

Innovation and Access to Finance

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Innovation and Access to Finance¹

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Abstract

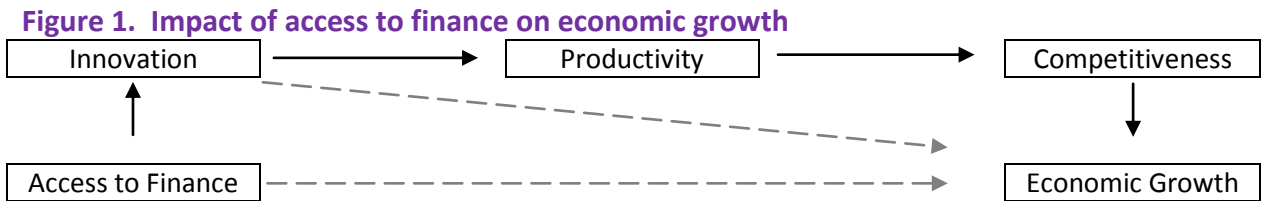
Promoting Research and Development (R&D) activities is the main goal of the EU 2020 Strategy in order to achieve an R&D spending at least 3% of GDP. The Innovation Union is one of the seven flagship initiatives of the EU 2020 Strategy, which has the aims: to improve access to finance for R&D; to get innovative ideas to market; to ensure growth and jobs (European Commission, 2014b). The aim of the present paper is to identify and explain the main mechanisms related to four commitments of Innovation Union: i) Commitment 10 (Put in place EU level financial instruments to attract private finance); ii) Commitment 11 (Ensure cross-border operation of venture capital funds); iii) Commitment 12 (Strengthen cross-border matching of innovative firms with Investors); iv) Commitment 13 (Review State Aid Framework for Research, Development and Innovation). To this purpose, a review of both theoretical and empirical literatures about 'Innovation, Access to Finance and SMEs' based on more than 80 scientific and other articles and analyses is presented. The paper provides an analysis of the main alternative financial instruments to bank loans, namely Risk-Sharing Facility Financing, Venture Capital, Business Angels and public subsidies. We found some evidence in the literature that Venture Capital could have a limited impact in enhancing innovation in the long-term and that some public support schemes could be more effective than other, depending on the firm's maturity state.

JEL: 031, 038, 052

1. Introduction³

Access to Finance is a key driver in the creation (Cassar, 2004; Popov and Roosenboom, 2013; Kim *et al.* 2016), survival (Tsoukas, 2011) and growth (Rahaman, 2011) process of firms, and especially for smalls (Beck and Demirguc-Kunt, 2006) and innovative firms (Lee *et al.*, 2015). Small and innovative firms have more constraints and difficulties to access to finance, because they tend to have riskier projects and business models (Lee *et al.*, 2015). Like access to finance is important for firms activities, it can consequently foster economic growth (Kim *et al.*, 2016) and influence positively innovation (Wang, 2014; Brown *et al.*, 2009). Furthermore, it was demonstrated that innovation has a positive impact on economic growth (see e.g. Hasan and Tucci, 2010; Galindo and Méndez, 2014). The importance and linkage of this two variables (Figure 1), has placed innovation in the heart of the Europe 2020 Strategy.

³ Authors are grateful to the comments received from Jacques Mairesse and Paul Zagamé as well as participants to the I3U meeting, at ULB, the 9th and 10th February 2016.



Source: Authors own elaborations based on Brown et al. (2009); Hasan and Tucci (2010); Frontiers Economics (2013); Galindo and Méndez (2014); Kim et al. (2016).

Promoting Research and Development (R&D) activities is the main goal of the EU 2020 Strategy in order to achieve a level of total (public and private) R&D spending of at least 3% of GDP. Presently, the European Union Member states exhibit a lower performance than the US and Japan, mainly due to the lower levels of private R&D investment (European Commission, 2011b:1).

The Innovation Union is one of the seven flagship initiatives of the EU 2020 Strategy, which has the aims: to improve access to finance for R&D; ii. to get innovative ideas to market; iii. to ensure growth and jobs (European Commission, 2014b). This initiative is divided in 34 commitments and the present paper focusses on commitments 10 to 13 (see Figure 2), with the aims to identify and explain the main mechanisms related to them. To this purpose we present a review of the literature on the different commitments' thematics.

Figure 2. Purpose of commitment 10 to 13 of Innovation Union

Commitment #	Purpose (Progress so far)
Commitment 10	Put in place EU level financial instruments to attract private finance
Commitment 11	Ensure cross-border operation of venture capital funds
Commitment 12	Strengthen cross-border matching of innovative firms with Investors
Commitment 13	Review State Aid Framework for Research, Development and Innovation

Source: Authors own elaboration based on European Commission (2014b).

More than 80 scientific and other articles and analyses related to innovation, access to finance and SMEs were retrieved from several electronic platforms, such as, ScienceDirect, SpringerLink, Taylor & Francis, Wiley Online Library, JSTOR, EconLit and Google Scholar. We have selected a range of papers based on keywords such as "innovation", "finance", "R&D", "SMEs", "venture capital", "business angels", "matching", "cross-border" and "state aid". Despite, priority have been give to studies focusing on Europe, research based on other regions and countries in the world have been also assessed.

The present paper is structured in six main sections. Following this introduction, the second section aims at presenting a brief overview of the main issues at stake: SMEs and access to finance. The third section focuses on commitment 10 (Put in place EU level financial instruments

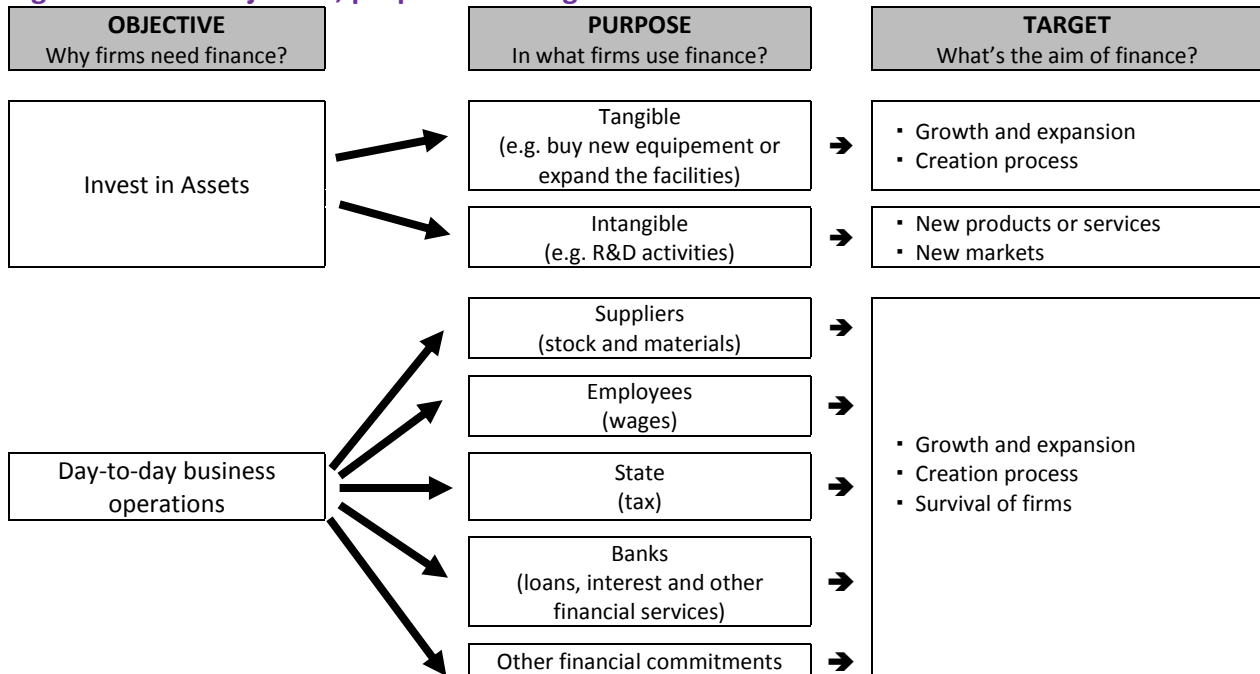
to attract private finance) and the link between debt or equity finance and innovation and economic growth. The fourth section intends to explain the rationale of commitment 11 and 12 based on cross-border and matching firms (demand) with investors (supply). The fifth section is dedicated to commitment 13 (Review of State Aid Framework for Research, Development and Innovation) and to assess the effectiveness of state aids in leveraging R&D investment. The last, sixth section presents conclusions.

