to business angel and venture capital investments other than risk aversion of the investors can mitigate the effect of the policy measures. Equally, there may be business angel and venture capital investment drivers other than the policy measures. If these “drivers” or “blockers” of funding are also correlated with the independent variables, the choice of supply-side policy measures, the policy effects may be biased. Such bias would lead to an over- or under-estimation of the policy effect. In econometrics, these confounders are called “omitted variables” and potential omitted variables are controlled for in the regression models. They can occur on the micro- and on the macro-level (Angrist et al., 2014).

The control variables stem from the following considerations. *What may explain a change in the financing gap (the dependent variable) other than the policy measures under consideration and affect the government’s choice of policy measure at the same time?*

On the macro-level, the expansion of the national economy may affect both, the availability of finance as well as the choice of supply-side policy measures. Just like the economic recession increased the risk aversion of investors, economic growth will most likely lower investors’ barrier to invest. It was also pointed out that business angels and venture capital firms were waiting out the crisis and observing (financial) markets and players, e.g. banks, before initiating any big investment projects (OECD, 2009a). Economic growth may also decrease the urgency of governmental market intervention to unlock positive externalities. Gross domestic product (GDP) growth is a good indicator for the economic wellbeing of nations, firms and citizens. A GDP growth control variable was added to the dataset for each of the 28 EU member states,

using Eurostat data. It expresses “GDP growth” as the GDP at market prices in chain linked volumes, with 2010 as a reference point (Eurostat, 2018).

The strength of financial markets is another domestic variable that may affect the dependent as well as the independent variables (European Commission, 2017). When financial markets are strong, the reliance of startups on business angel and venture capital may be smaller. This will decrease the financing gap and most likely also the presence of policy measures to foster business angel and venture capital investments in startups. A leading indicator for bank and investment strength is gross domestic savings (GDS) expressed as a percentage of GDP. The strength of financial markets was added to the dataset expressed as the annual GDS % of GDP for the time period 2009-2016 (The World Bank, 2018).

The GDP (growth) and GDS indicators serve a robustness test in the analysis to check for potential omitted variable bias on the macro level. On the micro level, the appetites of institutional investors may be an omitted variable. If enterprises’ demand for finance is saturated by institutional investors (non-venture capital), the number of investment opportunities for private investors (business angel and venture capital) will be low (EC, 2017). Simultaneously, the necessity to facilitate access to business angel and venture capital will be small. This is accounted for in those regression models that look at the perceived equity financing gap, as opposed to the composite financing gap.

3.4 Data Description

Table 5 summarizes the policy choices taken in all 28 EU member states. The majority of countries (10/28) have a combination of tax incentives and co-investment funds to foster venture capital and business angel investment in startups in place (TI*CIF). The second most frequent policy environment in the sample is the presence of co-investment funds exclusively (9/28). Thereafter comes the absence of any of the considered policy measures (7/28). Lastly, only two countries have tax incentives exclusively in place (2/28).

There does not seem to be a systematic difference between countries with regards to their choice of policy measure to stimulate venture capital and business angel investment in startups. The classification of countries along their supply-side policy measures does not resemble any welfare state model, e.g. the workhorse model with “Anglo-Saxon”, “Continental”, “Nordic”, “Southern European” welfare states. For instance, among the Nordic countries, Sweden offers both measures while the others offer only co-investment funds. Among the Continental countries, the Netherlands does not offer any tax incentives as opposed to Germany and France. Esping-Andersen’s “Three Welfare State Models” with “Liberal”, “Conservative” and “Social-

Democratic” does not fit either (Arts et al., 2002). Only one commonality between countries with the same policy environment could be found. All countries with neither tax incentives nor co-investment funds in place (“None”) are new EU member states. All of them entered the European Union after 2004 and are considered economically weaker than most of the old EU member states. It may well be that governments are hesitant to intervene in the financial markets when they are financially more constrained. Beyond that, no straightforward pattern of policy choices could be identified and it is assumed that government intervention is either driven by unknown domestic factors, based on political intuition and impulses, or arbitrarily.

Table 5 Policy measures per state

| Country: | Policy Measure: |
|---------------------|------------------------|
| Austria (AT) | CIF |
| Belgium (BE) | TI*CIF |
| Bulgaria (BG) | None |
| Croatia (HR) | None |
| Cyprus (CY) | None |
| Czech Republic (CZ) | None |
| Denmark (DK) | CIF |
| Estonia (EE) | CIF |
| Finland (FI) | CIF |
| France (FR) | TI*CIF |
| Germany (DE) | TI*CIF |
| Greece (GR) | CIF |
| Hungary (HU) | CIF |
| Ireland (IE) | TI*CIF |
| Italy (IT) | TI*CIF |
| Latvia (LV) | None |
| Lithuania (LT) | CIF |
| Luxembourg (LU) | CIF |
| Malta (MT) | TI |
| Netherlands (NL) | CIF |
| Poland (PL) | TI*CIF |
| Portugal (PT) | TI*CIF |
| Romania (RO) | None |
| Slovakia (SK) | None |

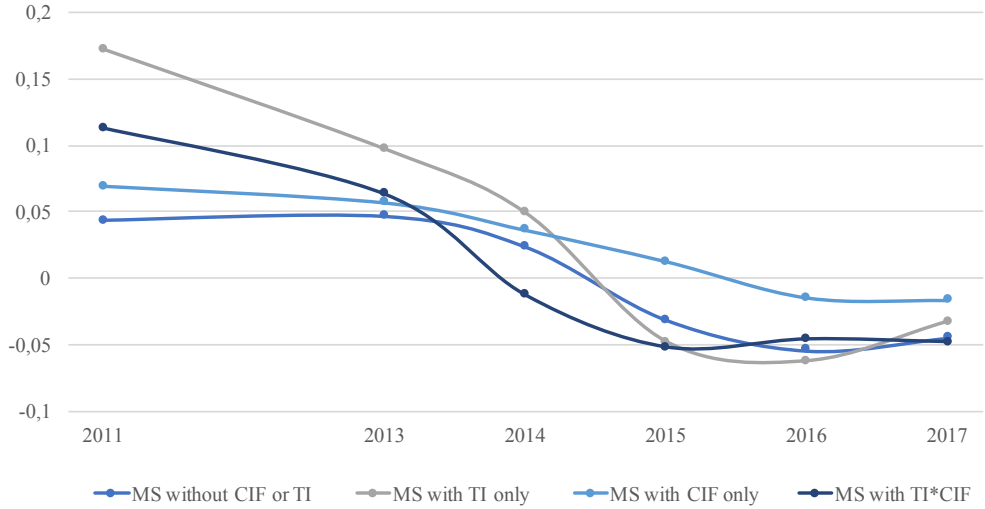
| | |
|---------------------|--------|
| Slovenia (SI) | TI |
| Spain (ES) | TI*CIF |
| Sweden (SE) | TI*CIF |
| United Kingdom (UK) | TI*CIF |

Graph 2 illustrates the development of the overall financial environment of European SMEs. It shows the average composite financing gap change indicator, reported by SMEs, stratified by the policy environment of the SMEs' country of residence (tax incentives only, co-investment funds only, a combination of both measures, neither of both measures). The trends are in line with the theory. In all countries, the financial situation (this indicator looks at all financing instruments) perceived by SMEs has improved over the years since the 2008 financial crisis. As explained above, a positive value stands for financing gap growth and a negative value stands for a gap decline during the past six months. Until 2013, SMEs in all countries, on average, reported a growing composite financing gap (all countries have positive values). Yet, the growth rate they reported weakened from year to year throughout the full time period. This means that, on average, all European SMEs reported that the difference between finance demand and supply continuously shrank. Though this perceived improvement is shared among all SMEs, the trends differ along policy environments. In 2014, in countries, where a combination of tax incentives and co-investment funds is offered, SMEs on average, reported a declining financing gap (negative value). Put differently, since 2014, the supply of finance grew while the demand for finance did not. In 2015, all SMEs, except for those in countries with co-investment funds exclusively, reported a declining financing gap. Finally, in the years 2016 and 2017, on average, in all policy environments, SMEs reported a negative value for the composite financing gap change. This means that in 2016 and 2017, SMEs, regardless of the supply-side policy measure in place, experienced a closing development of the overall financing gap. Their demand for finance could be met by finance supply, there is an increasing access to finance for SMEs. The downward trend of the financing gap is strongest for SMEs in countries with only tax incentives and weakest for SMEs in countries with only co-investment funds in place. SMEs in countries with a policy combination of tax incentives and co-investment funds present a switch from reporting a financing gap growth to reporting a financing gap decline earliest. The negative trend, which stands for a positive development of the availability of finance, is strongest for countries with tax incentives – alone or in combination with co-investment funds. Two things must be noted. Firstly, there is a downward trend even for those countries without tax incentives and co-investment funds to stimulate business angel and venture capital funding of startups. Secondly, a negative value

does not suggest that there no longer is a financing gap. It suggests that it develops positively, in the sense that supply and demand converge.

