

ECONOMICS – IMPACT STUDIES

Impact assessment of EIB venture debt



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Impact assessment of EIB venture debt

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Impact study, June 2022

This is a publication of the EIB Economics Department.

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Published by the European Investment Bank.
Printed on FSC® Paper.

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EXECUTIVE SUMMARY

A quantitative analysis was carried out to evaluate the impact of the EIB venture debt instrument on beneficiary firms. This is the first impact assessment of the EIB venture debt instrument. It addresses the following question: what is the impact of EIB venture debt on beneficiaries' performance and how well do EIB beneficiaries do compared to similar firms that do not receive any form of venture debt (but may still receive other forms of finance)?

Venture debt is provided by the EIB to fill the scale-up financing market gap faced by high-growth, innovation-focused companies in the EU. It is an important tool to assist firms heavily involved in research to continue to invest in research and development and market expansion. The EIB has utilised venture debt to support select investments in biotech, new technologies and strategic technology development in areas like drug development and green energy. These research-focused companies have limited access to standard debt financing due to a low asset base and not yet having reached profitability.

EIB venture debt financing provides a long-term loan with the pricing linked to company performance that allows the company to continue investing and expanding. EIB venture debt is typically offered to companies that have already benefited from venture capital funding. It complements venture capital by allowing companies to build a healthy capital base, while not entailing a further dilution of the founders' equity stake. Venture debt entails a hands-off approach to the management of recipient companies. Therefore, it potentially provides a signalling effect to other financiers that a company is promising and soundly managed.

To look at the impact of the EIB venture debt on firms, the report presents a statistical analysis that measures the performance of supported firms relative to similar firms that did not access venture debt through the EIB or from other sources. Data on EIB debt beneficiaries is linked to firm-level data providing balance sheet and other information. The impact assessment covers EIB venture debt transactions from 1 May 2015 to 30 June 2021, with the start closely aligning with the beginning of the program. A counterfactual analysis is then carried out. This involves selecting a control group of firms that are similar to the ones that received EIB venture debt.

A control group of similar firms is set up by first identifying firms that have received venture capital, but not venture debt, from Prequin, a deal-level database that has information on venture capital transactions. Not only is raising venture capital financing a prerequisite to obtain EIB venture debt, but also venture capital firms share similar innovation and growth characteristics to firms raising venture debt. Venture capital firms have generally already demonstrated a solid track record in their business activities, including having a credible business expansion plan.

Next, among the set of venture capital recipients, a control group is identified by selecting companies with similar financial and employment characteristics and age to EIB venture debt recipients. From a set of 4,000 venture capital recipients for which financial and employment

information is available, a control group of firms is selected, based on the following characteristics:

- **Financial and employment.** Among the available 4,000 firms, firms are selected that are similar to the EIB venture debt beneficiaries in terms of the number of employees, total assets, fixed assets and long-term debt prior to receiving the loan.
- **Age profile.** Firms with a similar age profile only are included, i.e. founded in 2005-2018.

The impact of EIB venture debt financing is estimated empirically using data for the treated EIB venture debt beneficiaries and the control group before and after receiving venture debt. The findings are that relative to their peers—innovative firms that received venture capital and are similar in age and financial circumstances, but that did not receive any venture debt loan—EIB venture debt beneficiaries:

- **Higher firm growth.** Beneficiaries experience significant additionality in terms of firm growth, as measured by an increase in beneficiary firms' total assets. EIB venture debt beneficiaries report about 30% on average higher total assets in the years after the venture debt loan signature compared to their peers that did not receive venture debt loans.
- **Crowds in financing.** Beneficiaries receive additional financing from the market following the receipt of the EIB loan. Firms have an average of 250% additional long-term debt, defined as a firm's debt minus the volume of the EIB venture debt loan, after the loan signature. This is a substantial and statistically significant increase implying that the EIB venture loan is followed by increased investment by other financiers (a quantity effect). In addition, EIB venture debt recipients report an average reduction in the cost of debt by 14% upon receiving venture debt (a price effect), although this was not statistically significant.
- **Higher productivity.** Show strong additionality in terms of beneficiaries' productivity (as measured by a firm's value added). EIB venture debt beneficiaries' value added increased by about 50% on average relative to comparable firms that did not receive EIB venture debt financing.
- **Innovation.** Show a small increase in the number of successful patent applications, although not statistically significant.

EIB venture debt is a relatively new instrument. Therefore, the study examines the impact on firms one to three years after they received a venture debt loan. A follow-up study when further years of performance data is available would allow a deeper investigation of the longer-term impacts of the instrument. Nevertheless, the current study indicates the strong initial value of the EIB's venture debt program to recipient firms.

1 INTRODUCTION

Lack of sufficient collateral and asymmetric information are among the two largest market failures preventing young and innovative SMEs from accessing traditional bank-lending and giving rise to a “scale-up” gap. While lack of collateral prevents banks from getting hold of valuable assets in the event of a default, asymmetric information limits the extent to which banks are able to collect relevant information before and after issuing a loan. Innovative and young firms are even more exposed to these market failures, which also affect several funding rounds after the initial seed phase and discourage growth and investments. Aiming to reducing the size of the scale-up gap in Europe, the EIB has recently launched a venture debt product targeting innovative European SMEs.

The scale-up gap in financing for innovative European companies also raises questions on the optimal mix of debt and equity instruments. Equity investments are used to finance growth in the early stages of a firm’s life cycle (seed capital, venture capital series), while senior debt can serve as a more extensive source of funding later in a company’s life as it generates sufficient cash to service it. In between, firms that have already raised equity through various venture capital rounds and that are not yet ready to raise traditional debt, have increasingly opted for quasi-equity financing instruments such as venture debt. Venture debt provides firms with greater flexibility and a less constraining and performance-contingent repayment structure than traditional senior debt. It also avoids the dilution costs associated with additional equity injections.

The analysis presented in this report is the first impact assessment of the EIB venture debt instrument. The EU venture debt market has been growing over the last few years and the EIB has been playing a significant role in it. The EIB venture debt instrument targets specifically European fast-growing innovation-driven companies that have typically already raised venture capital. The current analysis assesses the impact of EIB venture debt on beneficiaries’ performance compared to similar firms that did not receive venture debt (but may still receive other forms of finance).

2 THE EIB VENTURE DEBT PRODUCT AND THE EU VENTURE DEBT MARKET

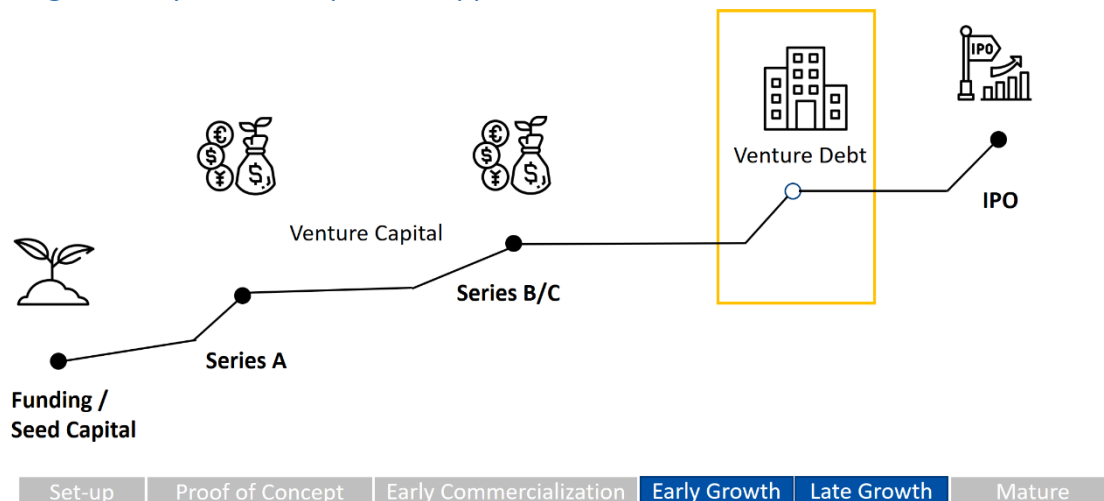
Venture debt is a debt product characterised by long maturity, designed to address the unique funding needs of fast growing innovative companies that have already raised venture (equity) capital. Venture debt is an important tool to assist small or medium-sized enterprises (SMEs) and mid-caps heavily involved in research to continue to invest in research and development and market expansion. These research-focused companies have limited access to standard debt financing due to a low asset base and not yet having reached profitability. The EIB venture debt product is structured to fit with investment plans. A longer loan maturity is extended to fit with full profitability forecasts, and for instance, repayment terms include a bullet repayment on maturity to facilitate repayment based on future funding plans. It is a quasi-equity product, with loan repayments depending on the performance of the company. The EIB gets warrants for