2. Access to finance, SMEs and innovation: an overview of the problem

2.1. Why do firms need finance?

Essentially, firms need finance to invest in assets or for day-to-day business operations (Figure 3). The final target is: i) to increase production, productivity and/or reduce costs, in order to be more competitive; ii) to develop new products, for maintaining or increasing market share; iii) to adapt technologies and products to new market conditions (e.g. regulations and consumer tastes); iv) to start a business; v) to pay daily financial commitments. The first three motivations are namely linked with the promotion of growth or expansion of established firms. The last one can be applied to both, new or existing firms.

Figure 3. Main objective, purpose and target of firms finance



Source: Authors own elaboration.

Liquidity for day-to-day business operations is crucial in businesses where firms need money in order to be able to produce goods (or more goods) to sell. Indeed, the time period between

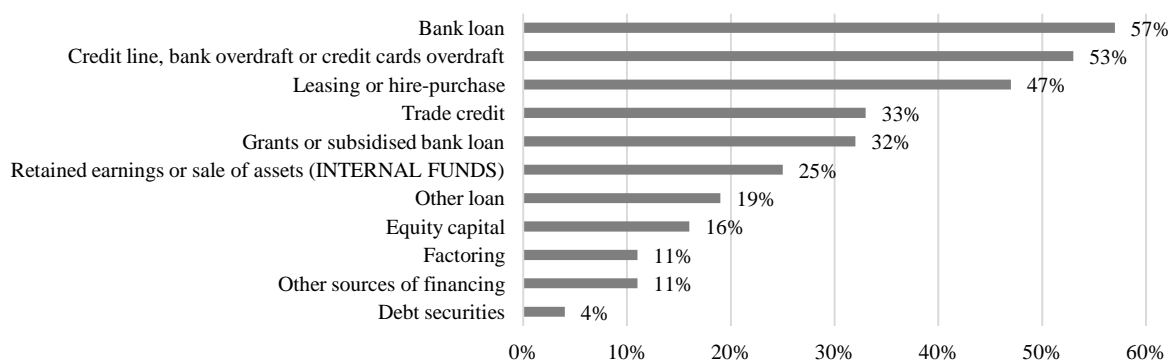
receiving from customers and payments to suppliers is not always the most convenient for firms. Companies have to fulfill their financial commitments with suppliers, employees, state, banks and other entities, independently of receiving promptly money from their customers. For newly established firms or in the process of being created, to start a business involves not only the initial capital expenditure for buying equipment and/or R&D investments but also liquidity to buy stock of material in order to start production and for day-to-day running business. In all these cases, internal or external sources of finance need to be used.

2.2. Where can firms get access to finance?

Firms can get access to finance by internal or external ways, using equity or debt instruments. Equity finance consists in retained earnings, sale of assets (both internal sources), or when investors from outside join the company with capital (external source). "Debt refers to the funds that are borrowed from an [internal or external] creditor and which need to be repaid at a future point in time" (European Commission, 2014a:12).

According to Casson *et al.* (2008), in general firms tend to have some preferences for the modes of financing, with debt preferred to equity since it involves less loss of control rights. This trend is also visible in the EU small and medium enterprises, which answered in the Survey on the Access to Finance of Enterprises (SAFE) that external debt finance instruments, such as bank loan and credit line, are more relevant than internal funds (Figure 4).

Figure 4. Relevance of financing types for SMEs, EU-28, 2014



Source: European Commission (2014a:12).

2.3. How do firms choose or can get access to a source of funding?

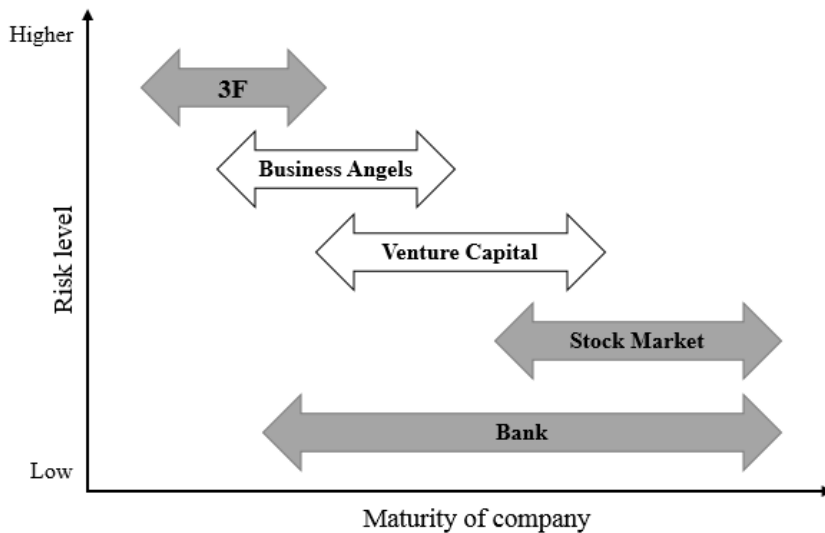
Access to different sources of funding (Figure 5) depends on the risk level (firm or investment project), the state of firm maturity, the amount of funds needed (Manigart and Witmeur, 2009:9), the firm size, age, and information availability (Berger and Udell, 1998:623), growth goals, the nature of ownership and the activity sector (Riding *et al.*, 2012). For example, small firms compared to larger have less access to formal sources of external finance (Beck and Demirguc-Kunt, 2006). According to Manigart and Witmeur (2009), in the early stage or seed, when the risk is higher and if the amount of investment is low, firms usually use private sources, such as, personal saving of founders, family or friends (3F). Banks usually fund companies with a low level of risk and equity financing through Venture Capitalists or Business Angels, can represent an alternative in the early stage of the company (Figure 6).

Figure 5. Different sources of financing

Private	Debt	Equity	Others
<ul style="list-style-type: none"> ▪ Firms self-finance; ▪ Personal saving of founders, family or friends (3F). 	<ul style="list-style-type: none"> ▪ Loans from banks or public institutions; ▪ Risk-Sharing Finance Facility (RSFF). 	<ul style="list-style-type: none"> ▪ Venture Capital (VC); ▪ Business Angels (BA); ▪ Stock Market. 	<ul style="list-style-type: none"> ▪ Subsidies and grants from governments and international organizations.

Source: Authors own elaboration.

Figure 6. Source of funding and the maturity of company

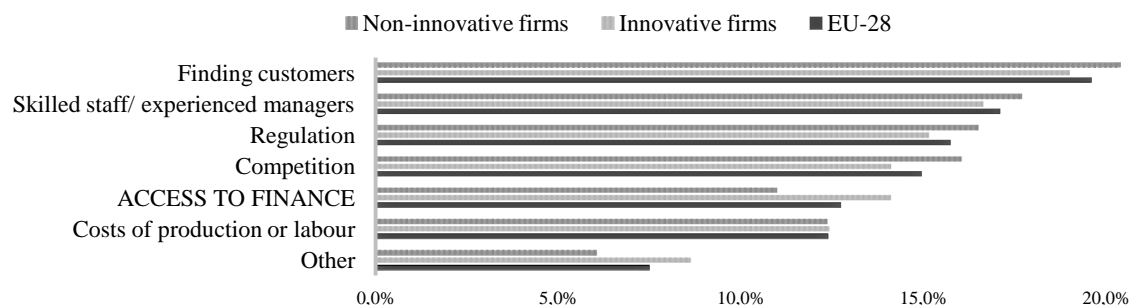


Source: Manigart and Witmeur (2009:9).

2.4. How easy is it to have an access to external financing?

According to the Community Innovation Survey (CIS) and Survey on the Access to Finance of Enterprises (SAFE), ‘access to finance’ is in the top 5 of the main obstacles for EU enterprises (Figure 7). This problem is even more pressing for innovative firms⁴ than for non-innovative ones and it is the obstacle where the difference between innovative and non-innovative firms is higher. Indeed, according to Lee *et al.* (2015:371) innovative SMEs have a higher probability for applying than other firms (higher demand), but they are also more likely to find it difficult to access to finance (restricted supply).

Figure 7. What is currently the most pressing problem your firm is facing?