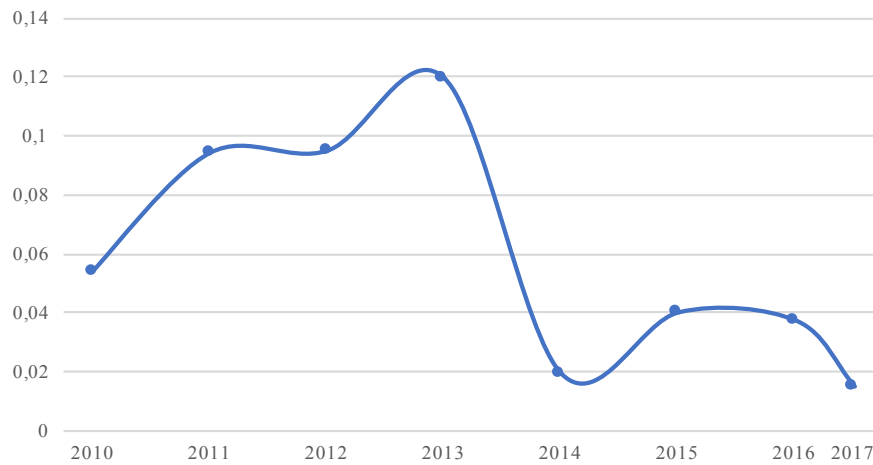
A set of graphs, which show the development of the financial situation, expressed by the composite financing gap change indicator, can be found in the Appendix. There are no strong deviations from the average values, except for Greece, where SMEs reported a significantly stronger gap growth and the value did not turn negative since the crisis.

Graph 2 Average Composite Financing Gap in EU Member States – reported by SMEs, 2010-2017, stratified by policy environment.



Graph 3. illustrates the average equity financing gap change, reported by European SMEs. Interestingly, this indicator does not turn negative throughout the years after the financial crisis. This means that during the full time period, SMEs on average reported a gap growth, meaning that, since the financial crisis, SMEs’ demand for private equity finance has exceeded its supply. The growth rate, however, has declined. In sum, the graph suggests an improving development of SMEs’ access to equity finance but it also indicates that SMEs are continuously struggling to get their demand for private equity funding covered. Comparing this graph to the previous graph (composite financing gap change), the imbalance between demand and supply seems to be particularly persistent and strong for private equity funding.

Graph 3. Average Equity Financing Gap Change in EU Member States – reported by SMEs, 2010-2017.



4. Analysis

4.1 Empirical Methodology

The research hypotheses, restated below, suggest a causal relationship between tax incentives and co-investment funds and the availability of venture capital and business angel finance for startups.

The research hypotheses:

- (H1) Tax incentives to stimulate venture capital and business angel investment in startups have a significant positive effect on the availability of finance for startups.*
- (H2) Public co-investment funds for venture capital and business angel investment in startups have a significant positive effect on the availability of finance for startups.*
- (H3) A combination of tax incentives and co-investment funds significantly enhances the respective positive effect on business angel and venture capital flow into startups.*

A large-N, pooled Ordinary Least Squares (OLS) analysis estimates the effects in a total of nine regression models. The rationale behind each of the models is briefly discussed and the

regression specifications are presented⁸. Finally, this section presents and interprets the analysis findings.

Regression models

The first model (I) studies the general effect of governments intervening in their domestic financial market on the availability of finance. To do so, a dummy variable *gov-intervention*, which indicates whether at least one of the two supply-side measures under consideration (TI, CIF) was in place in the firm’s country, was constructed. All dummies in this research are coded into binary variables which take on value one 1 for “presence” and value zero 0 for “absence”. The (a.) financing gap change perceived by all SMEs (y_{fgap}), (b.) the equity gap change perceived by all SMEs (y_{equity}), and (c.) the equity gap change perceived by startups in particular (“start-up”) were regressed on the *gov-intervention* variable. Furthermore, a wave dummy (d.) *i.wave* was included to control for time effects. The wave dummy controls for aggregate time trends, such as economic recovery from the 2008 financial crisis. It holds changes in the dependent variable due to time, here a six-monthly progression, constant.

I. Pooled OLS – The effect of government intervention:

$$a. y_{fgap} = \alpha + \beta x_{gov-intervention} + \varepsilon$$

$$b. y_{equity} = \alpha + \beta x_{gov-intervention} + \varepsilon$$

$$c. y_{equity, “start-up”} = \alpha + \beta x_{gov-intervention} + \varepsilon$$

$$d. y_{equity, “start-up”} = \alpha + \beta x_{gov-intervention} + i.wave + \varepsilon$$

The second, third and fourth model (II, III, IV) take a closer look into the different types of government intervention. They move from government intervention, in general, to tax incentives and co-investment funds, as well as their combination, as the explanatory variables. Again, some countries implemented only tax incentives, others implemented only co-investment funds and others combined tax incentives and co-investment funds. The dummy variable *ti* was constructed to indicate whether one or more tax incentive schemes were in place in the firm’s country of residence. The dummy variable *cif* was constructed to indicate whether one or more co-investment funds were active in the firm’s country of residence. These two dummy variables were interacted to create a third dummy variable *ti*cif*, which indicates

⁸ Box A.2 in the Appendix summarizes all regression models and provides a key to the variables.

whether a policy combination of one or more co-investment funds and tax incentive schemes was in place in the firm's country of residence. The interaction term was constructed to test the third hypothesis, which suggests that a policy combination magnifies tax incentives' and co-investment funds' respective effect on the availability of startup funding. The dependent variables (a) y_{fgap} , (b) y_{equity} , (c) $y_{equity, "start-up"}$ were regressed on the tax incentive variable x_{ti} in model II, the co-investment fund variable x_{cif} in model III, and the policy combination term x_{ti*cif} in model IV. Here too, aggregate time trends are controlled for with $i.wave$.

II. Pooled OLS – The effect of tax incentive schemes:

- a. $y_{fgap} = \alpha + \beta x_{ti} + \varepsilon$
- b. $y_{equity} = \alpha + \beta x_{ti} + \varepsilon$
- c. $y_{equity, "start-up"} = \alpha + \beta x_{ti} + \varepsilon$
- d. $y_{equity, "start-up"} = \alpha + \beta x_{ti} + i.wave + \varepsilon$

III. Pooled OLS – The effect of co-investment funds:

- a. $y_{fgap} = \alpha + \beta x_{cif} + \varepsilon$
- b. $y_{equity} = \alpha + \beta x_{cif} + \varepsilon$
- c. $y_{equity, "start-up"} = \alpha + \beta x_{cif} + \varepsilon$
- d. $y_{equity, "start-up"} = \alpha + \beta x_{cif} + i.wave + \varepsilon$

IV. Pooled OLS – The effect of a policy combination:

- a. $y_{fgap} = \alpha + \beta x_{ti*cif} + \varepsilon$
- b. $y_{equity} = \alpha + \beta x_{ti*cif} + \varepsilon$
- c. $y_{equity, "start-up"} = \alpha + \beta x_{ti*cif} + \varepsilon$
- d. $y_{equity, "start-up"} = \alpha + \beta x_{ti*cif} + i.wave + \varepsilon$

The fifth model (V) tests all three research hypotheses simultaneously. It combines the two supply-side measure variables and the interaction term in one pooled OLS regression equation for the dependent variables (a) y_{fgap} , (b) y_{equity} , and (c) $y_{equity, "start-up"}$ and accounts for (d) $i.wave$, too. One of the main contributions of this research lies in the evaluation of the tax

incentives and co-investment funds in relation to each other. Combining the main explanatory variables in one regression equation is crucial for their relative assessment.

V. Pooled OLS – A relative assessment of the main explanatory variables:

$$a. y_{fgap} = \alpha + \beta x_{ti} + \beta x_{cif} + \beta x_{ti*cif} + \varepsilon$$

$$b. y_{equity} = \alpha + \beta x_{ti} + \beta x_{cif} + \beta x_{ti*cif} + \varepsilon$$

$$c. y_{equity, \text{ "start-up" }} = \alpha + \beta x_{ti} + \beta x_{cif} + \beta x_{ti*cif} + \varepsilon$$

$$d. y_{equity, \text{ "start-up" }} = \alpha + \beta x_{ti} + \beta x_{cif} + \beta x_{ti*cif} + i.wave + \varepsilon$$

The sixth and the seventh model (VI,VII) regress the dependent variables (a) y_{equity} , (b) $y_{equity, \text{ if "start-up"}}$ and (c) $y_{equity, \text{ if "start-up"}}$ on the continuous variables *ti-generosity* and *ti-range* while accounting for *i.wave*. When governments intervene in the financial market with tax incentives, they have a broad discretionary space with respect to the design details of the schemes and the range of schemes they introduce. On the one hand, the generosity level of the tax advantages they offer to business angels and venture capital firms can vary greatly. On the other hand, they can chose to introduce one scheme versus a broader range of schemes to target investors. To draw a more nuanced conclusion over the effectiveness of tax incentive schemes and to avoid any over- or underestimation of the tax incentive effect, two question are posed. *Does the tax incentive generosity level magnify the effect of tax incentive schemes?* To answer this question, the sixth model (VI) estimates the effect of tax generosity levels on the perceived equity financing gap. *And what is the effect of broadening the range of tax incentive schemes on the tax incentive effect?* To answer this question, the seventh model regresses the perceived equity financing gap on the tax range score. In both models, (d) the respective continuous variable is also interacted with the tax incentive dummy variable to relate the scheme design effect to the effect of the mere presence of a tax incentive scheme. The tax incentive scoring methodology was discussed in the 3. Research Design section above and is presented in *Box A.1* in the Appendix.