shares in the company when it makes a quasi-equity investment, but the founders have call and put options to retain their share.

A good time to raise venture debt is immediately after an injection of venture capital. Such venture capital exists in different series, with Series A typically issued after a privately-held company has managed to present a valid business model and demonstrated its potential to grow and generate revenue. The EIB venture debt product is in principle available to firms at that stage (see also Annex 1), although the EIB (2019) describes the ideal profile of a firm applying for venture debt as having “*already raised Series B/C equity and ... needs additional financing to accelerate growth*”. Series B and C rounds are for companies at a more mature stage of development, past the development and into the market expansion stage. A stylised presentation of the thus implied sequence of financing rounds is provided in Figure 1. It illustrates how venture debt typically follows a venture equity capital round (though it can be part of an equity round), while preceding exit from private capital and into public markets through an initial public offering.

Venture debt extends the cash runway of an enterprise until the next round of valuation and equity raising. It also allows the enterprise to postpone raising additional equity through venture equity capital until it considers the timing more advantageous, and it can also serve as a cushion in case of unexpected events occurring before the next valuation round. Compared to raising equity, raising venture debt allows the borrower to avoid the cost of dilution, which is attractive to founders and early equity investors.

Figure 1. Stylised description of opportune moment to finance with venture debt



Source: Adapted from EIB Venture Debt as Growth Capital (2019).

The EIB venture debt instrument and its financial terms are tailored to high-growth companies in R&D driven industries, including biotechnology, vaccine and software development, and

robotics. Payment obligations are deferred and in part conditional on outcomes. To compensate for the associated higher risk, the instrument offers a higher nominal interest rate and additional upside as compared to standard debt. Compared to traditional venture debt and growth loans, EIB venture debt provides a longer loan maturity period according to a market overview produced for the EIB by Deloitte (2019 (Table 1). This gives greater space for research and development to yield profits in strategic technology investment areas. EIB venture debt can be secured or unsecured and provide different levels of subordination, while also allow for upside participation. As part of its non-dilutive financing, the EIB typically assumes no direct involvement in the daily management of the enterprise and does not convert any warrants into shares, but rather cash equivalents.

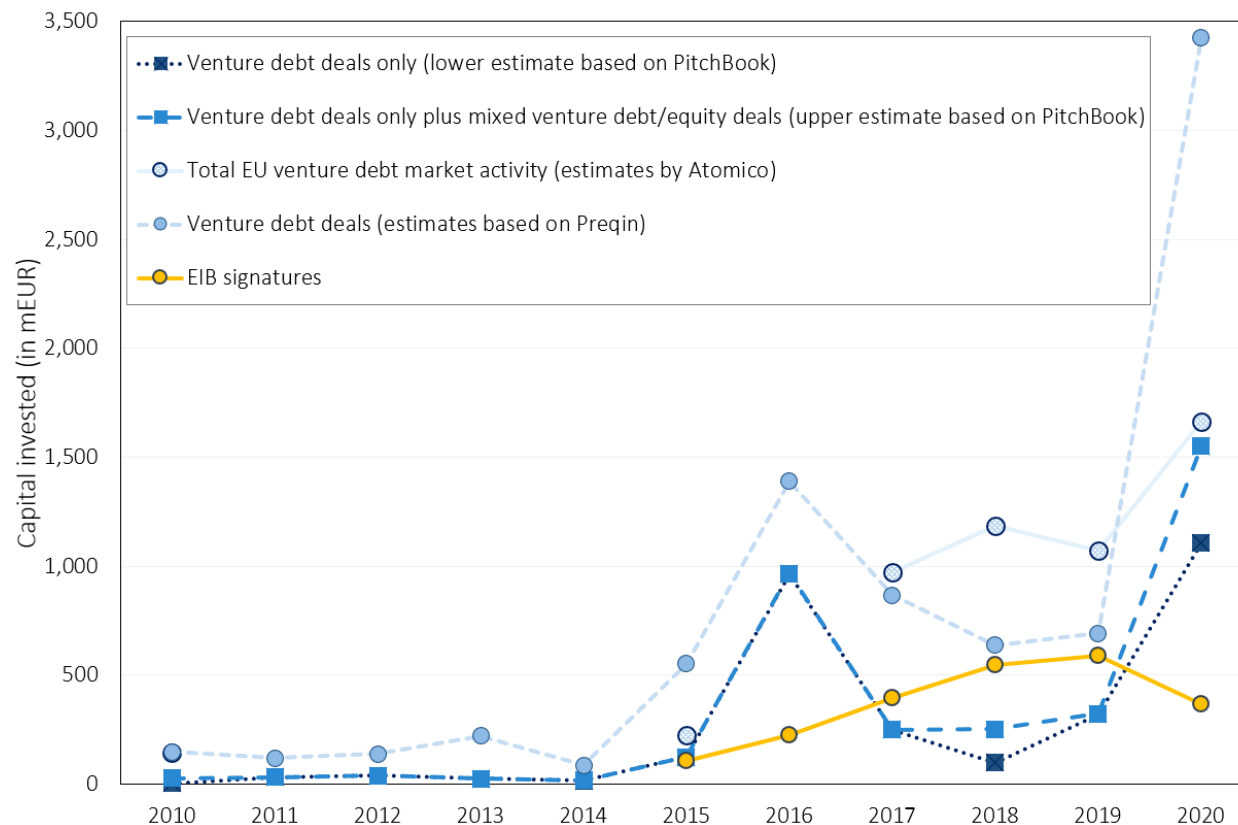
Table 1. Venture debt product comparison

	Traditional venture debt	Growth loan	EIB Venture Debt
Business characteristics	Medium to late venture capital stage experiencing high growth	Late venture capital / growth stage	Late venture capital / growth stage
Ticket size	€0.5m - €20m	€5m - €50m	€7.5m - €50m
Tenor	1 - 4 years	3 - 5 years	5 - 7 years
Interest rate (excl. warrants)	9% - 15%	6% - 12%	3% - 10%
Dilution	Generally a small fraction of equity <1.5% due to warrant	May include a small fraction of equity <1%, due to warrant	Generally a small fraction of equity due to warrant, exercised in cash
Financial covenants	None	1-2 covenants, P&L and/or balance sheet tests	None
Industry focus	<ul style="list-style-type: none"> Primarily technology and healthcare, but include also other sectors Focuses on future profitability 	<ul style="list-style-type: none"> Primarily technology and healthcare, but include also other sectors Focuses on future profitability 	<ul style="list-style-type: none"> R&D-driven industries Includes biotechnology, software, renewable energies, etc.