Source: European Commission (2014a)

2.5. Why innovative-firms find more difficulties to access to finance?

According to the European Commission, financial markets and financial institutions are traditionally reluctant to invest in R&D projects, because they bear a higher uncertainty/risk, compared to more traditional business projects. Firms need to find alternative channels to traditional bank loans, in order to finance their creation or expansion investments. Thus, when private sources are insufficient, banks refuse loans and governments’ grants are not suitable for a specific project, the remaining options are: i) convincing a Business Angels to invest; ii) finding an established industrial company interested in the project (corporate Venture Capitalist); or iii) going to a Venture Capitalist (Bottazzi and Da Rin, 2002:234). Indeed, according to Riding *et al.* (2012), firms that invest in R&D are more likely to seek equity financing. Moreover, for innovative firms, equity funding is also associated with R&D intensive innovation, while for incremental innovation, debt financing is more often used (Casson *et al.*, 2008).

In the present paper, special attention will be given to Venture Capital (VC) and Business Angels (BA) (see definition in Figure 8), given that these two equity finance instruments are linked with innovation (Faria and Barbosa, 2014; Dutta and Folta, 2016) and economic growth (Pistori and Venturelli, 2015). Venture Capital is effective in supporting firms to overcome credit and financial constraints (Bottazzi, 2002 and 2009), but the selection process of firms backed by VC is

⁴ An innovative firm is one that has implemented an innovation during the period under review (OECD, 2005).

hard, complex and slow. According to Manigart and Witmeur (2009), for each 100 applications to VC funding only 1 are accepted. This is why European Commission under Horizon 2020 includes a specific section on 'Access to Risk Finance'. As envisaged (see González, 2013), part of the Horizon 2020 budget would not be provided through grant funding but in the form of risk-sharing (for loans and guarantees) and by providing risk finance (equity). "This covers a set of debt and equity financial instrument facilities and a range of accompanying measures that scale up and refine the debt financial instruments and the early-stage equity facility" (European Commission, 2014b:35). On the debt side, two instruments need to be highlighted, namely the Risk-Sharing Facility Financing (RSFF) and the Risk-Sharing Instrument (RSI).

Figure 8. Debt and equity finance instruments focused on the topics of the paper

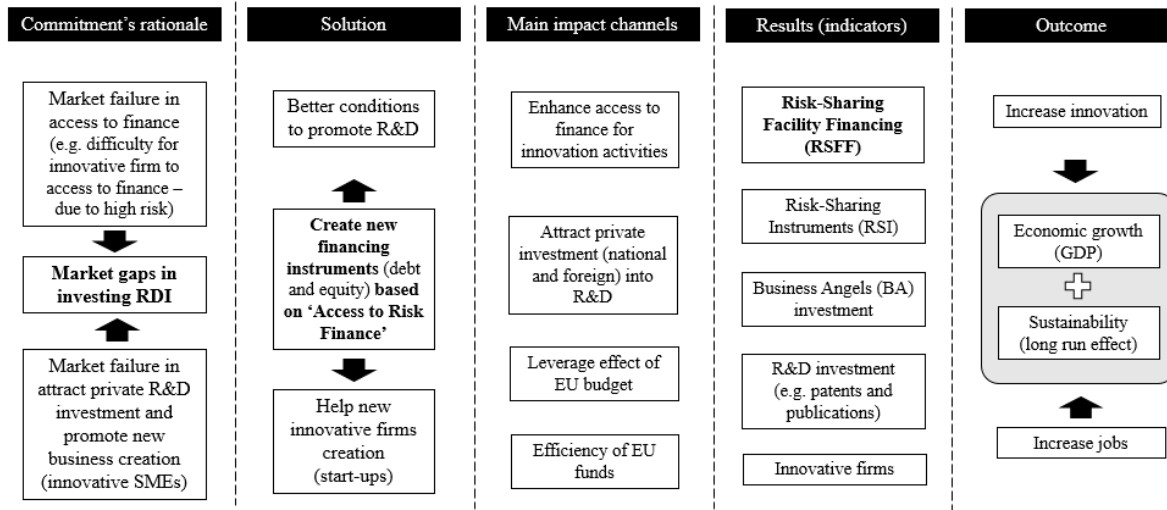
DEBT FINANCE	Risk-Sharing Finance Facility [1]	<ul style="list-style-type: none"> ▪ The Risk-Sharing Finance Facility was created in 2007 by the European Commission and the EIB. ▪ Sharing the risk between the Commission and the EIB allows the RSFF to produce additional loans for R&D projects. The loans will benefit those R&D projects (including infrastructure projects) which have a strong European dimension.
EQUITY FINANCE	Venture Capital [2]	<ul style="list-style-type: none"> ▪ "A VC is a financial intermediary, meaning that it takes the investors' capital and invests it directly in portfolio companies". ▪ "A VC takes an active role in monitoring and helping the companies in its portfolio". ▪ "A VC's primary goal is to maximize its financial return by exiting investments through a sale or an initial public offering (IPO)".
	Business Angels [2]	<ul style="list-style-type: none"> ▪ "Angel investors are similar to VCs but in some ways differ because Business Angels use their own capital". ▪ "BA could be wealthy individuals with no business background who are investing in the business of a friend or (...) groups of angels with relevant business or technical backgrounds who have banded together to provide capital and advice to companies in a specific industry". ▪ "BA tend to focus on younger companies than do VCs and make a larger number of smaller investments".

Source: Authors own elaboration based on [1] EC Website and [2] Metrick and Yasuda (2010:3-4).

3. Financial instruments for growth and innovation

Under the commitment 10 of Innovation Union, the European Commission highlights that the EU market fails in attracting private R&D investment and promoting new innovative business, because there is also a market failure in the access to finance (Figure 9). One goal of the European Commission (2014b:35) is to close the market gaps in investing in growth and innovation, namely by putting in place financial instruments to support investment in early stages of start-up development, to enhance venture capital investment for fast growing firms and to ensure access to loans for innovative fast growing SMEs. The present section focuses essentially in understanding: i) why and how putting in place new financial instrument could attract private finance; and ii) how and when Venture Capital (VC) and Business Angel (BA) can foster innovation and economic growth.

Figure 9. Commitment 10 map



Source: Authors own elaboration based on European Commission (2014b).

3.1. Debt Finance and Risk-Sharing

Bank loan is the most common example of debt finance and the selection process is essentially based on the credit risk. According to Zribi and Boujelbène (2011), Louzis *et al.* (2012), Chaibi and Ftiti (2015), the determinants of credit risk rest both on macroeconomic and microeconomic dimensions. These authors showed that growth of GDP, inflation, exchange rate, interest rate, unemployment rate and public debt are the main macroeconomic variables that influence the level of the risk. At the micro-level, they highlight firms' financial performance (such as, return on equity, solvency ratio and leverage), firm size and ownership structure as main factors. Inevitably, as the size of the firm matter, SMEs have more constraints in accessing the credit market (Beck and Demirgüç-Kunt, 2006) and the obstacles are still higher for innovative firms (Lee *et al.*, 2015). However, according to Angilella and Mazzù (2015), when banks are faced to an innovative SMEs, the assessment of credit risk and the linked uncertainty can be improved by experts' judgments, because in these cases evaluation based on business plans, market trends and the managerial capacity of a team are not enough. On the other hand, is also important to highlight that firms' risks over the innovation cycle are non-linear and are distinct across the different phases (Dockner and Siyahhan, 2015). The R&D phase corresponds to the phase where the risks are higher compared to the other next steps of the innovation cycle (Figure 10) and where firms needs for funding are the highest.

Figure 10. Risk level over the innovation cycle

Innovation phase	R&D	Trial	Market Introduction
Risk level	Risk is high as the firm faces high operating leverage originating from R&D fixed costs together with technological uncertainty.	Risk is significantly lower and dominated by option risk to launch the product in the market.	Risk is equivalent to the asset risk of the company.

Source: Docknet and Siyahhan (2015).

When financial markets do not work properly, government intervention is needed in order to close the market gaps in investing in innovation. Under the seventh Framework Program (FP7), the European Commission launched two financial debt instruments, i.e. the Risk-Sharing Facility Financing (RSFF) and Risk Sharing Instrument (RSI) in order to help firms with a highly risky project to have access to bank loan.