VI. Pooled OLS – Tax incentive generosity:

$$a. y_{equity} = \alpha + \beta x_{ti-generosity} + \varepsilon$$

$$b. y_{equity} = \alpha + \beta x_{ti-generosity} + \varepsilon$$

$$c. y_{equity, "start-up"} = \alpha + \beta x_{ti-generosity} + i.wave + \varepsilon$$

$$d. y_{equity, "start-up"} = \alpha + \beta x_{ti} * x_{ti-generosity} + \varepsilon$$

VII. Pooled OLS – Tax incentive range:

$$a. y_{equity} = \alpha + \beta x_{ti-range} + \varepsilon$$

$$b. y_{equity} = \alpha + \beta x_{ti-range} + \varepsilon$$

$$c. y_{equity, "start-up"} = \alpha + \beta x_{ti-range} + i.wave + \varepsilon$$

$$d. y_{equity, "start-up"} = \alpha + \beta x_{ti} * x_{ti-range} + i.wave + \varepsilon$$

The eighth model (VIII) is a robustness test, which is conducted to check whether the effects found in the preceding models are biased by any potential omitted variable. Two potential omitted variables, which may have driven both the policy choice and the development of the startup financing gap, were worked out above – economic expansion, expressed as GDP growth, and the strength of financial markets, expressed as GDS as a percentage of GDP. The robustness is tested by regressing the equity financing gap change perceived by startups $y_{equity, "start-up"}$ on the control variables GDP and GDS while controlling for time effects with $i.wave$. The coefficients will show whether or not the control variables affected startups' access to finance. The control variables are also included in the final regression equations of the fifth model, which specifies the relative assessment of the supply side policy (Model V, equation $d.$). This will show whether the control variables simultaneously affected policy choice and access to finance. Lastly, the test uses the equations (c) of Model VI and VII check whether a potential effect of the tax incentive generosity and range is modified by including GDP and GDS.

VIII. OLS Robustness test – Checking for omitted variable bias

$$a. y_{equity, "start-up"} = \alpha + \beta x_{GDPgrowth} + \beta x_{GDS} + \varepsilon$$

$$b. y_{equity, "start-up"} = \alpha + \beta x_{ti} + \beta x_{cif} + \beta x_{pm} + \beta x_{GDPgrowth} + \beta x_{GDS} + i.wave + \varepsilon$$

$$c. y_{equity, "start-up"} = \alpha + \beta x_{ti-generosity} + \beta x_{GDPgrowth} + \beta x_{GDS} + i.wave + \varepsilon$$

$$d. y_{equity, "start-up"} = \alpha + \beta x_{ti-range} + \beta x_{GDPgrowth} + \beta x_{GDS} + i.wave + \varepsilon$$

4.2 Findings

Model I. GOVERNMENT INTERVENTION

| Model I. X_{gov}- intervention | a. y_{fgap} | b. y_{equity} | c. y_{equity}, “start-up” | d. y_{equity}, “start-up, i.wave” |
|--|---------------------------------|-----------------------------------|---|---|
| Observations | 131, 990 | 11, 258 | 1, 927 | 1, 927 |
| R-squared | 0,0002 | 0,0033 | 0,0020 | 0.0197 |
| β - coefficient (SE) | -.01333807*** (.002388) | -.0376408*** (.006133) | -.031248* (.0159809) | -.034003** (.0164564) |
| t-value | -5.60 | -6.14 | -1.96 | -2.07 |
| Constant | .0361642*** | .0692206*** | .0929705*** | .118454** |

* if $P < 0,1$ ** if $P < 0,05$ ***if $P < 0,01$

The first regression model finds that supply-side policy measures have a significant, diminishing effect on the growth of both the composite and the equity financing gap perceived by European SMEs and startups since the financial crisis. The coefficient on the constant term functions as a reference, expressing the default predicted value without supply-side policy measures. In this model, it is the intercept, which indicates the perceived financing gap change in a hypothetical counterfactual situation, in which governments had not opted for government intervention by means of tax incentives or co-investment funds (MIT, n.d.). The beta-coefficient indicates the actual effect that government intervention (the explanatory variable) had on this development (the outcome variable).

Accordingly, the first equation (a.) suggests that the composite financing gap, experienced by European SMEs, would have grown by 3,6% every six months⁹, on average, had governments

⁹ The quantitative measurement value enables the expression of the perceived financing gap change as a percentage. Yet, as it stems from qualitative survey data, the percentage interpretation must be read with caution. It is a rough indicator for the six-monthly funding gap development perceived by firms rather than a reflection of the actual gap. When a startup reports no gap change (value zero), this is read as 0% of the potential gap growth, equivalently caused by demand- and supply-side. If a startup reports a strong, both-sided gap growth (value one), the development is read as 100% of that potential gap growth. Any value between that is read as the percentage fulfillment of a strong, both-sided gap growth. In the same manner, negative values refer to a gap decline. Section 3.3.1 extensively discusses the construction of this variable.

not intervened with supply-side policy measures (.0361642*** coefficient on the constant term). Government intervention in the form of tax incentives, co-investment funds or both, depressed this average six-monthly gap growth by 1,3% (-.01333807*** beta-coefficient). Both coefficients are statistically significant at the 99% level (***). Having a supply-side policy measure to stimulate business angel and venture capital investments in place has a significant downward effect on the financing gap growth experienced by SMEs. The downward effect, however, is not strong enough to turn around the development – from growth to decline. The coefficient on the constant term is greater positive than the coefficient on the government intervention variable is negative. The supply-side policy measures alone cannot close the composite financing gap for SMEs.

The second equation (*b.*) studies the effect of government intervention on the availability of private equity, as opposed to the availability of all financing instruments for SMEs. It expresses the same dynamics – government intervention had a depressing effect on the post-crisis growth of the equity financing gap experienced by SMEs.

The third equation (*c.*) captures the effect of government intervention on the private equity financing gap change, experienced by startups in particular. The size of both the beta-coefficient (negative) and the coefficient on the constant term (positive) are greater for this equation, as opposed to the first equation. This means that European startups experienced a greater growth of the discrepancy between demand and supply for private equity finance (.0929705***¹⁰) than for finance in general. This is in line with the theory, which suggests that, as banks became more hesitant, startups became more reliant on private equity funding. The demand for private equity increased while business angels and venture capital firms, the providers of private equity, were waiting out the crisis instead of covering the demand. This proves policy-makers right in their heightened concerns over barriers to finance for startups. At the same time, government intervention by means of tax incentives and co-investment funds for business angels and venture capital firms has a stronger fostering effect on the private equity funding experienced by startups (-.031248*). This reflects the objective of the government intervention under study. Tax incentives and co-investment funds were introduced to increase private equity flows. The fact that their effect on the private equity indicator is almost three times the size of their effect on the composite financing indicator suggests that they reached their target group.

¹⁰ Statistical significance is related to the precision of the causal estimates and, here, measured by means of a p-value ($P > |t|$). In econometrics, when the p-value is smaller than 0,05 ($P < 0,05$), the coefficient is statistically significant at the 95% level. When it is smaller than 0,01 ($P < 0,01$), the coefficient is statistically significant at the 99,99+% level (MIT, n.d.).

Controlling for time trends in the fourth equation (*d.*) strengthens the effect of government intervention and raises its statistical significance ($-.034003^{**}$). This proves that the general effects found for supply-side policy measures are not a result of aggregate time trends, such as economic recovery from the financial crisis in Europe. Controlling for time trends does identify that the gap growth was weakened by certain time trends because the coefficient on the constant term is strongest when including *i.wave* ($.118454^{**}$). The outcome of this final equation is interpreted as follows. The equity financing gap perceived by European startups would have grown by an average of 11,8% every six months, in the absence of supply-side government intervention. Where government intervention took place, this growth rate could be minimized by 3,4% on average.

It must be noted that, though it increases in the latter, most specific equation, the R-squared value, which expresses the variance explained by the explanatory variable, is rather low (MIT, n.d.). The fairly weak explanatory power of the government intervention coefficients may be explained by the study’s exclusive focus on supply-side policy measures as opposed to demand-side policy measures. In many countries, both “sides” of the gap were addressed. An example for demand-side policy measures are “investor readiness programs” which train startup entrepreneurs in accessing private equity funds (OECD, 2017). It is highly probable that these demand-side policy measures contributed to the improvement of the startup funding gap. This would also explain why the gap closure, displayed by *Graph 2* and *Graph 3* in the 3.4 Data Description section is stronger than the regression output suggests.

Unfortunately, country effects could not be controlled for because they are correlated with the main explanatory variables. To avoid drawing conclusions from biased effects, the robustness test, which is performed at last, includes potential omitted variables on the country-level.