Source: Venture debt provider websites consulted and market research conducted by Deloitte (2019).

The size of the European venture debt market remains uncertain, as there is no one authoritative source for data. The wide range of market estimates reflect the absence of a single definition of venture debt. Figure 2 shows estimates of the EU market size. Differences between estimates are due to varying sources of information gathered and aggregated together. For example, some private market participants use EIB reported deals as the focal point to arrive at their own market size estimates (e.g. those reported by Atomico), while others report aggregate available transactions on the market from a wide range of sources. These various estimates do however show the recent expansion of the EU market and that EIB activity has accounted for a substantial share of activity. The EU venture debt market remains considerably smaller than the US market.

Figure 2. Estimates of EU venture debt market size



Notes: Estimates of capital invested in Euro millions in EU countries (not including the United Kingdom) from different sources. Estimates by Atomico (2020, 2021) and data from Preqin converted from USD to Euros using exchange rates as reported by OECD.

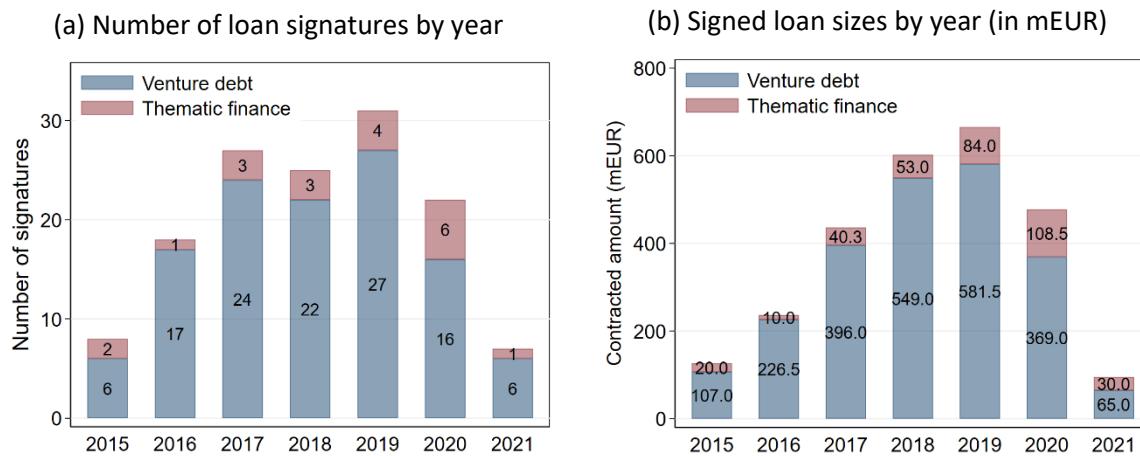
Source: Estimates for total market based on Atomico (2020, 2021), and data providers Preqin (download as of September 2021) and Pitchbook and EIB signatures from EIB Serapis.

3 THE EIB VENTURE DEBT PORTFOLIO

The EIB venture debt portfolio accounts for a total of EUR 2.65 billion of loans over the period 2015 to mid-2021, with the start closely aligning with the beginning of the programme. The venture debt portfolio corresponds to approximately 0.8% of the total EIB portfolio and to 3.8% of the EIB's special activities. Nevertheless, venture debt activities have been growing in importance. The EIB's venture debt activities have been increasing steadily since 2015. Figure 3 reports the evolution of the EIB venture debt portfolio over time. Panels (a) and (b) show that the number of loan signatures and the corresponding loan volumes increased from 2015 to 2019, before decreasing slightly in 2020.¹

¹ Data for 2021 are only partial and only relate to contracts signed between 1 January and 30 June.

Figure 3. The EIB venture debt portfolio, 1 January 2015 to 30 June 2021



Notes: The two graphs report descriptive statistics on the venture debt allocation dataset. Panel (a) reports the number of loan signatures by year for both venture debt and thematic finance. Panel (b) reports the loan amounts by year for both venture debt deals and thematic finance.

Source: EIB signatures from EIB Serapis.

The EIB portfolio considered in this analysis is composed of 134 firms, 21 of which are for thematic finance operations.² Specifically, it comprises “equity/quasi equity” transactions from the European Growth Finance Facility, the InnovFin IDFF Global Authorisation, the InnovFin FDP Global Authorisation and the Growth Finance Initiative with signature dates from 1 January 2015 to 30 June 2021. Deals that still needed to be signed or that have been cancelled after signature are excluded from the analysis. Table 2 includes examples of EIB venture debt beneficiaries and a description of their core activity. The EIB portfolio has a strong focus on social goods, including health, e-mobility and sustainability. A more comprehensive descriptive analysis of EIB venture debt beneficiaries’ characteristics is included in Annex 2.

² Over the full period covered by our data, 1 January 2015 to 30 June 2021, a total of EUR 2,294 million of venture loans were contracted and an additional EUR 356 million of thematic finance deals were signed. The key mandate behind venture loans being EFSI (European Fund for Strategic Investments) and behind thematic finance loans InnovFin - EU Finance for Innovators. Thematic finance loans are higher risk aimed at supporting companies with lower technological readiness levels, often at the demonstration stage.

Table 2. Example of EIB venture debt beneficiaries

Company Name	Description
Biosurfit SA	Diagnostic tests for diabetes, cardiac and metabolic diseases
Frosmo World OY	RDI expenditures in software development
Enevo OY	Growth expenditures for smart waste management systems
Forsee Power SAS	Battery systems for e-mobility: buses, trains, trams and marine vessels
BioNTech SE	R&D investments for the development of cancer patient-tailored therapeutic vaccines
Pluristem GMBH	Development of cell therapies for various conditions, incl. complications from COVID-19

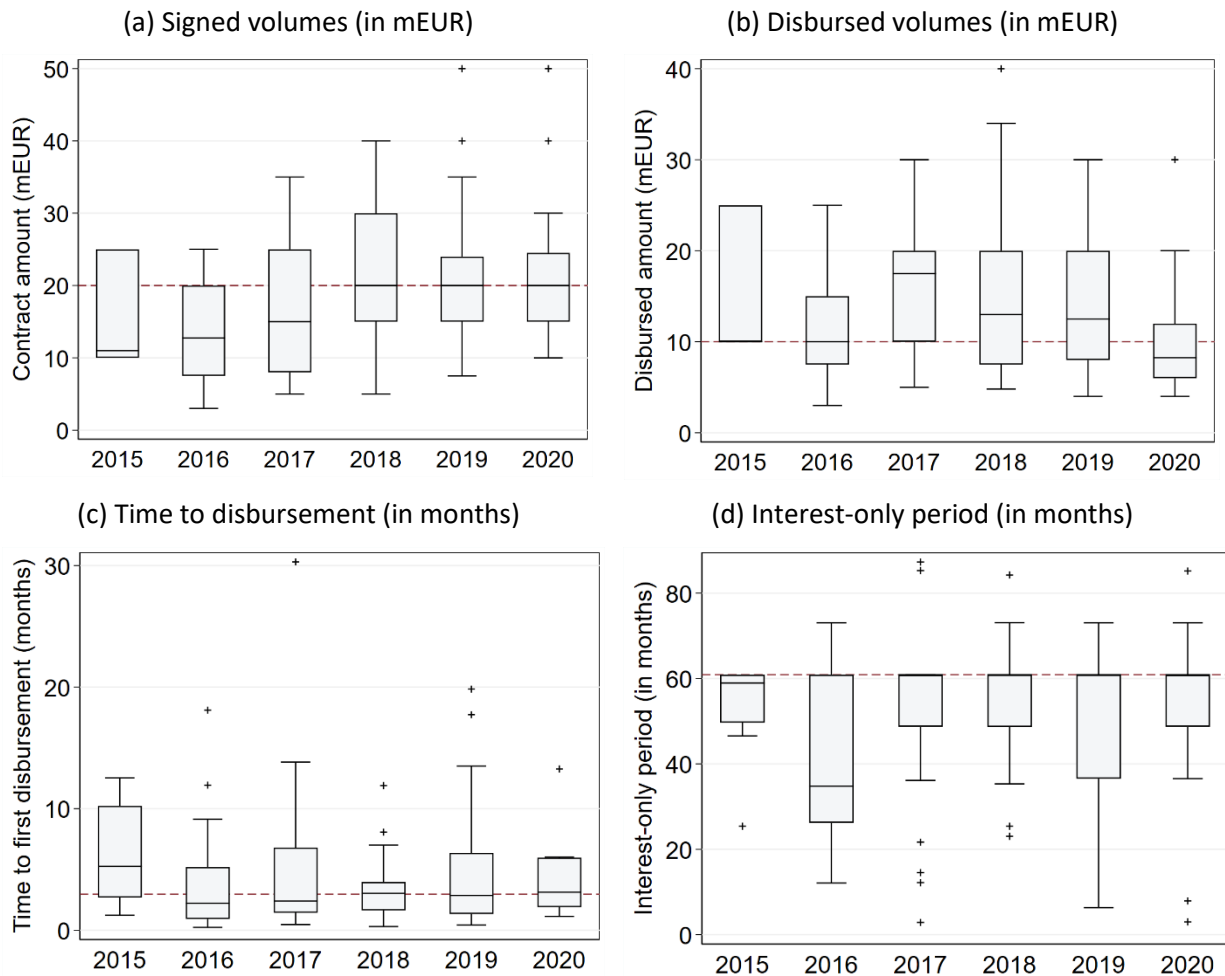
Notes: The table shows examples of firms that benefitted from the EIB venture debt.