Risk-Sharing Facility Financing (RSFF) is an instrument launched in 2007 through a partnership between the European Investment Bank (EIB) and the European Commission. It is expected that every euro provided by the partners will be translated into five euros of Research, Development and Innovation (RDI) investment (see appendix 1). RSFF “will cover, through capital allocation and provision, the risks borne by the EIB when lending directly to the promoter, or when guaranteeing loans made by financial intermediaries, e.g. banks in Member States and Associated Countries”⁵. This debt-based financial instrument promotes investments in RDI projects with high innovation potential that might otherwise not occur, due to the high risk⁶ and uncertainty (European Commission, 2011a:6). Private investment and finance are also encouraged because the beneficiary must provide a share of investment from its own resources or from other investors as well (European Commission, 2011a:7). On the other hand, once a project is selected by the EIB, it becomes more attractive and confident for other private investors, thanks to the EIB’s expertise in evaluating complex and high-risk projects (European Commission, 2011a:7).

Risk Sharing Instrument⁷ (RSI) is a facility under RSFF to support innovative SMEs and Smaller Mid-caps managed by the EIB and the EC through the European Investment Fund (EIF). Under RSI scheme, the EIF is providing guarantees to banks and leasing companies, which supports SMEs and Small Mid-caps with innovation potential or with a focus on R&D and innovation. Reducing credit risks and lower capital consumption achieved through the guarantee, the EIF encourages financial intermediaries to extend new loans and leases to innovative enterprises on more attractive terms.

3.2. Equity Finance

The European Private Equity & Venture Capital Association (EVCA), recently re-named “Invest Europe”, defines Private Equity (PE) such as, a form of medium to long-term equity investment into private companies not listed on the stock exchange. According to this association, “Private

⁵ RSFF brochure: http://ec.europa.eu/invest-in-research/pdf/download_en/rssfb_brochure.pdf (accessed on 11 December 2015).

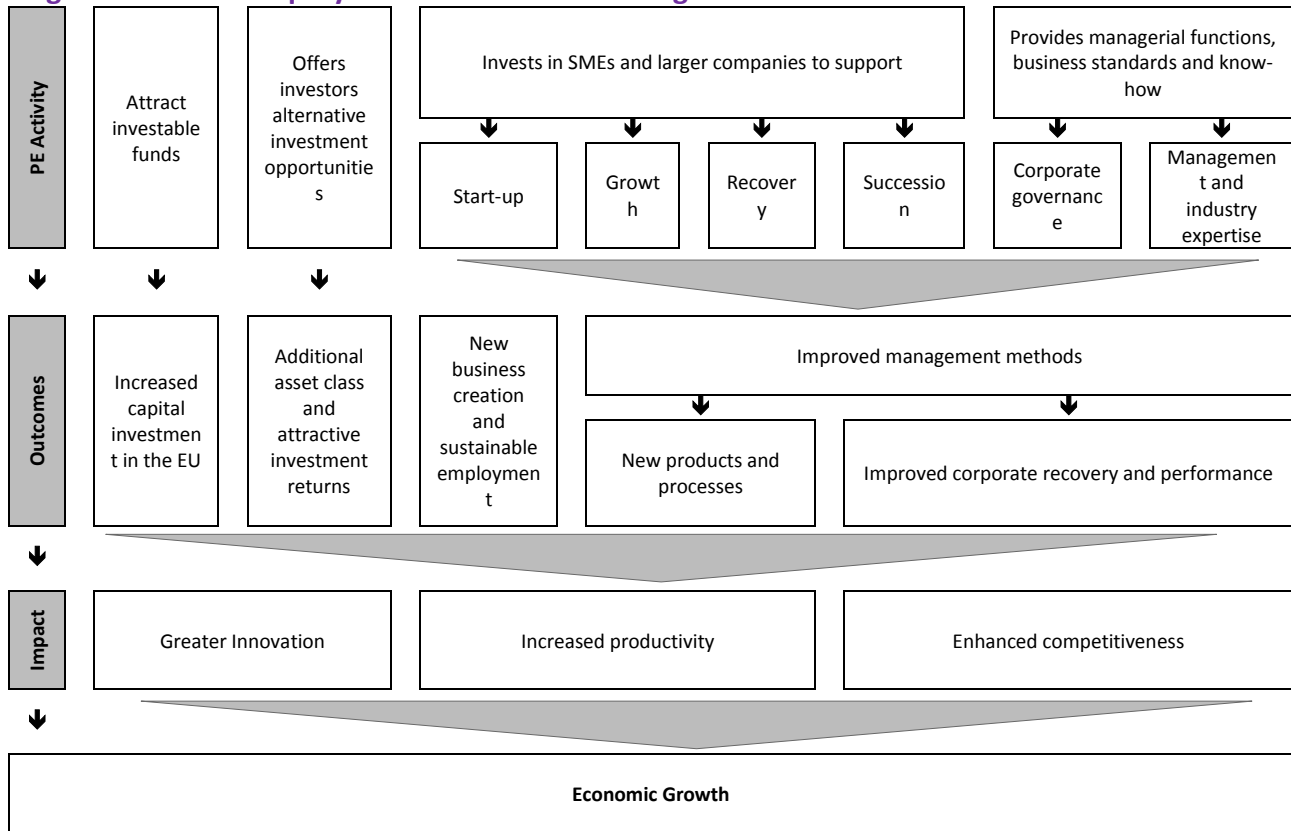
⁶ RSFF coverage project which risk is comparable with the following categories used by global ratings agencies for sovereign and corporate debt: from ‘BBB-’ to ‘B-’ of S&P and Fitch and from ‘Baa3’ to ‘B2’ of Moody’s (European Commission, 2011:7).

⁷ RSI Flyer: http://www.eif.org/news_centre/publications/07_fei_flyer_rsi_en.pdf (accessed on 11 December 2015).

equity builds better businesses by strengthening management expertise, delivering operational improvements and helping companies to access new markets”⁸.

Studies have demonstrated that Private Equity can improve performance of PE-Backed firms (Frontier Economics, 2013), increase innovation, measured by patent applications, (Popov and Roosenboom, 2009b) and help new business creation (Popov and Roosenboom, 2009b; Samila and Sorenson, 2011). On the other hand, according to Gemson *et al.* (2012), PE can leverage the investment amount and even to share the risk of a project. These authors showed that: i) projects with PE investment were larger than when compared to project with no PE funding; and ii) in developing countries, PE investment in infrastructure have a higher number of sponsors, without any corresponding increase in the project size, which means that PE investors can help to share the project risk. With all these interactions between inputs, outcomes and impacts, it is expected that Private Equity activity leads, at the end, to economic growth (Figure 11).

Figure 11. Private Equity activities and economic growth



Source: Frontier Economics (2013:15).

⁸ See Invest Europe Website: <http://www.investeurope.eu/about-private-equity/private-equity-explained/> (accessed on 14 December 2015).

There are many types of private equity investors and funds, however, in the present paper we only focus on Venture Capital and Business Angels, since Venture Capital is more dedicated to start-up companies with innovative ideas and Business Angels to the seed investment.

3.2.1 Venture Capital

The concept of Venture Capital was born in 1946 in the USA and “has become the form of financial intermediation most closely associated with dynamic entrepreneurial start-ups⁹, especially in high-tech industries like biotechnology, information technology (IT) and e-commerce” (Bottazzi and Da Rin, 2002:233).

Venture Capitalists provide financial, managerial and monitoring support, however, the role of this entity depends on the firm stage in which the support is offered (see Figure 12). According to Hellmann and Puri (2000:980), VC provides different contributions for different types of companies: “for imitators, venture capital matters in terms of providing financial resources, and for innovators, it matters in other dimensions, such as for instance product market aspects”.

Figure 12. The stage and roles of venture capital financing

STAGE OF FIRM	ROLE OF VENTURE CAPITALIST
Seed finance	Help to explore the viability of a project, financing small investment, which allows entrepreneur to verify whether the project is feasible and economically attractive.
Start-up finance	Support the company organization and corporate strategy. Investment is aimed to start and operationalize the firm: contracting employee, developing prototype, implementing marketing test, etc.
Expansion finance	Help to find additional clients and suppliers, recruit marketing and other non-technical executives. Financial support is needed in order to reach industrial-scale production, upgrade the production facilities and attract further employees.
Later stage finance	Financial assistance to become market leader and support company in the VC exit stage for trade sale or Initial Public Offering (IPO).

Source: Authors own elaboration based on Bottazzi and Da Rin (2002:237).