What can be pre-concluded is that, as expected, intervening in the financial market by means of supply-side policy measures to foster business angel and venture capital investment in startups has an ameliorating effect on the funding gap perceived by European startups after the 2008 financial crisis.

Model II. TAX INCENTIVES

| Model II. <i>X_{it}</i> | a. <i>y_{fgap}</i> | b. <i>y_{equity}</i> | c. <i>y_{equity}</i>, if “start-up” | d. <i>y_{equity}</i>, if “start-up”, <i>i.wave</i> |
|--|-----------------------------------|-------------------------------------|--|---|
| Observations | 131, 990 | 11, 258 | 1, 927 | 1, 927 |

| | | | | |
|-------------------------------|-----------------------------|-----------------------------|----------------------------|---------------------------|
| R-squared | 0,0045 | 0,0037 | 0,0029 | 0,0202 |
| β - coefficient (SE) | -.0142437*** (0.0024116) | -.0399788*** (0.0061821) | -.0381107** (0.0160463) | -.0378979** (0.006281) |
| t-value | -5.91 | -6.47 | -2.38 | -2.30 |
| Constant | .0369102*** | .071346*** | .097503*** | .1215532** |

* if P<0,1 ** if P<0,05 ***if P<0,01

The second regression model (II) provides evidence for the negative effect of tax incentive schemes in particular. Most importantly, the effect found for tax incentives in particular (-.0378979**) outweighs the general effect found for unspecified supply-side policy measures in model I. The perceived gap between equity finance supply and demand would have grown by an average of 12% per six months, in the absence of tax incentives (.1215532** coefficient on the constant term). Tax incentive schemes diminished this development by almost 4%. The findings of this model are in line with the first research hypothesis.

Model III. CO-INVESTMENT FUNDS

| Model III. Xcif | a. Yfgap | b. Yequity | c. Yequity, "start-up" | d. Yequity, "start-up", i.wave |
|-------------------------------|---------------------------|--------------------------|-----------------------------------|---|
| Observations | 131, 990 | 11, 258 | 1, 927 | 1, 927 |
| R-squared | 0,0020 | 0,0007 | 0,0175 | 0,0188 |
| β - coefficient (SE) | .0545437*** (.0033737) | .0233215** (.0083621) | .0467322** (.0196582) | .0333297 (.0209992) |
| t-value | 16.15 | 2.79 | 2.38 | 1.59 |
| Constant | .0215499*** | .0269722*** | .0389447** | .0580682 |

* if P<0,1 ** if P<0,05 ***if P<0,01

The outcome of the third regression model (III) indicates that, unlike tax incentive schemes, co-investment funds do not fulfil their policy objective of increasing the availability of finance for startups. Surprisingly, the positive beta-coefficient .0467322** for the third equation (c.)

suggests that introducing co-investment funds is associated with an acceleration of the equity financing gap growth, perceived by startups. It outweighs the coefficient on the constant term, meaning that the private equity funding gap perceived by startups would have shown a weaker growth rate had co-investment funds not been introduced. One may argue that the co-invested capital goes to SMEs other than startups. The positive beta-coefficient $.0233215^{**}$ in the preceding, second equation (b.), however, indicates an accelerating effect of co-investment funds on the equity financing gap reported by all SMEs, too. The estimates may be biased by aggregate time trends because, once accounted for time effects in the fourth equation (d.), the beta-coefficient as well as the coefficient on the constant term are no longer statistically significant. Nonetheless, model III provides strong evidence that co-investment funds did not (yet) achieve their intended outcome. It can be concluded that startups did not notice an improvement of their financial situation thanks to the introduction of co-investment funds. The findings of this model contradict the second research hypotheses.

Model IV. POLICY COMBINATION

| <i>Model IV. X_{it}*cif</i> | <i>a. Y_{fgap}</i> | <i>b. Y_{equity}</i> | <i>c. Y_{equity}, "start-up"</i> | <i>d. Y_{equity}, "start-up", i.wave</i> |
|--|-----------------------------------|-------------------------------------|---|---|
| Observations | 131, 990 | 11, 258 | 1, 927 | 1, 927 |
| R-squared | 0.0002 | 0,0033 | 0,0020 | 0,0197 |
| β - coefficient (SE) | -.0133807*** (.002388) | -.0376408*** (.006133) | -.031248* (.019809) | -.034003** (.0164564) |
| t-value | -5.60 | -6.14 | -1.96 | -2.07 |
| Constant | .0361642*** | .0692206*** | .0929705* | .118454** |

* if P<0,1 ** if P<0,05 ***if P<0,01

A number of governments addressed the start-up financing gap by introducing co-investment funds *and* tax incentives. The fourth regression model (IV), the last in the set of models which estimate the effect of particular policy environments in isolation, proves this approach to have a positive effect on the perceived access to finance for SMEs and startups. However, the effect found for tax incentives in isolation, in model II, is slightly stronger ($-.0378979^{**}$) than the effect of a combination ($-.034003^{**}$) on the perceived equity financing gap for startups when

accounting for time trends. Policy environments, in which both policy measures were active, were less successful in hindering a financing gap growth than policy environments, in which only tax incentives were offered, but more successful than policy environments, in which only co-investment funds were offered. It is extremely likely that the tax incentive effect makes up the full gap growth diminishing effect of the policy combination variable. The fact that the co-investment fund coefficients in model III were positive, supports this assumption. There is a great chance that a share of the tax incentive effect in cancelled out by co-investment funds in a policy combination. The findings of this model strongly contradict the third research hypothesis.

Model V. TAX INCENTIVES, CO-INVESTMENT FUNDS, POLICY MIX COMBINED

| Model V. $X_{ti}, X_{cif},$ $X_{ti}*cif$ | a. y_{fgap} | | b. y_{equity} | | c. $y_{equity},$ “start-up” | | d. $y_{equity},$ “start-up”, $i.wave$ | |
|---|---------------------------------|----------------------------|-----------------------------------|---------------------------|---|--------------------------|--|---------------------------|
| Observations | 131, 990 | | 11, 258 | | 1, 927 | | 1,927 | |
| R-squared | 0,0045 | | 0,0077 | | 0,0113 | | 0.0249 | |
| β - coefficients (SE) | X_{ti} | .0383332** (.0116794) | X_{ti} | -.0029304 (.0236933) | X_{ti} | .0191576 (.0311611) | X_{ti} | .0139466 (.0316253) |
| | X_{cif} | .0996426*** (.0042023) | X_{cif} | .0678666*** (.010144) | X_{cif} | .1004255*** (0242824) | X_{cif} | .0798784** (.0249195) |
| | $X_{ti}*cif$ | -.0246141*** (.0120335) | $X_{ti}*cif$ | -.0606771** (.0247505) | $X_{ti}*cif$ | -.0341376 (.0605003) | $X_{ti}*cif$ | -.0793495** (.0346777) |
| Constant | -.0239131*** | | .0235328** | | .0369712** | | .0635605 | |

* if P<0,1 ** if P<0,05 ***if P<0,01

The fifth model (V) integrates all three – tax incentives, co-investment funds and a combination – policy environments in one pooled OLS regression equation. The outcome of estimating their effects on the different outcome variables is consistent with the previous models. The final equation (d.) of this model is decisive for the acceptance or rejection of the research hypotheses. It estimates the effects of each of the three policy environments that can be created by tax incentives and co-investment funds, relative to each other, on the development of private equity funding perceived by startups, while accounting for aggregate time trends. The beta-coefficient .0798784** for co-investment funds and the -.0793495** beta-coefficient for the interaction

term reconfirm that co-investment funds are an ineffective – even destructive – instrument to stimulate private equity funding for European startups. A great negative beta-coefficient - .0793495** for the combination of tax incentives and co-investment funds indicates that government intervention with both measures strongly affected the development of the private equity startup funding gap. The lack of a statistically significant effect for tax incentives can be explained by the fact that only two countries in the research sample have tax incentives exclusively in place. In all other tax incentive countries, the schemes go hand-in-hand with co-investment funds. The gap-closing tax incentive effect is, therefore, captured by the policy mix interaction term when the measures are integrated in one regression equation. There is strong evidence that tax incentives are an effective policy instrument to facilitate access to private equity finance for European startups. In fact, the effect outweighs the gap growth coefficient on the constant term. A clear effect of tax incentive schemes to foster venture capital and business angel investments on the availability of private equity finance was identified in the previous models. Having a tax incentive scheme in place significantly depresses the financing gap growth perceived by startups.

Like the previous models, the integration of policy environments in this model proves the financing gap to be of primary concern for startups with a stronger positive coefficient on the constant term for startups (3,7%) than for SMEs (2,3%).

The findings of this model provide evidence to confirm the first research hypothesis and reject the second as well as the third research hypothesis. Tax incentives have a significantly positive effect on the availability of business angel and venture capital finance for startups. Co-investment funds do not have a positive effect on the availability of business angel and venture capital finance for startups. A combination of tax incentives and co-investment funds does not enhance the positive effect of tax incentives on business angel and venture capital flow into startups. In fact, the tax incentive effect is weaker when accompanied by co-investment funds. The sixth (VI) and the seventh (VII) model take a closer look at the effect found for tax incentives. Can the design of tax policies affect the tax incentive effect? The former (VI) looks at the generosity aspect of schemes and the latter (VII) looks at the range of schemes active in one country.