Source: EIB signatures from EIB Serapis/BO.

Despite substantial heterogeneity across allocations, venture debt signature amounts have been increasing as the market grew, while the median signature amount has been stable since 2018. Of the total signed volumes, the EIB disbursed 59.6% or EUR 1,573 million. However, there is substantial heterogeneity across allocations. Figure 4 plots the distribution of the signed (panel a) and disbursed (panel b) EIB venture debt volumes across beneficiaries across beneficiaries and time. The median volume at signature has been gradually increasing since the instrument's inception in 2015 to stabilise at around EUR 20.0 million since 2018. The median disbursement stands at EUR 10.0 million, i.e. for the median loan the EIB disbursed half the financing. The time to disbursement and interest-only periods of the allocations, as displayed in panels (c) and (d) of Figure 4, show noticeably more variance and no trend across time except for a strong concentration around the median. In particular, the median time to disbursement is 3 months, i.e. relatively fast. The median interest-only period granted to the beneficiaries is 61 months.³

³ The respective means for the signed and the disbursed contract volumes are EUR 19.1 million and EUR 11.4 million, respectively. The average time to disbursement and interest-only period are 4.4 and 53.2 months, respectively.

Figure 4. Distribution of the signed and disbursed EIB venture debt volumes across beneficiaries



Notes: The graphs report descriptive statistics on the distribution of signed and disbursed venture debt volumes and disbursements. The red dashed line shows the median value for the total sample, i.e. across all beneficiaries and years. Per year, the distribution is plotted using a standard boxplot, with the box starting at the 25th percentile and ending at the 75th percentile. The inner line displays the median for that year. Outliers (i.e. values beyond the usual range, as displayed by the boxes' whiskers) are displayed by plus signs. In panel (d) a signature from 2018 was dropped as it had an interest-only period over 200 months, i.e. an outlier in the data.

Source: EIB staff calculations based on signatures from EIB Serapis.

By providing venture debt loans, the EIB mobilizes at least a 1.4-fold of financing from other sources through the co-financing of projects. On average, for every euro loaned by the EIB, another EUR 1.37 flows into the financed venture debt projects from other sources. Based on the data on co-financing as reported to the EIB, the promoter company accounts for the majority of co-investments (65.2%), followed by external corporates (27.1%).⁴ As such, there is only limited evidence for crowding-in of other investments as part of specific operations. Nevertheless,

⁴ Co-financing from banks, public entities and EU contributions only make up marginal shares at 3.9%, 1.0% and 0.4%, respectively.

crowding-in might occur more indirectly and subsequent to the specific EIB operations (see Section 4.2).

4 IMPACT ASSESSMENT

4.1 Methodology

To assess the impact of EIB venture debt on firm performance, we carry out a counterfactual analysis that compares EIB venture debt beneficiaries to a group of firms that did not receive any venture debt (but may have still received other forms of financing).⁵ Our methodology consists of two steps: (i) defining a “good” control group; and (ii) estimating the impact of venture debt using an econometric model.

We define a control group as a group of firms similar to the EIB beneficiaries (“treated group”), but that did not receive any venture debt. Ideally, a control group would be composed of the same EIB beneficiaries observed under a hypothetical scenario where they did not sign any venture debt contract (“counterfactual”). Since counterfactuals are not observable, we approximate this “ideal” control group with a group of firms that are similar to the treated ones. Importantly, we require the treated and control group to show *parallel trends* on a set of predetermined characteristics measured in the years before signing the venture debt contract (“pre-period”). Ensuring parallel trends in the pre-period supports the assumption that, in the absence of venture debt, treated firms would have behaved as the ones in the control group. A detailed description of this approach and other notes on the methodology can be found in Annex 3.

To construct a control group that could credibly act as a counterfactual to the one receiving EIB venture debt, we rely on an international database of venture capital deals. Specifically, we use Preqin, a deal-level database containing more than 200,000 venture capital transactions and information on different financing rounds. From this source, we identify about 12,000 firms that received venture capital financing through different rounds (either A, B or C series), but that have not received any venture debt.

We build our control group from firms that received venture capital for several reasons. First, raising venture capital financing is a prerequisite to obtain venture debt, which only comes after either A, B or C financing rounds. Venture capital firms are thus similar to venture debt recipients in terms of capital structure, especially if compared to the average firm on the market. Moreover, venture capital firms share similar innovation and growth characteristics to firms raising venture debt: they have generally already demonstrated a solid track record in their business activities;

⁵ The approach follows a broadly similar methodology as previous impact assessments of the EIB Group’s multiple beneficiary intermediated loan (MBIL) activities (Amamou et al., 2020; Barbera et al., 2021), loan guarantees (Bertoni et al., 2018, 2019; Brault and Signore, 2019) and venture capital (Pavlova and Signore, 2019, 2021).

they have an established client base; they show consistent revenue figures and they meet other key performance indicators.⁶

Among the set of 12,000 venture capital recipients, we identify about 4,000 EU-based firms for which financial variables are available in ORBIS, a firm-level dataset containing balance sheet information.⁷ From this sub-set, we select 71 firms for our control group, based on the following characteristics:

- ***Innovativeness***: We ensure that the control group is composed of highly innovative firms, as we only consider firms that have successfully raised VC to implement their business idea.
- ***Financials***: Among the available 4,000 firms, we choose those that are similar to the EIB venture debt beneficiaries along the following variables: number of employees, total assets, fixed assets and long-term debt prior to receiving the loan.
- ***Age profile***: Among the available 4,000 potential controls, we only consider those firms with a similar age profile, i.e. founded in 2005-2018.

As a second step, we estimate an econometric model that compares the treatment and control groups before and after receiving venture debt (so-called difference-in-differences estimation). This model compares firms in the treated and control groups, before and after treatment. Finally, the causal interpretation of our results is ensured by testing whether the estimated effects can be explained by any alternative mechanisms at different points in time. More methodological details are provided in Annex 3.