The selection process of VC funded firms is essentially based on firms’ characteristics and performance. In general, innovating firms are more likely to obtain venture capital investment and faster compared to imitator firms (Hellman and Puri, 2000). VC tends to select firms with a higher number of patent applications (Engel and Keilbach, 2007), profitability, labor productivity, sales growth and R&D activities (Guo and Jiang, 2013).

⁹ Start-up is defined as “a new company created by an entrepreneur in a high-tech industry” (Bottazzi and Da Rin, 2002:235).

The studies assessing the impact of Venture Capital can be divided in four different levels:

- Firm-level (e.g. Hellmann and Puri, 2000; Bottazzi and Da Rin, 2002; Davila, Foster and Gupta, 2003; Engel and Keilbach, 2007; Capizzi *et al.* 2011; Croce et al., 2013; Guo and Jiang, 2013; Paglia and Harjoto, 2014; Colombo *et al.*, 2016);
- Country-level (e.g. Groh, von Liechtenstein and Lieser, 2010; Geronikolaou, and Papachristou, 2012; Prohorovs and Pavlyuk, 2013; Faria and Barbosa, 2014);
- Industry-level (e.g. Kortum and Lerner, 2000; Sahaym *et al.*, 2010; Hirukawa and Ueda, 2011);
- Regional-level (e.g. Pistoresi and Venturelli, 2015).

At the firm-level, several authors (Davila, Foster and Gupta, 2003; Colombo and Grilli, 2005; Engel and Keilbach, 2007; Guo and Jiang, 2013; Paglia and Harjoto, 2014) found that on average VC backed firms outperform non-VC backed firms.

The presence of VC firms has a positive impact on growth (Davila, Foster and Gupta, 2003; Paglia and Harjoto, 2014) and in company' size (Colombo and Grilli, 2005), measured by the number of employees (increase of jobs). However, according to Paglia and Harjoto (2014) the durability of this impact is shorter. This conclusion is in line with the results of Capizzi *et al.* (2011:224) who found that the presence of VC or PE seems to enhance productivity (value added per employee) but only in the short term (year of VC entry). However, these authors also report that after VC or PE entry, funded firms gain greater access to bank credit at better terms (certification effect). This conclusion converges to the findings of Davila, Foster and Gupta (2003), which defend that Venture Capital funding is an important signal about the quality of the start-up project/investment.

Other interesting conclusions were also emphasized by Engel and Keilbach (2007), Capizzi *et al.* (2011) and Guo and Jiang (2013), which focus on German, Italian and Chinese firms respectively. These authors showed some evidence that VC does not improve innovation. According to Engel and Keilbach (2007), after a VC investment, the difference between venture-funded and non-venture-funded firms in the probability to apply for at least one patent is insignificant. Capizzi *et al.* (2011) demonstrated that after VC and PE entry the growth and investment in fixed assets slowdown. Guo and Jiang (2013) found no evidence of improvement in sales growth or R&D investment of the VC-backed firms after the VC entry. Some explanations highlighted by the authors are that VC seems to focus rather on commercialization of existing innovations and growth of the firm (Engel and Keilbach, 2007) or in the implicit aim to consolidate firms' result (Capizzi *et al.*, 2011).

According to the Venture Capital and Private Equity (VCPE) country index, Germany ranks slightly above the average and Italy is below (Groh, von Liechtenstein and Lieser, 2010). So can the impact of VC on innovation be generalized to other countries or at European Union level?

At country and industry level analysis, Geronikolaou and Papachristou (2012), Faria and Barbosa (2014) and Hirukawa and Ueda (2011) also report similar conclusions for the European countries and US industry than Engel and Keilbach (2007) and Capizzi *et al.* (2011). When innovation is measured by patent applications, Hirukawa and Ueda (2011) econometric results suggest that patenting activities slowdown in the US industry, once firms obtain VC funding. At European

level, Geronikolaou and Papachristou (2012) demonstrated that VC investments do not cause patents but patents cause VC investment, which suggest that innovation precedes VC investment. However, Faria and Barbosa (2014), found that VC financing in the later stage of the firm’s creation has a positive impact on innovation, which suggests that VC is more helpful in the commercialization of innovation results rather than to foster its creation.

Certainly, if the main goal of VC is the maximization of financial return (Metrick and Yasuda, 2010:3), it can be expected that this source of funding focuses more on the profitability of investments already carried out and with a market potential rather than on more uncertain projects’ investments.

In general, venture capitalists invest in firms with the aim to exit after 4 - 7 years and to realize a positive return on investment (Schwienbacher, 2008:1888). According to Prohorovs and Pavlyuk (2013), the level of the country economic development and the level of the Initial Public Offering are important determinants of VC investment. Exit conditions for VC are also important in the selection process of firms to be funded. Schwienbacher (2008) found that start-up financed by VC choose their innovation strategy (innovative or imitative) based on the investors’ exit preferences (see exit route option in Figure 13). For example, “more innovative and profitable ventures are more likely to go to an IPO than ventures with more imitative or derivative projects” (Schwienbacher, 2008:1911).

Figure 13. Description of main Venture Capitalist exist route

EXIT ROUTE	DESCRIPTION
Initial Public Offering (IPO)	The company is listed on stock market and the VC share is sold to one or different investors
Trade Sale (TS)	The venture is sold to another company which acquires the innovative technology, if the entrepreneur does not find the funds required to buy out the VC
Liquidation	The entrepreneur is unsuccessful in developing the new product and the venture is liquidated

Source: Authors own elaboration based on Schwienbacher (2008:1895).

3.2.2. Business Angels

Another equity financing instrument, which shares some similarities with Venture Capital, is represented by Business Angels. The EBAN (European Trade Association for Business Angels, Seed Funds and Early Stage Market Players) Glossary¹⁰ defines a business angel as “an individual investor (qualified as defined by some national regulations) that invests directly (or through their personal holding) their own money predominantly in seed or start-up companies with no family relationships”. Business Angels provide not only financial support for high-risk projects and start-ups, but also assistance in the management and strategy development (Dibrova,

¹⁰ <http://www.eban.org/glossary-page> (accessed on 22 July 2016).

2015:286). The main differences between a Venture Capital and a Business Angels are that: i) Business Angels focus more in the seed and early stage than Venture Capitalists (Dutta and Folta, 2016) and consequently in firms or projects with a higher risk (Manigart and Witmeur, 2009:9); ii) Business Angels have a more limited capacity of funding than Venture Capitalist (Hellman and Thiele, 2015:640). Nevertheless, like for Venture Capitalists, the potentially high return on investment (ROI) and the exit strategy are also two important criteria for investors and entrepreneurs (Dibrova, 2015:283), which influence the selection process.

Despite the critical importance of Business Angels for an entrepreneurial economy (Mason and Harrison, 2015), the majority of impact assessment of private equity are more focused on venture capitalist (Dutta and Folta, 2016). However, in the last years some studies have been carried out such as Mason and Harrison (2015), Hellman and Thiele (2015) and Dutta and Folta (2016).

Mason and Harrison (2015) shown that, during the 2008 financial crisis, business angels played an important role in the UK economy, through financing entrepreneurial businesses when banks and venture capitalists reduced their levels of investments.

Regarding to this last conclusion how could Business Angels and Venture Capitalist interact in the market? Are these entities complementary? Hellman and Thiele (2015) studied the interrelationship between both types of investors and found that, on the one side, they are complementary, because Business Angels have limited funds and need VCs for providing the follow-on funding of their company, and VC also needs Business Angels for their own deal flow. However, on the other side, they are also competitors, when at the later stage the venture capitalists no longer need the Business Angels to make the investment funding (Hellman and Thiele, 2015:640).

In the light of these findings, what can be said about the performance of Business Angels and Venture Capitalist? Dutta and Folta (2016) compare Business Angels and Venture Capitalist on the basis of a sample of made North American firms. They found that group composed of Business Angels and early stage VCs have a similar impact on the innovation rate, measured by patent applications. However, the findings also conclude that there are no marginal benefit of receiving VC investment if a firms had already received funding form Business Angels (or vice versa), because the effects are non-additive (Dutta and Folta, 2016:41). Regarding to the success in the commercialization phase, the authors found that the impact of VC is higher compared to the Business Angels' one.