Model VI. TAX INCENTIVE GENEROSITY

| | | | | |
|------------------|------------------------|---|--------------------------|------------------------|
| Model VI. | a. Y_{equity} | b. Y_{equity} , if “start-up” | c. Y_{equity} , | d. Y_{equity} |
|------------------|------------------------|---|--------------------------|------------------------|

| | | | "start-up", <i>i.wave</i> | |
|--------------------------------|----------------------------------|----------------------------------|----------------------------------|---|
| Observations | 11,258 | 1,927 | 1, 927 | 11,258 |
| R-squared | 0.0016 | 0.0018 | 0.0191 | 0.0022 |
| β - coefficients (SE) | <i>X_{ti}-generosity</i> | <i>X_{ti}-generosity</i> | <i>X_{ti}-generosity</i> | β <i>X_{ti}*X_{ti}-generosity</i> |
| | -.004251*** (.0009909) | -.0050166** (.0026816) | -.0047533** (.002694) | 1*3 -.0272326*** (.0074514) |
| | | | | 1*4 -.0271254** (.0112268) |
| | | | | 1*7 -.0230141** (.0086946) |
| | | | | 1*10 -.0502546*** (.0137846) |
| Constant | .0587322*** | .0887369*** | .1070889** | .0626924*** |

* if P<0,1 ** if P<0,05 ***if P<0,01

A tax incentive generosity score was assigned to countries based on their incentive form (see Appendix *Box A.1* for the scoring methodology). The higher the score, the more generous the tax advantage scheme(s) offered to business angels and venture capital firms in the startups' country of residence. In the first three equations, the (a.) private equity gap indicator, (b.) perceived by startups are regressed on while (c.) holding time effects constant. Then, (d.) an interaction term of the generosity score and the tax incentive scheme dummy is used as the main explanatory variable. This enables the comparison of the tax incentive effects originating from distinctly generous schemes. One stands for the presence of a scheme, and the value it is interacted with stands for its generosity level.

The beta-coefficients of the first three equations (a.) $-.004251^{***}$, (b.) $-.0050166^{**}$, (c.) $-.0047533^{**}$ suggest a marginal effect of the tax generosity level on the availability of finance. The outcome of the fourth (d.) equation proves that a higher generosity level (1*3, 1*4, 1*7) is not associated with a greater effect of a scheme's closing effect on the funding gap. Schemes with three points (tax credits), four points (tax exemptions) and seven points (an integration of various incentive forms) depress the financing gap growth by around 2,5%.

The gap-closing effect for schemes with ten generosity points (assigned when one scheme offers all four types of incentive forms – tax exemptions, tax credits, tax deferral and loss relief) is twice as great ($-.0502546^{***}$). It should be noted, however, that such generous schemes are

found in the UK exclusively, a pioneering country when it comes to supporting business angels (Owen et al., 2017).

Increasing the generosity of a tax incentive hardly magnifies the gap closing effect of that tax incentive. The findings of this model add to the confirmation of the first research hypothesis. The positive effect of tax incentives on the availability of finance, which was found in previous models, is not conditional on a certain generosity level. The generosity level does not systematically magnify the incentive effect of a scheme. An important conclusion can be drawn from this result. Unlike the literature suggests, the design of tax incentive schemes, with regards to their generosity, does not “make or break” their effectiveness (OECD, 2017). The rationale behind tax incentive schemes is that offering an advantage will increase investors’ risk appetite and stimulate funding of higher-risk firms, namely startups (Mason et al., 2013). It was found that a greater generosity of that advantage is not associated with greater funding. Instead, schemes of any generosity level, working with any incentive form, similarly enhance the availability of finance. The investment decisions of business angels and venture capitalists are sensitive towards the presence of tax incentives. Yet, the effective tax relief realized by that incentive does not alter its effect on the investors’ decision-making process.

This is particularly interesting given the fact that the countries with the most generous tax incentive schemes also struggled with comparably reported financing gap growth rates in the initial years after the crisis. For instance, startups in France (0,14) and Italy (0,16) reported some of the highest growth rates for the composite financing gap and France and Italy both scored 7 generosity points. It can be assumed that the French and the Italian government opted for more generous tax incentives precisely because entrepreneurs were facing particularly great barriers to funding. The findings suggest that the stimulant effect of tax incentives does not increase with a greater level of generosity. There is a great chance that French and the Italian government could have achieved the same results with lighter tax reliefs.

Model VII. TAX INCENTIVE RANGE

| Model VII. | a. <i>Yequity</i> | b. <i>Yequity</i>, if “start-up” | c. <i>Yequity</i>, “start-up”, <i>i.wave</i> | d. <i>Yequity</i> |
|-------------------|--------------------------|---|---|--------------------------|
| Observations | 6,385 | 989 | 989 | 6,358 |
| R-squared | 0.0000 | 0.0009 | 0.0173 | 0.0009 |

| β - coefficients (SE) | $X_{ti-range}$ | $X_{ti-range}$ | $X_{ti-range}$ | $X_{ti} * X_{ti-range}$ | |
|--------------------------------|----------------|-------------------------|------------------------|-------------------------|---------------------------------|
| | | -.0007778 (.0017388) | -.004505 (.0047756) | -.0037992 (.0049184) | 1*1 1*2 1*2 1*4 1*6 |
| Constant | .0369301*** | .076988*** | .1104387** | .0353818*** | |

* if P<0,1 ** if P<0,05 ***if P<0,01

A second policy design aspect, governments have to decide on when intervening in financial markets with tax incentives to address the start-up financing gap, is the scheme range. Governments can choose to introduce various schemes as opposed to one single tax incentive scheme. None of the equations in the seventh model (VII) finds a statistically significant effect of the tax incentive range on the equity gap perceived by startups. Again, the policy details do not seem to “make or break” the tax incentive effect. Regarding the tax scheme range, the lack of an effect may be explained by an equally successful targeting of investors by a single, broad national scheme and a broader range of specialized national schemes.

What matters is the presence of a tax advantage to make investing in startups more attractive. Beyond that, the efforts of maximizing the generosity of tax advantages or implementing a broader range of independent, specialized schemes do not seem to pay off. In conclusion, model six and seven (VI, VII) undermine the confirmation of the first research hypothesis. Considering tax policy design details proves that the tax incentive effect is not conditional on generosity levels or target group specialization. There is, hence, no under- or overestimation of the general tax incentive effect due to these design details.

Model IX. ROBUSTNESS TEST

| Model VIII. $X_{GDPgrowth}$, X_{GDS} | a. Y_{equity} , “start-up”, $i.wave$ | b. Y_{equity} , “start-up”, $i.wave$ | c. Y_{equity} , “start-up”, $i.wave$ | d. Y_{equity} , “start-up”, $i.wave$ |
|--|--|--|--|--|
| Observations | 1,456 | 1,456 | 1,456 | 777 |

| | | | | | | | | |
|--------------------------------|------------------------------|-------------------------|------------------------------|--------------------------|------------------------------|------------------------|------------------------------|-------------------------|
| R-squared | 0.0223 | | 0.0291 | | 0.0246 | | 0.0240 | |
| β - coefficients (SE) | Control variables | | Control variables | | Control variables | | Control variables | |
| | x_{GDP} growth | -.0007157 (.0015095) | x_{GDP} growth | -.000328 (.0015208) | x_{GDP} growth | .623006 (.0018632) | x_{GDP} growth | .0026512 (.0028746) |
| | x_{GDS} | -.0004786 (.001832) | x_{GDS} | .0004224 (.0018577) | x_{GDS} | -.001362 (.0018632) | x_{GDS} | -.0002046 (.0029606) |
| | Explanatory variables | | Explanatory variables | | Explanatory variables | | Explanatory variables | |
| | - | | x_{ti} | .0156992 (.0370135) | x_{ti} -generosity | | x_{ti} -range | |
| | | x_{cif} | .0644725* (.0355277) | -.008214** (.0033176) | | | -.0073046 (0076238) | |
| | | x_{ti}^*c if | -.0812971** (.0399525) | | | | | |
| Constant | .16387 | | .0882686 | | .1329339** | | -.1607938 | |

* if P<0,1 ** if P<0,05 ***if P<0,01

The last model (IX) tests the robustness of the preceding models. It includes potential omitted variables, which may have simultaneously affected the policy choice of governments and the development of the startup funding gap. Two domestic factors that could have confounded the results this way were worked out: economic expansion, expressed as GDP growth, and the strength of financial markets, expressed as gross domestic savings (GDS) as a % of GDP.

The first equation (a.) of this robustness check already proves that the control variables do not have a significant effect on the outcome variable. Accordingly, the control variables show neither show a significant effect on the outcome variable the latter three robustness test equations. They can be excluded as potential omitted variables. The second equation (b.) shows that the effect of the main explanatory variables remain their direction and significance when controlling for GDP growth and GDS are controlled for. The regression models are robust and their results are not biased by economic expansion and strength of financial markets on the country level.

4.2.1 Linking the findings to the research hypotheses

The findings of the pooled OLS regression analysis are summarized and linked to the research hypotheses below.