4.2 Results

We produce three different sets of results that assess the impact of EIB venture debt on firm growth, additional debt, innovativeness and other financial variables.

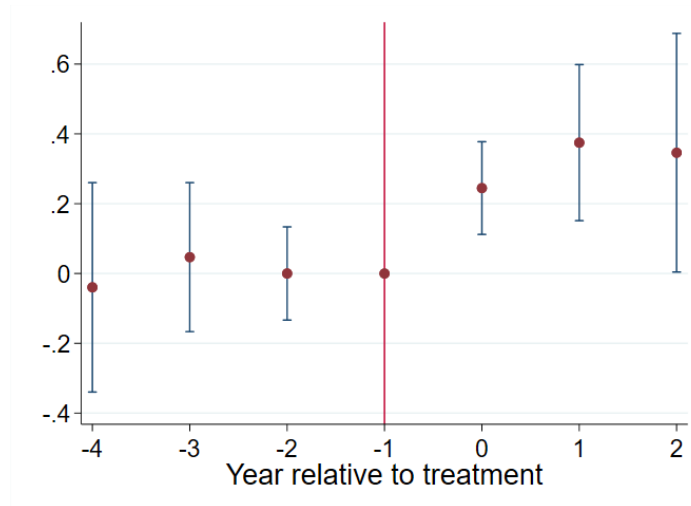
Our first set of result shows a significant and positive impact on firm growth, measured as total assets, in the years after signature. Figure 5 shows that EIB beneficiaries report on average a third higher total assets compared to firms that did not sign any venture debt contract. Dots in figure 5 represent the estimated effect of venture debt on total assets for EIB beneficiaries, with respect to their peers in the control group, at each point in time. The effects are normalised to zero in the year prior to loan signature ($t=-1$) and can thus be interpreted as relative to the year immediately before signing the contract. For example, in the year of signature ($t=0$) the average venture debt beneficiary reports total assets that are almost 25% higher than in the year prior to signature. The bands around the dots show the 90% confidence intervals of the estimates. Figure 5 also shows that the evolution of total assets had been similar for venture debt beneficiaries and firms in the control group prior to loan signature. This helps rule out other explanations for

⁶ We have also considered alternative sources to Preqin, as described in section 5 of this report.

⁷ 83 firms out of the 12,000 firms that received venture capital were also involved in non-EIB venture debt transactions and were thus excluded from the sample

the relative increase in total assets for beneficiary firms and supports a causal interpretation of the results.

Figure 5. The effect of venture debt on total assets of firms



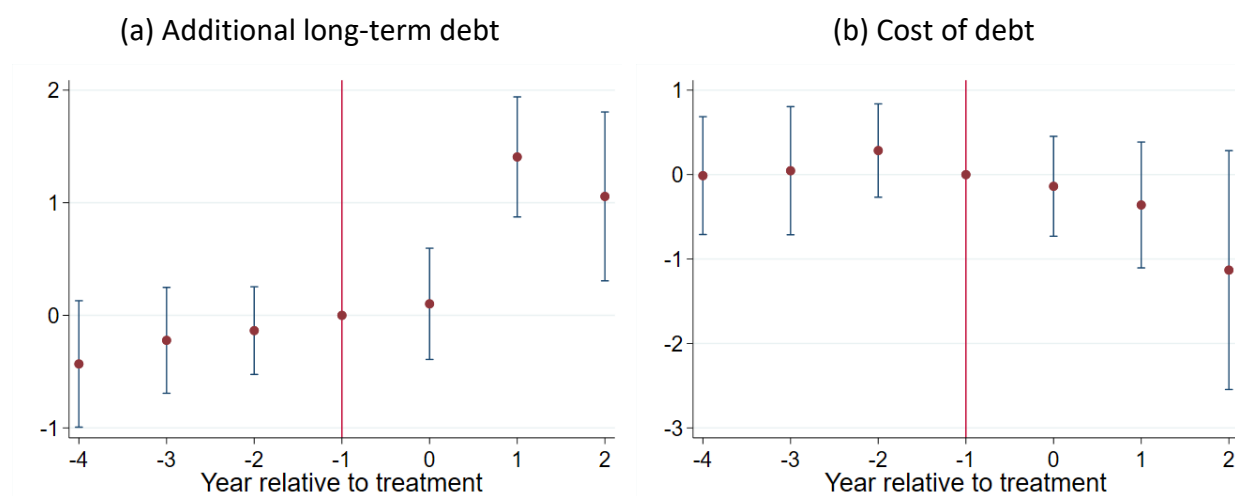
Notes: The graph reports the time-varying effect of VD. Coefficients are normalised with respect to the year prior to loan signature ($t=-1$) and can be interpreted as the cumulative effect of VD with respect to this baseline. Estimates are based on a sample of 788 observations, 60 treated and 62 controls.

Source: ECON estimations based on EIB allocation data from Serapis and ORBIS Bureau van Dijk.

Our second set of results explains the mechanism driving the increase in total assets and it shows that EIB loans pull in other financing. More precisely, we look at long-term financing net of EIB venture debt and we show that the increase in total assets is not only mechanically driven by venture debt, but it is also explained by additional funding raised by EIB beneficiaries. Panel (a) in Figure 6 shows that EIB beneficiaries report on average 2.5 times more additional long-term debt than firms in the control group, suggesting that EIB loans pull in other financing. Moreover, panel (b) in Figure 6 shows that EIB beneficiaries report a moderate, albeit not statistically significant, reduction in the cost of debt in the years after treatment.

Taken together, results in Figure 6 panels (a) and (b) show that EIB beneficiaries obtain greater financing without increasing their cost of debt. These results are consistent with the role of the EIB as improving financial markets efficiency, by reducing information asymmetries and costs in an otherwise opaque market.

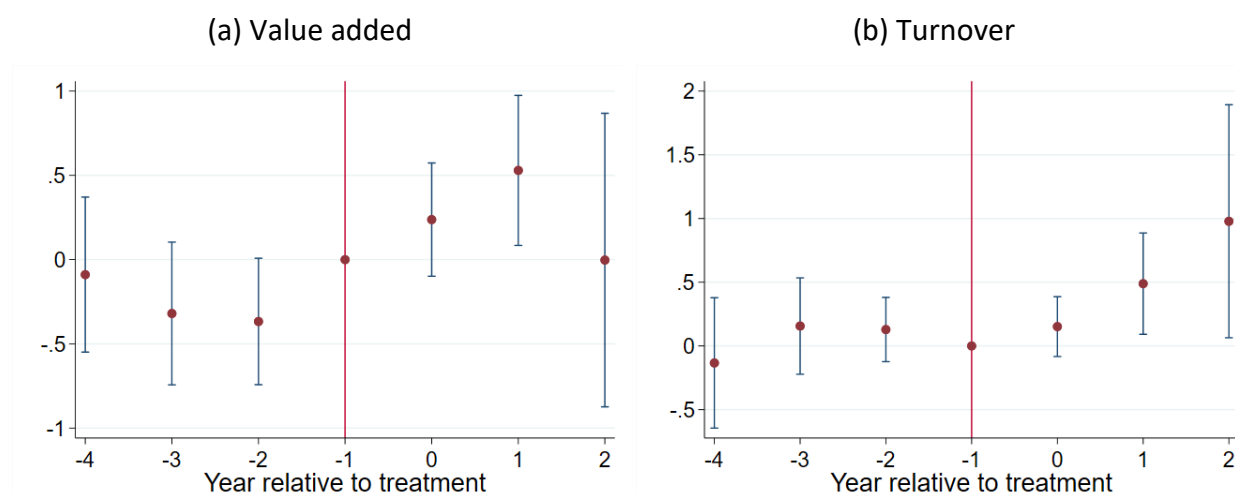
Figure 6. Effect of EIB venture debt on debt of firms



Notes: The graph on the left reports the effect of EIB venture debt on additional debt, defined as firm's debt minus the volume of the EIB venture debt loan. The graph on the right shows the effect of EIB venture debt on the cost of debt, defined as interest paid over long-term debt. Coefficients are normalised with respect to the year prior to loan signature ($t=-1$) and can be interpreted as the cumulative effect of VD with respect to this baseline. Estimates are based on a sample of 773 observations, 58 treated firms and 61 controls.