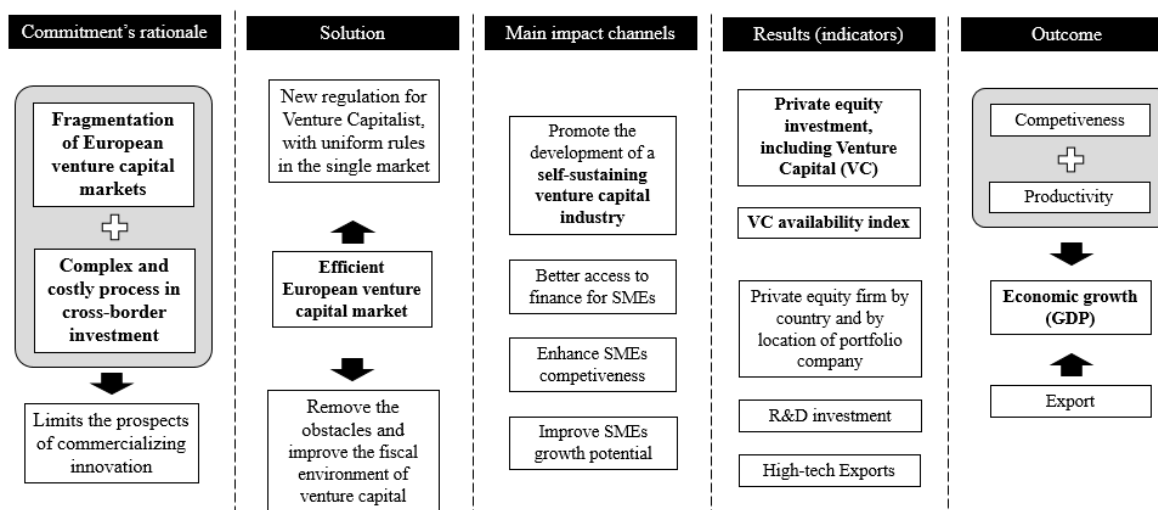
4. Cross-border and matching innovative firms with investors

4.1. Cross-border venture capital investment

With the aim to promote better access to finance for SMEs, the European Commission introduced in 2011 a new regulation, entered into force in 2013 and with the goal to make it easier for venture capitalists to raise funds across Europe for the benefit of start-ups (European

Commission, 2014b:36). By removing the obstacles and improving the fiscal environment of VC, the European Commission seeks a more efficient European venture capital market, able to enhance innovation, competitiveness and growth. The goal of commitment 11 of Horizon 2020 (Figure 14) is precisely to ensure cross-border operation of venture capital funds.

Figure 14. Commitment 11 map



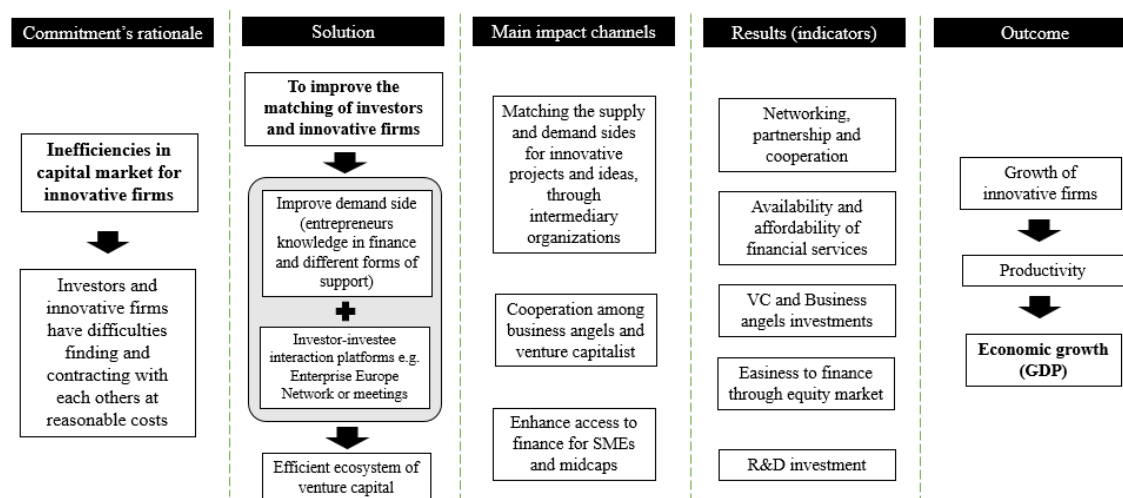
Source: Authors own elaboration based on European Commission (2014b).

The literature about the geography of venture capital investment (see e.g. Mason and Harrison, 2002; Guo and Jiang, 2013; Jääskeläinen and Maula, 2014; Espenlaub *et al.*, 2015) converge about the importance and added value of cross-border venture capital. On the one hand, the supply of venture capital is not equally distributed across regions and in order to close the gap in the most disadvantaged areas, firms need to attract VC from elsewhere (Mason and Harrison, 2002). Actually, VC is even more effective in the poorest regions in promoting regional economic growth (Pistoresi and Venturelli, 2015). On the other side, foreign VC compared to domestic VC appear to add more value to firm after the investment, as demonstrated Guo and Jiang (2013). These authors, which compared the effect of foreign and domestic VC investment on Chinese firms' performance, explain their results by highlighting that foreign VCs have more expertise in monitoring and providing support to their portfolio companies compared to domestic VCs. Another interesting conclusion of the study is that, conversely to domestic VC, foreign VC backed firms intensify their R&D investment after the original investment is made. This finding is very relevant if we compare with the results of other studies which do not make a distinction about the location of the portfolio of VC companies and the location of private equity firms. Espenlaub *et al.* (2015) also found that cross-border VC investment could speed up VC backed firms' performance in North America, because the time to exit through IPO (initial public offering) or an M&A (merger and acquisition) is shorter than for domestic VC investments. However, the exit performance is also linked with the degree of economic freedom in the domestic country (Wang and Wang, 2012) and could be improved through partnerships between foreign and local VC (Dai *et al.*, 2012).

4.2. Matching innovative firms with investors

The commitment 11 previously cited is also linked with the commitment 12 of Innovation Union (Figure 15) whose target is to strengthen cross-border matching of innovative firms with investors. Indeed, it is important not only to improve the financial ecosystem, but also to develop instruments focused on: i) Matching the supply and demand sides for innovative projects and ideas, through intermediaries' organizations; ii) Developing a new 'financial culture' among entrepreneurs, improving their knowledge in finance and in different forms of support; and iii) Promoting the cooperation among Business Angels and Venture Capitalists.

Figure 15. Commitment 12 map



Source: Authors own elaboration based on European Commission (2014b).

'Enterprise Europe Network' is an example of an interactive platform, created by the European Commission with the aim to connect SMEs and match business opportunities. Services are offered to SMEs by its member, such as chambers of commerce and industry, technology centers, universities and development agencies.

Networking, partnership and cooperation are keywords in fostering access to finance (Dai *et al.*, 2012; Jääskeläinen and Maula, 2014) and in making the innovation ecosystem more efficient (Samila and Sorenson, 2010; Colombo *et al.*, 2016).

Network in financial intermediaries could mitigate the effects of distance in cross-border venture capital, because it facilitates the identification of investment opportunities among partners and have also a certification effects about the project quality (Jääskeläinen and Maula, 2014). Partnership between a foreign and local venture capitalist could also improve the VC backed firms' performance, measured by the success of VC exit (Dai *et al.*, 2012).

The strong interaction between private financial intermediation and public research funding appears to bring positive effects on promoting entrepreneurship (creation of new firms) and innovation (rates of patenting) (Salima and Sorenson, 2010). The study of Salima and Sorenson

(2010) show that US regions which receive high levels of public funding to R&D (innovation and firm creation stimulus) are also those who benefit from an influx of venture capital. On the other side, according to Colombo *et al.* (2016), VC has a positive impact on EU-funded R&D partnerships for new technology-based firms. Both studies highlight the importance of an effective innovation ecosystem as a whole, where different players interact together.