(H1) Tax incentives to stimulate venture capital and business angel investment in startups have a significant positive effect on the availability of finance for startups.

→ Confirmed

As expected, tax incentives are an effective supply-side policy measure to facilitate the access to business angel and venture capital for startups. Tax incentives clearly had a diminishing effect on the growth of the startup funding gap in Europe after the 2008 financial crisis. They fulfilled their objective of facilitating access to business angel and venture capital. The analysis also found that the stimulant effect of tax incentive schemes is not conditional on a certain generosity level or degree of specialization. In fact, investors' investment decisions, once stimulated by any form of tax advantage, seem to be unaffected by the size of the effective tax relief. What matters is the presence of a tax advantage while the generosity of that advantage and the operation of schemes do not "make or break" the scheme. In sum, the first research hypothesis is strongly confirmed by the analysis findings.

(H2) Public co-investment funds for venture capital and business angel investment in startups have a significant positive effect on the availability of finance for startups.

→ Rejected

Unlike expected, co-investment funds are not effective in fostering business angel and venture capital investments in startups. The regression results even suggest that the presence of co-investment funds is positively related to the growth of the startup funding gap. When tax incentive schemes are accompanied by co-investment funds, the tax incentive effect was dampened. The causal mechanism underlying these dynamics could not be studied in this research. What can be concluded, however, is that co-investment funds did not fulfil their objective of fostering private equity investment in startups during the observed time period. There are three possible explanations. First, it may be that no policy effect could be identified because there is a time lag (Plümper et al., 2005). This would mean that co-investment funds can increase the availability of finance for startups but this effect takes more time to manifest itself. Maybe investors are not yet aware of their presence and benefits. In this case, the research findings underestimate the co-investment fund effect. Second, it may be that European co-investment funds do not facilitate startups access to private equity finance because they are not well run. The theory suggests that public-private partnerships depend on "face-to-face dialogue, trust building, cultivated commitments, and shared understanding" (Robichau, 2011, p. 124).

The design details of European co-investment funds were not studied in this research. Potentially, business angels and venture capitalists were not willing to co-invest with government agents because of distrust, conflicts of interest, a lack of dialogue or other operational deficiencies (ibid.). Third, it may be that business angels and venture capitalists are simply not sensitive towards co-investment funds. The rationales behind the two supply-side measures under study differ. The approach of tax incentives is the reduction of investment costs and, consequentially, profit maximization. Co-investment funds base on the assumption that maximizing the investment volume will enable greater startup investment deals and, in doing so, make startup funding more attractive. The relative costs and profits are unaffected by co-investing. There is a great chance that investors' risk appetite does not respond to the idea of partnering with the government and that the disincentive effect of startups (their higher-risk nature and spill-over effects) can only be overcome by profit maximization tools.

Clearly, the findings reject the second research hypothesis.

(H3) A combination of tax incentives and co-investment funds significantly enhances the respective positive effect on business angel and venture capital flow into startups.

→ Rejected

As discussed, only tax incentives were found to have a positive effect on business angel and venture capital flow into startups. Their effect was not enhanced, rather dampened, by the accompaniment of co-investment funds. Possible explanations for the failure of co-investment funds to facilitate startups' access to private equity funding were discussed above. The theory suggests that policy combinations can better target diverse stakeholder (Lodge et al., 2012). Private investors are diverse in terms of risk aversion, expertise and investment capacities. If this were a hindrance to the tax incentive effect, co-investment funds are certainly not the right tool to overcome it. As a consequence, the third research hypothesis is rejected.

5. Conclusion

A gap between European startups' demand for finance and the supply of business angel and venture capital emerged after the 2008 financial crisis. Almost a decade later, European enterprises reported an increasingly positive financial environment (ECB, 2017b). The objective of this study was to identify the effect of tax incentive schemes and public co-investment funds on the development of this gap. It was guided by the research question: *To*

what extent can tax incentives and co-investment funds foster business angel and venture capital investment in startups?

In conclusion, tax incentives have a significant positive effect on the availability of finance for startups. For co-investment funds, on the contrary, no such effect could be identified. Tax incentive schemes can stimulate investment by business angels and venture capital firms to the extent that the startup funding gap growth is significantly contained. It is not strong enough, however, to fully prevent the gap from growing without the help of additional impulses, e.g. demand-side policy measures. The findings confirm Stiglitz's argument that "if there is decreasing absolute risk aversion, wealthier individuals undertake riskier projects" (Stiglitz et al., 1981, p. 404). While, unlike the literature suggests, risk-sharing is not an effective tool to decrease investors' risk aversion, the findings do confirm the theory that increasing the effective rate of return will increase investors' risk appetite (European Commission, 2017a). The enhanced investments empower entrepreneurs in starting up businesses and, in doing so, unlock the positive externalities associated with startup formation. By means of tax incentives, the social return, which is created through the channels of employment, innovation, knowledge spill-overs, and competition, can be redistributed to the investor by increasing her private investment return. Future strategies to increase investments to the socially desirable level, e.g. in the context of sustainability, are well advised to work with tax incentives. Rewarding investors with a tax relief comes at the cost of foregone tax incomes, that would otherwise be due on their investment returns. In this regard, the study provides strong evidence that moderate generosity levels are sufficient to solve the undersupply of finance. This knowledge is helpful to avoid a deadweight loss, which can occur if the foregone tax income outweighs the welfare gains.

From a methodological viewpoint, the study's contribution is twofold. It adds to the literature by overcoming a dependent variable problem. So far, private equity investments were hardly studied because of their informal character. The study's choice of data, micro-data from the *ECB Survey on the Access to Finance of Enterprises*, enables meaningful insights into the development of business angel and venture capital flows. Though studying the experience of firms – the recipients of private equity – is the best possible approach, it entails the danger of reporting bias. Furthermore, the study assesses the supply-side policy measures, in relation to each other, for the first time. A next step would be to relate the supply-side policy measures to demand-side policy measure to close the startup funding gap. This would most likely increase the R-squared values and, in doing so, resolve a shortcoming of this study. Another recommendation for future research is a repeated study of the co-investment effect to make sure

that it is not underestimated. It may be that its impact on startup funding levels occur with a time lag.

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Appendix

Box A.1 Tax incentive generosity and range score construction

| Country (PM; TI) | Name of Scheme | Tax exemption | Tax credit | Tax deferral | Loss relief | Generosity Score |
|---|---|------------------|---------------|-----------------|----------------|---------------------|
| Belgium (BE) | Tax shelter for investments in startups | x | √ | x | x | 3 |
| | Tax treatment of crowdfunding loans | √ | x | x | x | 4 |
| | Win-Win Lending Scheme (Flanders) | x | √ | x | x | 3 |
| | Loan "Coup de pouce" (Wallonia) | x | √ | x | x | 3 |
| Generosity score: 4 – Range score: 4 | | | | | | |
| France (FR) | Additional allowance on sale of shares in young SMEs | x | √ | x | x | 3 |
| | "Madelin" tax reductions | x | √ | x | x | 3 |
| | Wealth tax reliefs (ISF-PME Regime) | x | √ | x | x | 3 |
| | Venture Capital Firms (Sociétés de Capital Risque or SCR) | √ | x | √ | x | 4 |
| | Venture Capital Funds (including FCPR, FCPI and FIP) | √ | √ | x | x | 7 |
| | PEA-PME | √ | x | x | x | 4 |
| Generosity score: 7 – Range score: 6 | | | | | | |
| Germany (DE) | "INVEST - Venture Capital Grant" | x | √ | x | x | 3 |
| Generosity score: 3 – Range score: 1 | | | | | | |
| Ireland (IE) | Employment & Investment Incentive | x | √ | x | x | 3 |
| Generosity score: 3 – Range score: 1 | | | | | | |
| Italy (IT) | Tax incentives for investing in Venture Capital Funds (VCF) | √ | x | x | x | 4 |
| | Tax incentives for investing in innovative startups and innovative SMEs | √ | √ | x | x | 7 |

| | | | | | | |
|---|--|---|---|---|---|----|
| | PIR (Piani Individuali di Risparmio) | √ | x | x | x | 4 |
| Generosity score: 7 – Range score: 3 | | | | | | |
| Malta (MT) | Seed Investment Scheme | x | √ | x | x | 3 |
| Generosity score: 3 – Range score: 1 | | | | | | |
| Poland (PL) | Tax exemption on the disposal of stocks and shares | √ | x | x | x | 4 |
| Generosity score: 4 – Range score: 1 | | | | | | |
| Portugal (PT) | “Programa Semente” (Tax relief for investing in Startups) | √ | x | x | x | 4 |
| | Tax Relief for Business Angels | x | √ | x | x | 3 |
| Generosity score: 4 – Range score: 2 | | | | | | |
| Slovenia (SI) | Corporate income tax regime | √ | x | x | x | 4 |
| Generosity score: 4 – Range score: 1 | | | | | | |
| Spain (ES) | Deduction for investments in newly or recently created companies | √ | x | x | x | 3 |
| | Regional incentives for business angels | √ | x | x | x | 3 |
| Generosity score: 3 – Range score: 2 | | | | | | |
| Sweden (SE) | New Investment Incentive | √ | x | x | x | 3 |
| Generosity score: 3 – Range score: 1 | | | | | | |
| United Kingdom (UK) | Enterprise Investment scheme (EIS) | √ | √ | √ | √ | 10 |
| | Seed Enterprise Investment Scheme (SEIS) | √ | √ | √ | √ | 10 |
| | Venture Capital Trust | √ | √ | √ | X | 8 |
| | Social Investment Tax Relief | √ | √ | √ | X | 8 |
| | Private Placement Withholding Tax Exemption | √ | x | x | X | 4 |
| | Business Property Relief | √ | x | x | X | 4 |