Source: ECON estimations based on EIB allocation data from Serapis and ORBIS Bureau van Dijk.

Figure 7. Value added and turnover of firms



Notes: The graph on the left reports the effect of EIB venture debt on value added, defined as the sum of a firm's net income, taxation, cost of materials, cost of labour, depreciation and interests paid. The graph on the right shows the effect of EIB venture debt on turnover, which denotes the operating revenue in the firm's profit & loss account. Coefficients are normalised with respect to the year prior to loan signature ($t=-1$) and can be interpreted as the cumulative effect of VD with respect to this baseline. Estimates for value added are based on a sample of 259 observations, 12 treated and 14 controls. Estimates for turnover are based on a sample of 641 observations, 56 treated and 47 controls.

Source: ECON estimations based on EIB allocation data from Serapis and ORBIS Bureau van Dijk.

Our third set of results shows the positive effect of EIB venture debt on firms' balance sheet variables such as value added and revenues. Panel (a) in Figure 7 shows that EIB beneficiaries report greater value added of about 50% compared to comparable firms that did not sign any venture debt contract. Panel (b) shows instead that EIB venture debt recipients benefit from an increase in turnover by approximately one third compared to firms in the control group. The higher turnover reported by EIB beneficiaries, however, is not statistically significant.

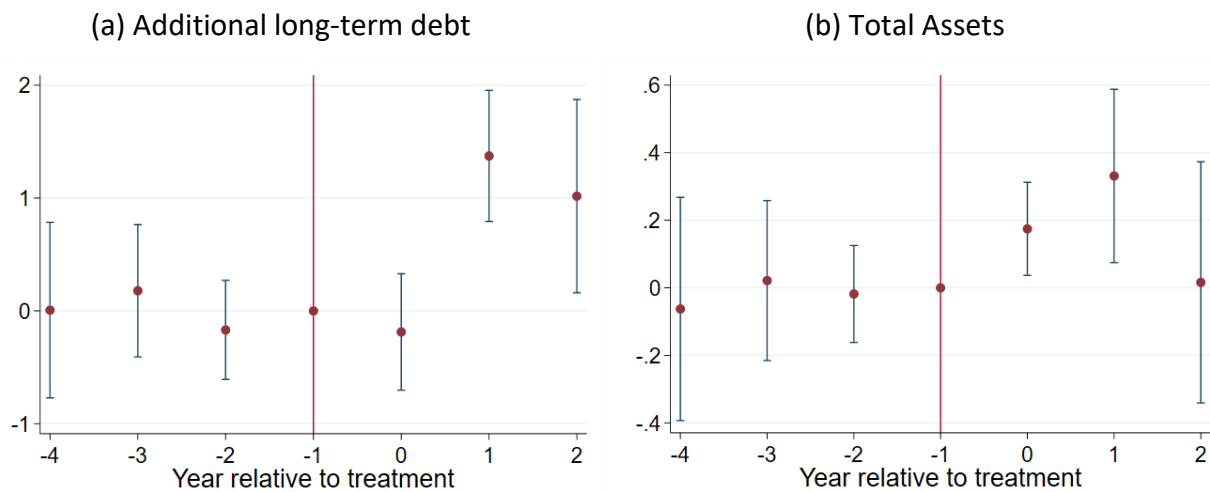
Finally, we also find a small positive impact of venture debt on employment after signature, albeit not statistically significant. At the same time, we find evidence of a trend several years prior to signature, which prevents the causal interpretation of this result. Finally, we also find that firms receiving EIB venture debt show a small increase in the number of patent applications, although this increase is not statistically significant.

5 ALTERNATIVE CONTROL GROUPS AND MODEL SPECIFICATIONS

In order to test the robustness of our results, we have run a series of tests considering alternative control groups and different model specifications.

The main results hold when we exclude firms benefitting from thematic finance operations. However, the large drop in the number of observations reduces estimation precision. To account for the fact that the set of treated firms is composed of firms that receive EIB venture debt or thematic finance, we replicated our analysis with a subset of firms that only include firms involved in venture debt transactions. From a technical point of view, we excluded firms involved in thematic finance operations before building the control group and we defined the treated group as the group of firms only raising venture debt. This reduces the number of firms used for estimation, from 71 to 64. While this drop does not change the results on total assets and crowding-in of additional debt, estimates on the effect on value added suffered from an already low number of observations. The drop from 12 to 10 treated firms makes results for the impact on value added statistically insignificant. Moreover, the reduction in the number of treated firms also affects results on turnover and number of employees, which were already only marginally significant.

Figure 8. Additional debt and cost of debt without thematic finance operations



Notes: The graph on the left reports the effect of EIB venture debt on additional debt, defined as firm's debt minus the volume of the EIB venture debt loan. The graph on the right shows the effect of EIB venture debt on total assets. Coefficients are normalised with respect to the year prior to loan signature ($t=-1$) and can be interpreted as the cumulative effect of VD with respect to this baseline. Estimates are based on a sample of 230 observations, 12 treated firms and 14 controls.

Source: ECON estimations based on EIB allocation data from Serapis and ORBIS Bureau van Dijk.

We decided against using the list of “unsuccessful” venture debt applicants as a potential alternative control group because of potential bias. We refer to the EIB unsuccessful applicants as those firms that applied for EIB venture debt, but that were either rejected at the last assessment round, or preferred alternative funding sources despite qualifying for EIB venture debt. This control group represents a potentially good counterfactual to EIB recipients, because it includes firms that explicitly considered and applied for EIB venture debt as a financing instrument. In other words, it considers firms for which, similarly to the set of EIB recipients, it is possible to identify a demand for credit. Unfortunately, however, we could not rely on the list of EIB “unsuccessful” venture debt applicants because a complete data on all the applicants is not available. The available sample of applicants for which the EIB has the information is composed of only 118⁸ firms defined as follows: 82 firms, of which the loan application was rejected by the EIB; 32 firms that decided to withdraw their loan application; and 4 “caduqué” firms.⁹ The low number of available firms limits the possibility of finding a good control group to compare to the EIB beneficiaries, as applicants differ from treated firms across the set of pre-treatment characteristics.

Relying on EIB applicants instead of the available pool of 4,000 firms from Preqin may thus invalidate the causal interpretation of our results, as differences between treated and control

⁸ The set of applicant firms is considerably smaller than the 4,000 potential firms available from Preqin.

⁹ Caduqué firms are those firms for which a decision regarding their venture debt financing was not taken further and their application consequently expired.

groups might date prior to venture debt signature, which would invalidate the parallel trend assumption. Moreover, our results would also be biased as we do not have information on the reason why firms decide to opt out of the venture debt contract, despite qualifying for it. Although this could be due to the availability of more favourable financing conditions, a drop in demand for credit could be included among the possible explanations.¹⁰

We also decided against using firms that received venture debt from other non-EIB market actors as a control group. To begin with, EIB and non-EIB venture debt are somewhat different products. As shown in Table 1, EIB's venture debt has different characteristics from the one issued by other private-market participants. For example, the instrument has a longer maturity, a lower interest rate, a larger ticket size and targets highly technological firms. Moreover, comparing EIB versus non-EIB venture debt recipients would shift the focus of the research question even if the products had similar characteristics. In fact, using non-EIB venture debt recipients as control group would change the scope of the analysis to assessing EIB's additionality on a market otherwise characterised by private participants. Answering this question would be most valuable for more developed and well-established markets, where understanding the use of public resources is very important. However, as the European venture debt market is small and far from being fully established, we found it more valuable to assess additionality of the EIB-sponsored venture debt compared to a wider set of alternative investments.