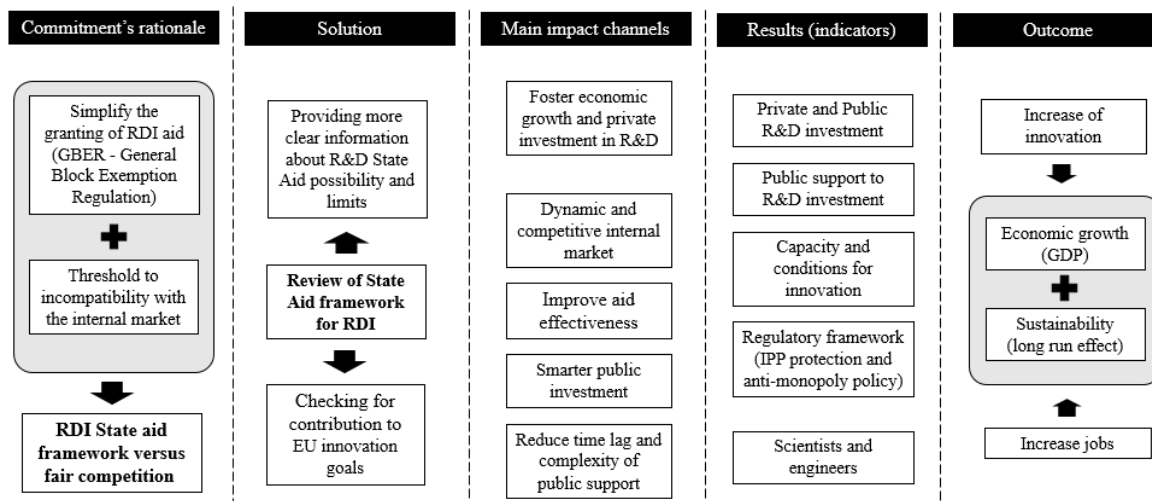
5. State Aid Framework for RDI

In order to assess the effectiveness of the legal framework for RDI State aids revised in 2008, the European Commission conducted in 2011 a Mid-Term Review of the Community Framework for State Aids (European Commission, 2014b:38). The study concluded “that the current Framework has so far constituted a useful instrument for well-targeted public support (...), [however,] the possibilities offered by the R&D&I Framework and the GBER (General Block Exemption Regulation) have not been utilized by the Member States to their full extent” (European Commission, 2011b:7).

The European Commission launched in 2012 the State Aid Modernization (SAM) and, in order to simplify the granting of RDI aids, a new General Block Exemption Regulation (GBER) was developed (European Commission, 2014b:38).

Commitment 13 of Innovation Union focuses on a Review of State Aids Framework for RDI, aims at: i) providing a clearer information about R&D State Aid possibilities and limits; and ii) checking for its contribution to the EU innovation goals (Figure 16). This section will focus on: i) understanding the threshold to incompatibility of state aids with internal market rules; and ii) how and when State Aids can enhance RDI.

Figure 16. Commitment 13 map



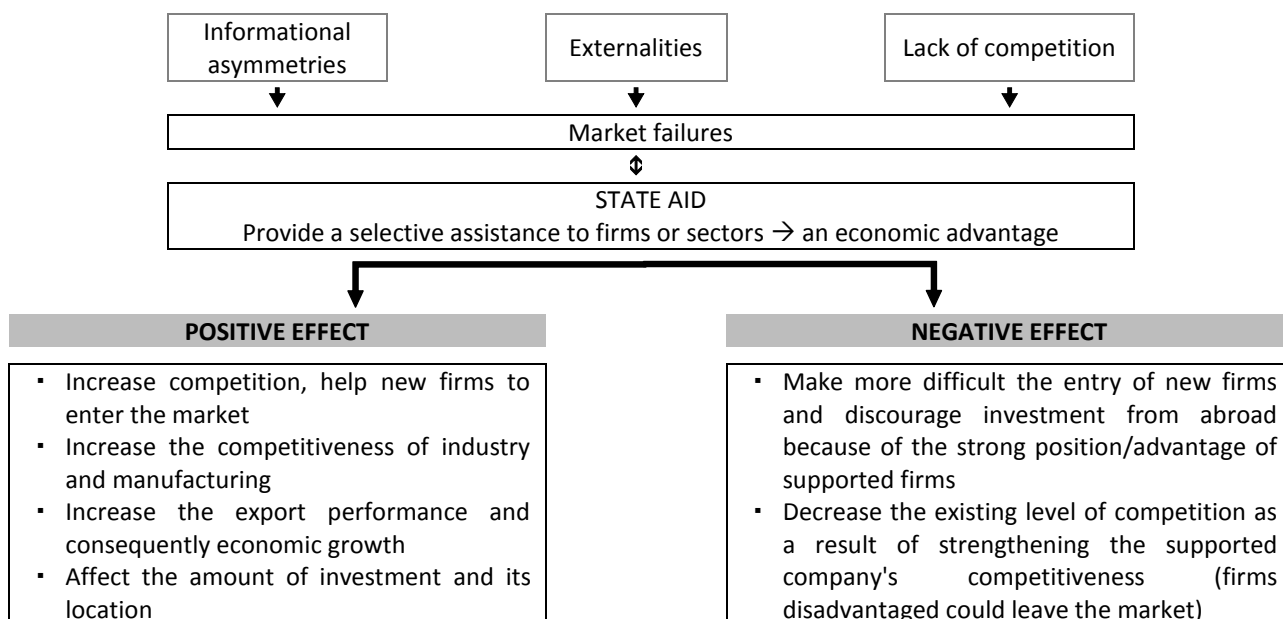
Source: Authors own elaboration based on European Commission (2014b).

5.1. State Aid and Competition Policy

The focus of industrial policy is on industrial sectors and firms, with the aim to regulate activities, to support innovation and to promote competitiveness and sustainability. For example, state aids that support the manufacturing sector have a positive impact on export performance (Holzner and Stöllinger, 2013) and consequently on the economic growth (Dritsaki and Stiakakis, 2014; Szkorupová, 2014) of Member States. However, in the EU, state aids are also restricted and regulated by the EU competition policy in order to contain their potential negative economic impact. “The aim of the EU competition policy is to safeguard the correct functioning of the Single Market, [ensuring] that enterprises have the possibility to compete on equal terms on the markets of all member states” (Szczepański, 2014:1).

State aids support can be considered as creating a distortion of competition within the Internal Market of the EU to the extent that it provides an economic advantage to particular entities or sectors, which in turns affects trade between EU Member States (Sciskalová and Münster, 2014:224). The distortion of potential competition only exists “if the aid is considered to hinder the entry of new competitors into the market” (Wishlade, 2003:10) or leads the undertakings to leave the market. On the other hand, state aids also have the function to alleviate market failures. Yet, when the public support is excessive it can represent a barrier to entry for new firms and decrease the real level of competition (Figure 17).

Figure 17. Functions and potential impact of state aid



Source: Authors own elaboration based on Sciskalová and Münster (2014), Spector (2009) and Szczepański (2014).

“The EU prohibits in principle any public measure that constitutes a state aid” (Nicolaidis, 2013:2), since it is considered incompatible with the definition and purpose of the Internal Market (Szczepański, 2014:12)¹¹.¹⁰ Nevertheless, some exceptions exist, such as for instance regional aids specifically designed to certain disadvantaged areas, sectorial aids for structural problems in specific sectors and horizontal aids targeting all economic sectors, e.g. R&D activities (Szczepański, 2014:12). Public funding to support private R&D is an example of state aid allowed, under certain conditions, by the EU law.

5.2. State Aid, Innovation and Effectiveness

When countries or regions are faced with market failures, such as, the difficulty to access to finance, public support can foster innovation (Falk, 2007; Un and Montoro-Sanchez, 2010; Afcha and López, 2014; Radas *et al.*, 2015) and this effect is even higher during crisis periods (Paunov, 2012; Moşteanu and Romano, 2013). According to Paunov (2012), the recent economic and financial crisis led many firms to stop ongoing innovation projects, but firms with access to public funding were less likely to abandon innovation investments. On the other hand, Moşteanu and Romano (2013), who assessed the effectiveness of the EU Competition Policy, also found a positive impact of this instrument on economic development, especially during the crisis period, given its effect on reviving the EU economy.

The main public policies to support R&D activities are: i) grants and direct funding; ii) tax incentives; iii) public-private partnerships; iv) loans and guarantees; v) market regulation; vi) knowledge-based environments (e.g. science parks).

The effectiveness of the public intervention to support R&D was assessed by several authors, such as, Hyttinen and Toivanen (2005); Muscio *et al.* (2013); Takalo *et al.* (2013); Antolín-López *et al.* (2015); Radas *et al.* (2015). The effect of public instruments on leveraging private R&D or innovation have nevertheless some restrictions.