Generosity score: 10 – Range score: 6

| | | | | | |
|---|----------------------|-------------------|--------------------|---------------------|---|
| Frequency of incentive form in EU: | Tax exemption (4) | Tax credit (3) | Loss relief (2) | Tax deferral (1) | Within-scheme integration of incentive form |
| | 19 | 16 | 2 | 5 | 6* |

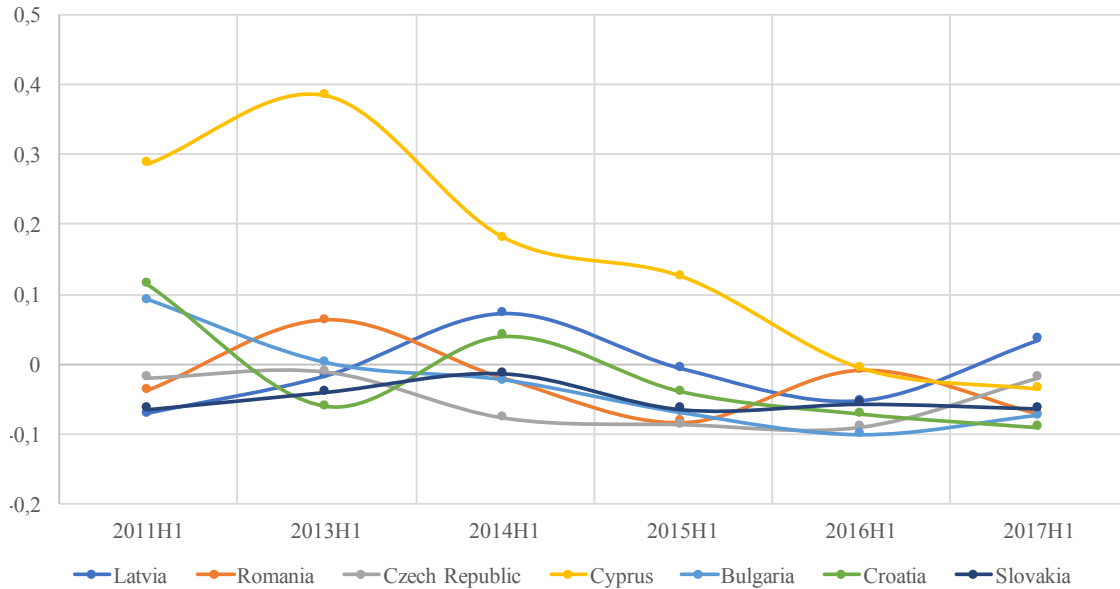
* Four in UK, one in FR, and one in Italy.

Table A.1 Summarized tax incentive scores per country

| EU Member State: (PM; TI) | Tax Incentive Score | |
|-------------------------------------|----------------------------|---------------|
| | Generosity: | Range: |
| Belgium (BE) | 4 | 4 |
| France (FR) | 7 | 6 |
| Germany (DE) | 3 | 1 |
| Ireland (IE) | 3 | 1 |
| Italy (IT) | 7 | 3 |
| Malta (MT) | 3 | 1 |
| Poland (PL) | 4 | 1 |
| Portugal (PT) | 4 | 2 |
| Slovenia (SI) | 4 | 1 |
| Spain (ES) | 3 | 2 |
| Sweden (SE) | 3 | 1 |
| United Kingdom (UK) | 10 | 6 |

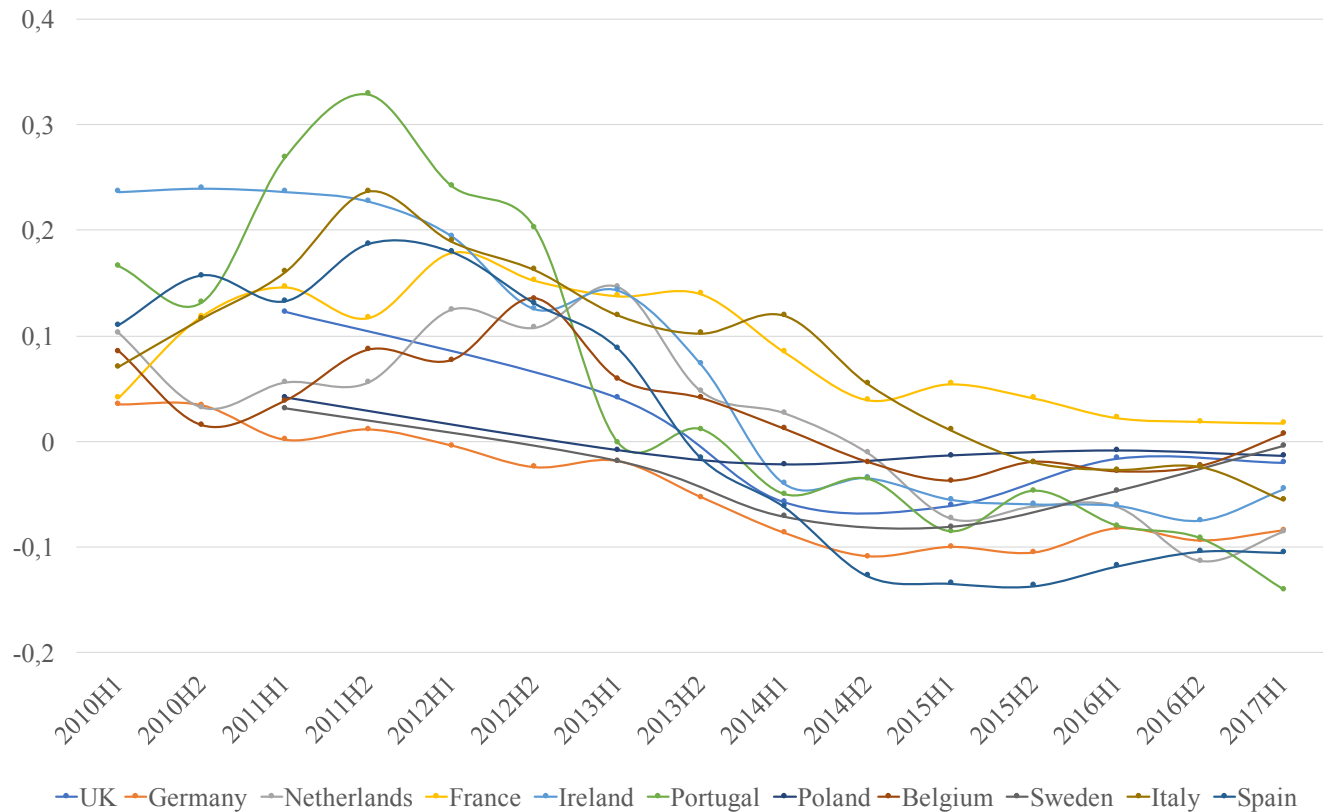
Graph A.1

Average Composite Financing Gap Change – reported by SMEs, 2011-2017, per country without any of the considered policy measures (TI, CIF or TI*CIF)



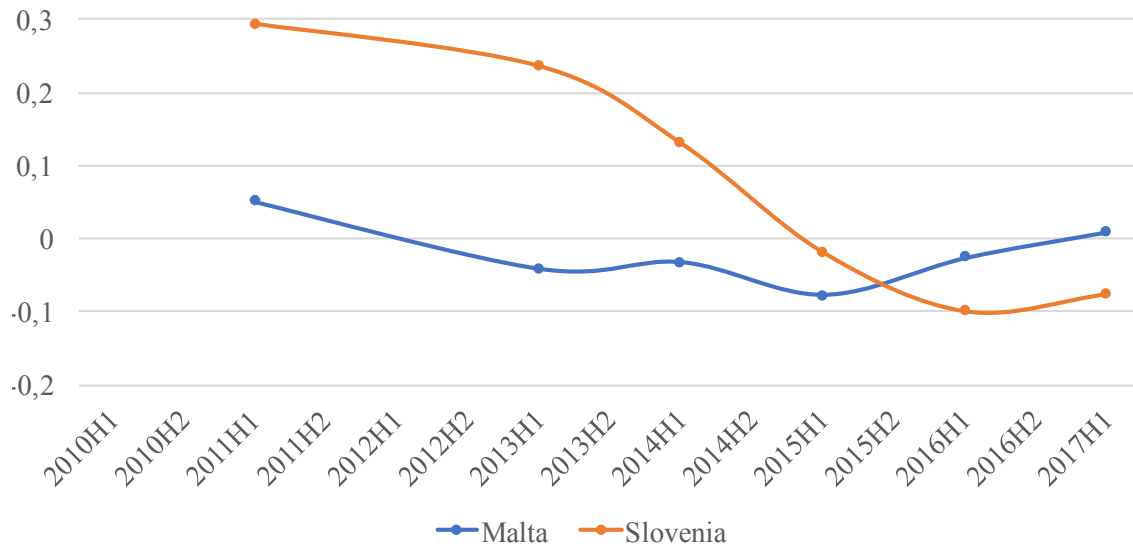
Graph A.2

Average Composite Financing Gap Change – reported by SMEs, 2010-2017, per country with a policy combination of tax incentives and co-investment funds in place.