As we cannot perfectly exclude all of those firms that received non-EIB venture debt from the control group, our results constitute a conservative estimate of the true impact of venture debt on EIB beneficiaries. We rely on Preqin to construct our control group, defined as the set of firms that receive venture capital, but no venture debt. However, as Preqin only reports a subsample of venture debt transactions, some firms receiving non-EIB venture debt might still be included in the control group. Comparing EIB beneficiaries with firms that also benefitted from venture debt (albeit non-EIB) could thus produce conservative estimates of the true effect of venture debt on firm performance (results would be downwards biased).¹¹

Finally, our results are robust to alternative model specifications. We tested the robustness of our difference-in-difference model by estimating four different specifications for each outcome variable considered. We first estimated a plain vanilla version of the difference-in-differences model, which does not account for firms' time-invariant characteristics (e.g. firms' innovation ability, firms' location), nor firm-invariant terms such as changes to macroeconomic conditions (e.g. changes in interest rates, business cycle fluctuations). This first, simple, model specification compares treated and control firms without controlling for these terms. We then included, individually, terms that control for firms' time-invariant characteristics and changes to macroeconomic conditions to control for factors that are not the direct result of venture debt. Our baseline results presented in Section 4 include both time-invariant and firm-invariant

¹⁰ However, we would consider using this set of firms in the future if the EIB collects information on unsuccessful applicants more consistently and if the number of unsuccessful firms increases enough.

¹¹ We argue that including treated firms in the control group would reduce the magnitude of the estimated effect. Therefore, the results presented in the study err on the side of caution.

characteristics at the same time. Our fourth model specification only considers treated and control firms for which we have a “balanced” panel dataset, meaning that we only include firms for which we have data on the three years before signing venture debt and for the two years after. Results, included in Annex 3, are robust to all model specifications, suggesting that the estimated impact is indeed due to venture debt.

6 CONCLUSIONS

The report finds that firms receiving EIB venture debt report significantly larger firm growth, productivity and additional debt, suggesting a crowding-in effect. The analysis shows that relative to comparable peers that did not receive venture debt, EIB venture debt beneficiaries show stronger growth, as measured by an increase in total assets. The increase is partially driven by additional debt funding sources that EIB beneficiaries obtain in the years following the signature of venture debt contracts. This finding, together with the observation that beneficiaries report a slight reduction in the overall cost of debt after treatment, suggests that venture debt crowds in additional debt from other sources. The results also show a positive effect of EIB venture debt on firms’ productivity, as measured by their value added. Finally, firms receiving venture debt also report higher turnover and an increased number of patent applications, although these effects are not found to be statistically significant. Taken together, the report provides positive evidence regarding the economic additionality of the venture debt instrument.

EIB venture debt is a relatively new instrument and ex post data are available for a short time period only, thus follow-up is desirable to gauge more medium-term impacts. It is reasonable to assume that some of the effects on economic variables only materialize over the more medium term. For example, results on employment and innovation are harder to gauge. In addition, as venture debt is a recent EIB instrument, there is still limited data available for later years after loan signature. Therefore, a follow-up assessment is desirable to start measuring the more medium-term impacts and to increase estimation precision.

ANNEX 1: EIB VENTURE DEBT ELIGIBILITY CRITERIA

The EIB essentially describes the potential venture debt borrower as an innovation-driven EU firm with growth driven by the value of the firms' intellectual property, having already raised venture capital and needing additional financing to accelerate growth, and having a sustainable business model and established corporate governance (see EIB, 2019).¹² For example, the application form for venture debt financing under the European Growth Finance Facility (EGFF) spells out specific related criteria that need to be met to be eligible. EU-based small or medium-sized enterprises (SMEs) with less than 250 employees become eligible by default and do not strictly speaking have to meet any of the other criteria that are set out in the form. By contrast, firms with more than 250 employees become eligible only if they meet one additional criterion, which could be that growth is R&D driven, as documented by patent applications during the last two years.

More precisely, a counterparty is deemed eligible if it complies with *at least one* of the following criteria:

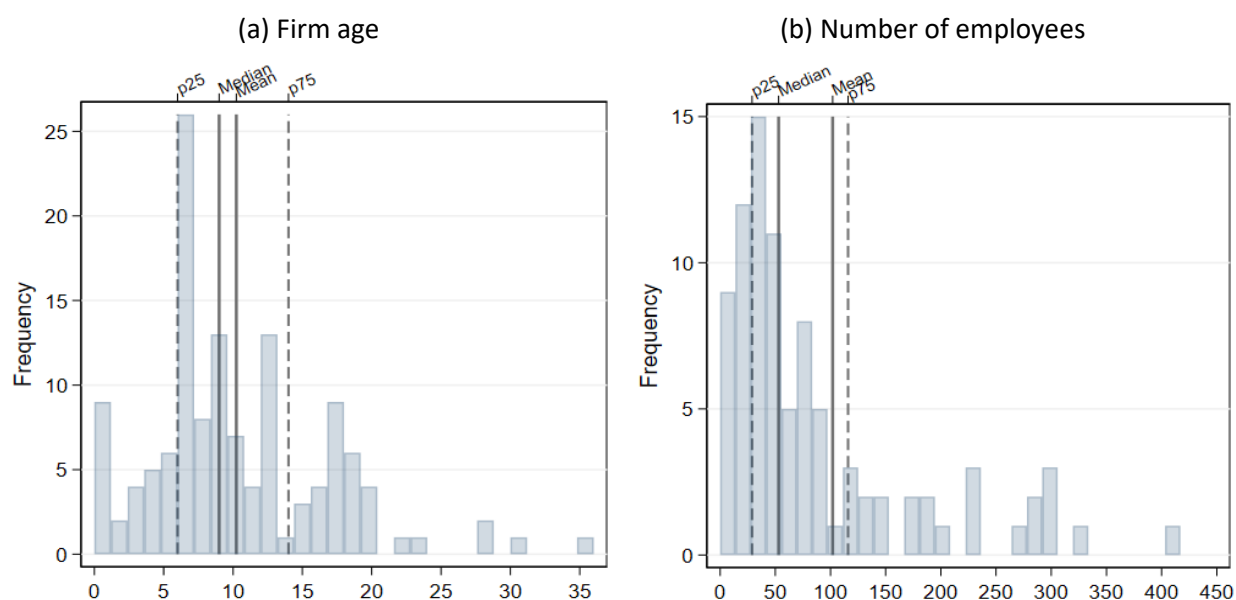
- 1) the company is an SME with less than 250 full-time employees and its headquarters or its subsidiaries, which are expected to receive the financing, are located within the EU; or
- 2) the company should intend to use the EIB financing to invest in producing or developing products, processes and/or services that are innovative and where the business plan indicates a risk of technological or industrial failure, or a business risk; or
- 3) the company is a "fast-growing enterprise", as measured by employment or by turnover; or
- 4) the company shall have a significant innovation potential and/or be an "Research and Innovation (R&I) driven enterprise"; or
- 5) the company does not meet any of the above conditions but its investment programme is targeting convergence regions within EU Member States.