Hyttinen and Toivanen (2005) found that in the presence of capital market imperfections, public policy can complement capital markets. These authors demonstrated that “firms in industries that are more dependent on external financing invest relatively more in R&D and are relatively more growth-oriented when they can benefit from more government funding (potentially) available” (Hyttinen and Toivanen, 2005:1402). However, when the cost of external finance taken into account, Takato *et al.* (2013) showed that a higher costs will lead to a lower optimal subsidy amount which will make greater additionality impacts of public funding in the firms and industries with a small knowledge spillover effects.

Radas *et al.* (2015) found that direct subsidies used alone or with tax incentives enhance R&D activities of the Croatian SMEs compared to firms that did not use any of the two instruments,

¹¹ The European Commission defines the internal market as a “single market in which the free movement of goods, services, capital and persons is ensured and in which European citizens are free to live, work, study and do business. Since it was created in 1993, the single market has opened more to competition, created new jobs, defined more affordable prices for consumers and enabled businesses and citizens to benefit from a wide choice of goods and services” (EC Website).

although the effects of policy measures are not much different when users of direct grants are compared with those who used both the grants and the tax incentives. When the distinction is made between new and established firms, Antolín-López *et al.* (2015) found that some instruments are more effective than others in fostering product innovation, in function of the firm's maturity state. These authors conclude that for new ventures the participation in trade fairs and networking with other companies are the most effective support, whereas, for established firms the most effective policies consisted in tax incentives and subsidies to R&D activities.

At last, if we focus on the effectiveness of public R&D spending in leveraging private R&D, Bogliacino and Lucchese (2011) highlighted that investment in public research can also promote private participation in innovation financing and this instrument of the innovation system could be an alternative when financial market fail, e.g. downturn phases of VC investment. Muscio *et al.* (2013:63) provide "evidence that government funding to universities complements funding from research contracts and consulting, contributing to increasing universities' collaboration with industry and activating knowledge transfer processes".

6. Conclusions

The paper has reviewed the main findings and conclusions of studies published in peer-reviewed journals, working papers and in the grey literature, in order to assess the theoretical mechanisms related to the commitments 10 to 13 of the Innovation Union and understand how they can be empirically assessed.

According to the Survey on the Access to Finance of Enterprises (SAFE), access to finance is in the top 5 of the main obstacles for EU enterprises and even this problem is more pressing for innovative firms, because inherent risks associated with their projects. In order to fill the market gap, new debt financing instruments were created by the European Commission in partnership with the European Investment Bank, such as, the Risk-Sharing Facility Financing and the Risk Sharing Instrument. These two tools aim at enhancing the access to finance and leverage private investment, by covering and sharing the risk of a project.

However, not all firms are eligible to RSFF or RSI. Faced with financial constraints, firms need to find alternative solutions for funding their projects or business creations. Venture Capital and Business Angels are two equity financing instruments dedicated to start-up companies with innovative ideas or in the seed stage. Despite VC-backed firms show a higher growth (Davila *et al.*, 2003; Paglia and Harjoto, 2014), financial and innovation performance compared to non VC-backed firms (Engel and Keilbach, 2007; Guo and Jiang, 2013), some studies (e. g. Capizzi *et al.*, 2011; Hirukawa and Ueda, 2011) also showed some limits of these impacts, in particular a slowdown in the innovation performance after the VC investment or the firm entry in the market.

To enhance access to finance, matching both the demand (entrepreneurs) and the supply (investors) sides is also very important, because entities such as venture capitalists are not equally distributed around European regions. Networking of financial intermediaries could

mitigate the effects of distance in cross-border venture capital (Jääskeläinen and Maula, 2014). In addition, foreign VC compared to domestic VC, appears to add more value to firms after the initial investment (Guo and Jiang, 2013).

Another way to enhance access to finance and fostering innovation is through public support to R&D activities (see e.g. Falk, 2007; Un and Montoro-Sanchez, 2010; Afcha and López, 2014; Radas *et al.*, 2015). However, Antolín-López *et al.* (2015) found that some instruments are more effective than others in fostering product innovation, in function of the firm's maturity state.

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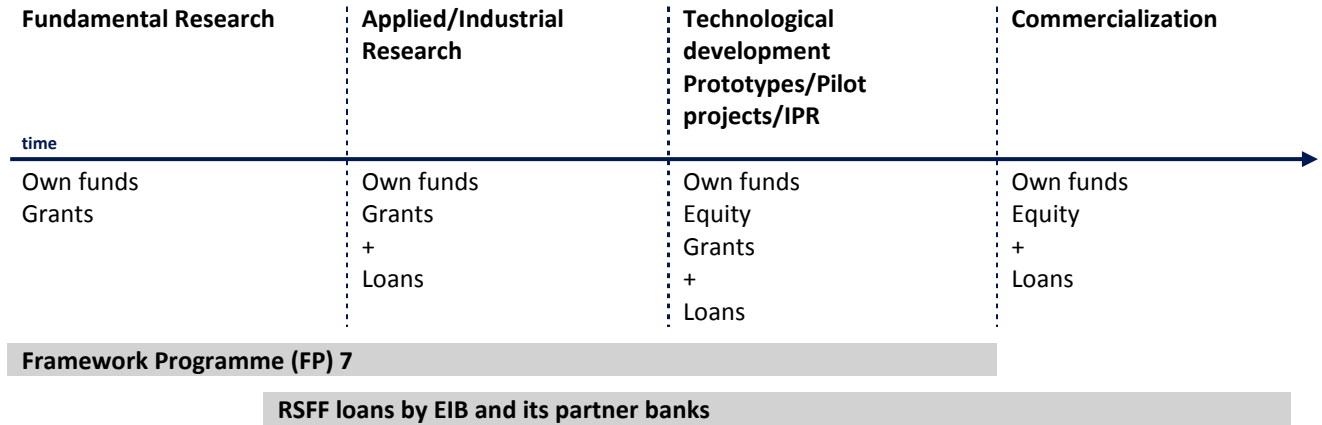
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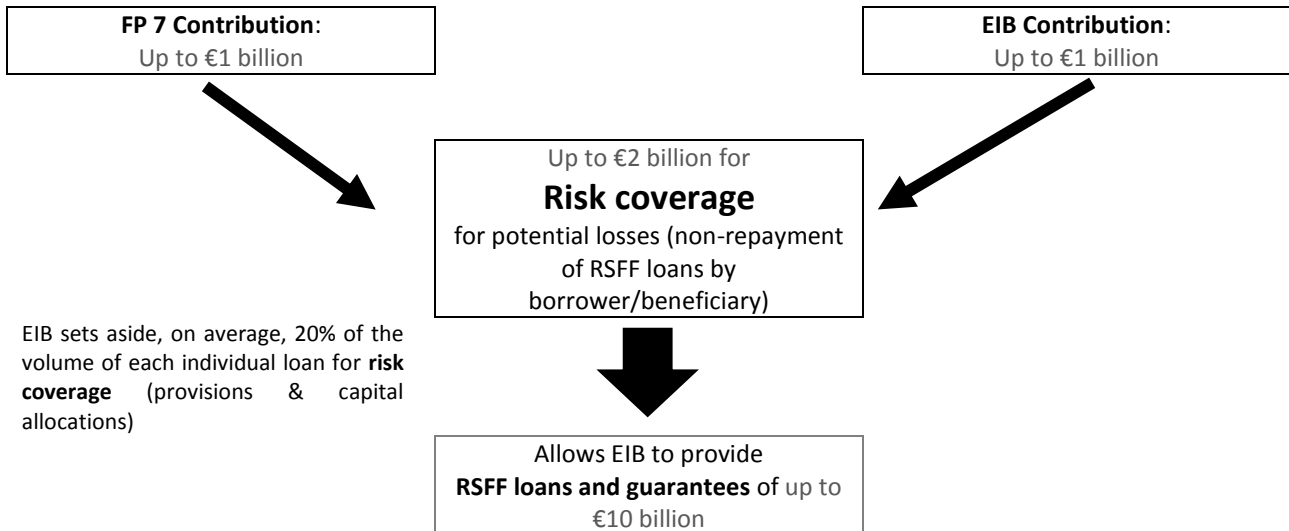
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Appendix 1. Risk Sharing Finance Facility (RSFF) Approach

Loans for R&D



Risk Sharing EC/EIB and Mobilisation of RSFF Finance



Source: Risk Sharing Finance Facility (RSFF) presentation: http://ec.europa.eu/invest-in-research/pdf/download_en/rsff_presentation.pdf (Accessed 15 December 2015)