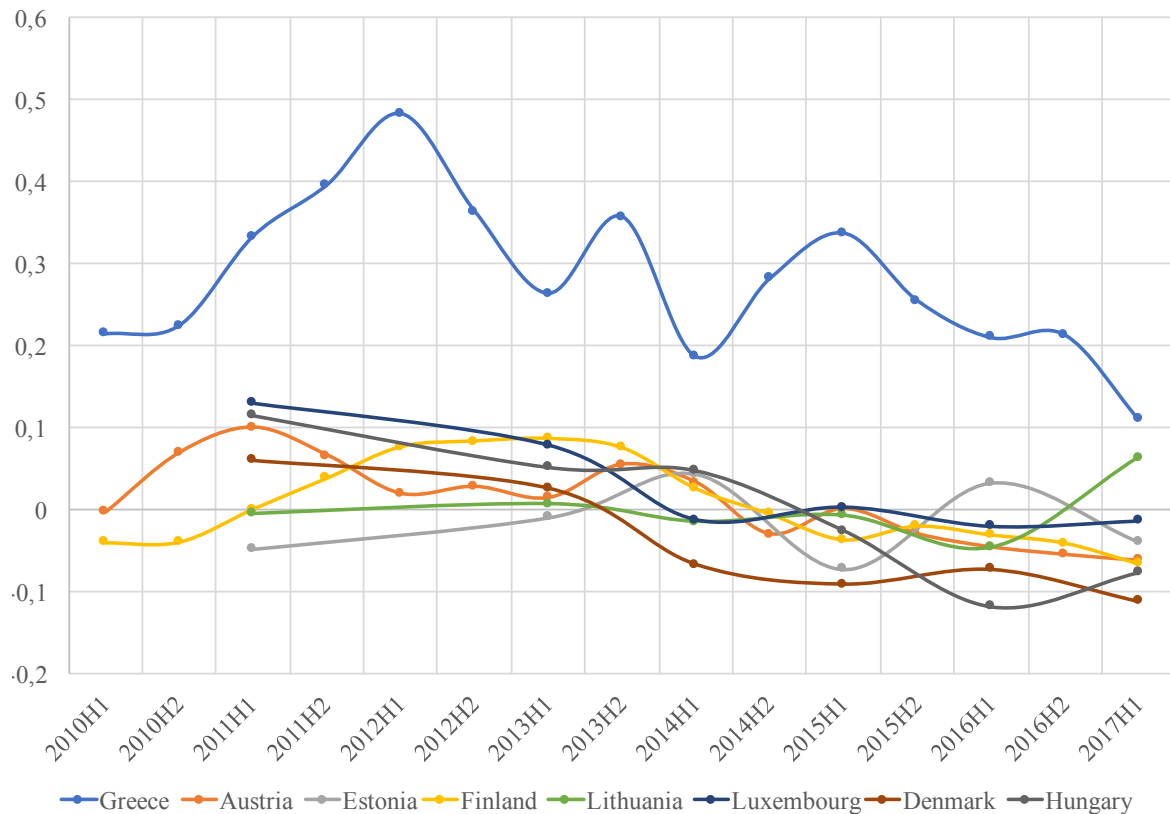
Graph A.3

Average Composite Financing Gap Change – reported by SMEs, 2010-2017, per country with exclusively tax incentives in place.



Graph A.4

Average Composite Financing Gap Change – reported by SMEs, 2010-2017, per country with exclusively co-investment funds in place.



Box A.2 Regression models and key to regression specifications:

I. Pooled OLS – The effect of government intervention:

- a. $y_{fgap} = \alpha + \beta x_{gov-intervention} + \varepsilon$
- b. $y_{equity} = \alpha + \beta x_{gov-intervention} + \varepsilon$
- c. $y_{equity, "start-up"} = \alpha + \beta x_{gov-intervention} + \varepsilon$
- d. $y_{equity, "start-up"} = \alpha + \beta x_{gov-intervention} + i.wave + \varepsilon$

II. Pooled OLS – The effect of tax incentive schemes:

- a. $y_{fgap} = \alpha + \beta x_{ti} + \varepsilon$
- b. $y_{equity} = \alpha + \beta x_{ti} + \varepsilon$
- c. $y_{equity, "start-up"} = \alpha + \beta x_{ti} + \varepsilon$
- d. $y_{equity, "start-up"} = \alpha + \beta x_{ti} + i.wave + \varepsilon$

III. Pooled OLS – The effect of co-investment funds:

- a. $y_{fgap} = \alpha + \beta x_{cif} + \varepsilon$
- b. $y_{equity} = \alpha + \beta x_{cif} + \varepsilon$
- c. $y_{equity, "start-up"} = \alpha + \beta x_{cif} + \varepsilon$
- d. $y_{equity, "start-up"} = \alpha + \beta x_{cif} + i.wave + \varepsilon$

IV. Pooled OLS – The effect of a policy combination:

- a. $y_{fgap} = \alpha + \beta x_{ti*cif} + \varepsilon$
- b. $y_{equity} = \alpha + \beta x_{ti*cif} + \varepsilon$
- c. $y_{equity, "start-up"} = \alpha + \beta x_{ti*cif} + \varepsilon$
- d. $y_{equity, "start-up"} = \alpha + \beta x_{ti*cif} + i.wave + \varepsilon$

V. Pooled OLS – A relative assessment of the main explanatory variables:

- a. $y_{fgap} = \alpha + \beta x_{ti} + \beta x_{cif} + \beta x_{ti*cif} + \varepsilon$
- b. $y_{equity} = \alpha + \beta x_{ti} + \beta x_{cif} + \beta x_{ti*cif} + \varepsilon$
- c. $y_{equity, "start-up"} = \alpha + \beta x_{ti} + \beta x_{cif} + \beta x_{ti*cif} + \varepsilon$
- d. $y_{equity, "start-up"} = \alpha + \beta x_{ti} + \beta x_{cif} + \beta x_{ti*cif} + i.wave + \varepsilon$

VI. Pooled OLS – Tax incentive generosity:

a. $y_{equity} = \alpha + \beta x_{ti-generosity} + \varepsilon$

b. $y_{equity} = \alpha + \beta x_{ti-generosity} + \varepsilon$

c. $y_{equity, "start-up"} = \alpha + \beta x_{ti-generosity} + i.wave + \varepsilon$

d. $y_{equity, "start-up"} = \alpha + \beta x_{ti} * x_{ti-generosity} + \varepsilon$

VII. Pooled OLS – Tax incentive range:

a. $y_{equity} = \alpha + \beta x_{ti-range} + \varepsilon$

b. $y_{equity} = \alpha + \beta x_{ti-range} + \varepsilon$

c. $y_{equity, "start-up"} = \alpha + \beta x_{ti-range} + i.wave + \varepsilon$

d. $y_{equity, "start-up"} = \alpha + \beta x_{ti} * x_{ti-range} + i.wave + \varepsilon$

VIII. OLS Robustness test – Checking for omitted variable bias:

a. $y_{equity, "start-up"} = \alpha + \beta x_{GDPgrowth} + \beta x_{GDS} + \varepsilon$

b. $y_{equity, "start-up"} = \alpha + \beta x_{ti} + \beta x_{cif} + \beta x_{pm} + \beta x_{GDPgrowth} + \beta x_{GDS} + i.wave + \varepsilon$

c. $y_{equity, "start-up"} = \alpha + \beta x_{ti-generosity} + \beta x_{GDPgrowth} + \beta x_{GDS} + i.wave + \varepsilon$

d. $y_{equity, "start-up"} = \alpha + \beta x_{ti-range} + \beta x_{GDPgrowth} + \beta x_{GDS} + i.wave + \varepsilon$

Key to regression models:

Dependent variables:

y_{fgap} – composite financing gap change perceived by all SMEs

y_{equity} – equity financing gap change perceived by all SMEs

$y_{equity, "start-up"}$ equity financing gap change perceived by startups

Independent variables:

$x_{gov-intervention}$ – government intervention (dummy variable)

x_{ti} – tax incentive scheme (dummy variable)

x_{cif} – co-investment fund (dummy variable)

x_{ti*cif} – policy combination (interaction term of the preceding two dummy variables)

$x_{ti-generosity}$ – tax incentive generosity (continuous variable)

$x_{ti-range}$ – tax incentive range (continuous variable)

Controls:

i.wave – time effects

XGDPgrowth – GDP growth (continuous variable)

XGDS – Gross domestic saving as % of GDP (continuous variable)