¹² Also see <https://www.eib.org/en/products/equity/venture-debt.htm>

ANNEX 2: THE KEY CHARACTERISTICS OF BENEFICIARY FIRMS

The age and size of beneficiary firms varies widely, with the average borrower being founded 10 years ago and employing 102 employees. Beneficiaries' ages ranges from 1 to 36 years since the foundation of the firm (Panel (a) of Figure 8), with the majority of firms between 5 and 15 years of age. The size of beneficiary firms as measured by the number of employees is skewed to the right (Panel (b) of Figure 8), i.e. with most firms on the smaller side (with the median firm size at the time of signature being 53 employees) and a small subset of mid-caps in the right tale. BioNTech SE, for example, has to be dropped from the graph as an outlier, since it counted 1,323 employees at the time of signature.

Figure 9. Distribution of beneficiaries' age and size



Notes: The two graphs report the distribution of EIB venture debt beneficiaries by age and size. In addition to the frequency, they plot the mean, median and 25th/75th percentiles. Data cover signatures for which the firm age or employee data are available at the time of signature: 130 and 90 beneficiary firms, respectively. In panel (b) BioNTech SE was dropped as an outlier, as it counted 1,323 employees at the time of signature.

Source: EIB staff calculations based on EIB Serapis, matched to ORBIS Bureau van Dijk.

Nine out of ten beneficiary firms make the size-based eligibility criterion, being either a micro, small or medium-sized enterprise based in the EU. Table 3 reports the representation of the size groups (Micro, Small, Medium and mid-cap) by number of firms and by loan volumes.¹³ The

¹³ Following EU recommendation 2003/361/EC, the term SME refers to firms with up to 249 employees. In particular, a firm is considered a micro, small or medium-sized enterprise if it has 0-9, 10-49 or 50-249 employees, respectively. By contrast, a firm with between 250 and 3,000 employees is considered a mid-cap.

distribution is broadly in line with expectations. The comparatively small share of micro enterprises is in line with the phase of life of target firms (Figure 1) and the focus on fast-growing innovative firms. The presence of mid-cap-sized beneficiaries is not excluded by the eligibility criteria, as long as they are fast-growing and/or innovative and/or targeting convergence regions.¹⁴

Table 3. Distribution of number of borrowers and signed volumes by firm size

	Firms	%	Mln euro	%
Micro	10	9.3%	173.8	9.0%
Small	36	33.6%	630.0	32.5%
Medium	51	47.7%	878.5	45.3%
MidCap	10	9.3%	257.0	13.3%
Total	107	100%	1,939.3	100%

Notes: The table reports the number of beneficiaries and volumes by firm size. Data cover signatures for which employee data are reported in ORBIS at the time of signature.

Source: EIB staff calculations based on EIB Serapis, matched to ORBIS Bureau van Dijk.

Table 4. Distribution of number of borrowers according to the "high-growing enterprise" (HGE) criteria

	No	Yes	%
Turnover growth	89	44	33%
FTE growth	112	21	16%
Fast-growing enterprises	81	52	39%

Notes: The table reports the number of beneficiaries fitting ("yes") and not fitting ("no") the HGE criteria. Data cover signatures for which the employee and turnover data are reported in ORBIS at the time of signature.

Source: EIB staff calculations based on EIB Serapis, matched to ORBIS Bureau van Dijk.

Almost four out of ten beneficiary firms (39%) are considered a high-growing enterprise (HGE) according to the subcriteria for turnover or employment growth. Specifically, to be deemed a fast-growing enterprise the borrower must demonstrate: (i) an average annualised growth in turnover greater than 10% a year, over a three-year period, or (ii) an average annualised growth in full-time employees of at least 5% a year, over a three year period, and have one hundred or more employees at the beginning of the observation period. Table 4 reports the number of beneficiaries fulfilling each of the criteria as well as their share in the total number of beneficiaries. A total of 44 (or 33%) of beneficiaries make the criterion for turnover and 21 (or 16%) make the criterion on employee growth and initial size, resulting in 52 fast-growing enterprises in total, accounting for overlap across criteria. The turnover criterion appears to be dominant, with 31 borrowers fulfilling it and another 13 borrowers making both the turnover and the employment growth criterion. By contrast, only eight borrowers achieve the required employment growth without achieving the required turnover growth. When decomposing the criteria by firm size, one thing stands out: none of the micro enterprises benefiting from EIB venture debt make any of the growth criteria. All fast-growing enterprises identified in the data are either small or medium-sized enterprises (SMEs) or mid-caps.

¹⁴ Any company larger than a mid-cap is excluded.

Patent applications drive the majority of cases where the “Research and Innovation (R&I)” criterion is met. To be considered an R&I-driven firm applicants should meet at least one of several criteria, including: (i) having R&I expenses/investment equal to or larger than 5% of its annual turnover in the latest financial statements, or (ii) having registered at least one patent in the last 24 months, or (iii) having registered its seat in a science, technology or innovation park or technology cluster or technology incubator.¹⁵ Table 5 reports the number of beneficiaries fulfilling each of the criteria as well as their share in the total number of beneficiaries. A total of 77 (or 58%) of borrowers are considered R&I-driven enterprises. With 74 of these firms having applied for a patent in the two preceding years, the patent criterion makes up the bulk of R&I qualifications.

Table 5. Distribution of borrowers according to "Research and Innovation driven" criteria

	No	Yes	%
R&I spending / investment	120	13	9%
Patents	59	74	56%
Science Parks	112	11	8%
Research & Innovation driven	56	77	58%

Notes: The table reports the number of beneficiaries fitting (“yes”) and not fitting (“no”) the R&I-driven criteria. Based on location and research and development expenditure data as reported in ORBIS and patent applications registered with the European Patent Office as reported in Patstat.

Source: EIB staff calculations based on EIB Serapis, matched to ORBIS Bureau van Dijk and Patstat.

The lion’s share of beneficiaries supported by EIB venture debt are concentrated in three innovative economic sectors: (i) Manufacturing, (ii) Information and Communication, and (iii) Professional, Scientific and Technical activities. Together these three sectors make up 91.5% of the total signed volumes, covering nine out of ten beneficiary firms (Table 6). This is not entirely surprising, as sectors such as Manufacturing and Professional, Scientific and Technical activities score comparatively well on innovation criteria such patent counts.¹⁶ For example, the venture loans to BioNTech SE, which is pioneering the development of next generation of personalised immunotherapies, and Pluristem GMBH, which is developing cell therapies for conditions following a severe infection (including COVID-19 infection), fall under Professional, Scientific and Technical activities. Hence, it is safe to say that the EIB venture debt portfolio has a strong sectoral focus on innovation.

¹⁵ Several sub-criteria for the R&I-driven criterion could not be tested for this analysis due to a lack of data, namely whether the borrower will spend 80% of the EIB loan on R&I spending, whether the borrower was awarded a grant (e.g. Horizon 2020 or FP7) or innovation prize, whether it received investment from a private-equity fund or business angel, or whether it has benefited from a tax credit or tax exemption in the two years prior to its application.

¹⁶ All three sectors dominate the list of innovative sectors as set out in the OECD Oslo manual, as based on results from Eurostat’s Community Innovation Survey.

In line with the European venture debt market, the EIB venture debt portfolio has a strong representation of companies based in France and Germany. A large share of venture debt transactions in Europe are concentrated in the United Kingdom, France and Germany. This geographical breakdown is also present in the EIB venture debt portfolio, with signed volumes to German firms amounting to EUR 712 million (or 27.0% of the EIB portfolio) and to French firms adding up to EUR 538 million (or 20.4%). Finland, Sweden, Italy and the Netherlands follow at 6.0%, 5.7%, 5.3% and 5.2%, respectively. This geographical concentration holds for the number of contracts signed as well.

Table 6. Sectoral distribution of signed and disbursed volumes

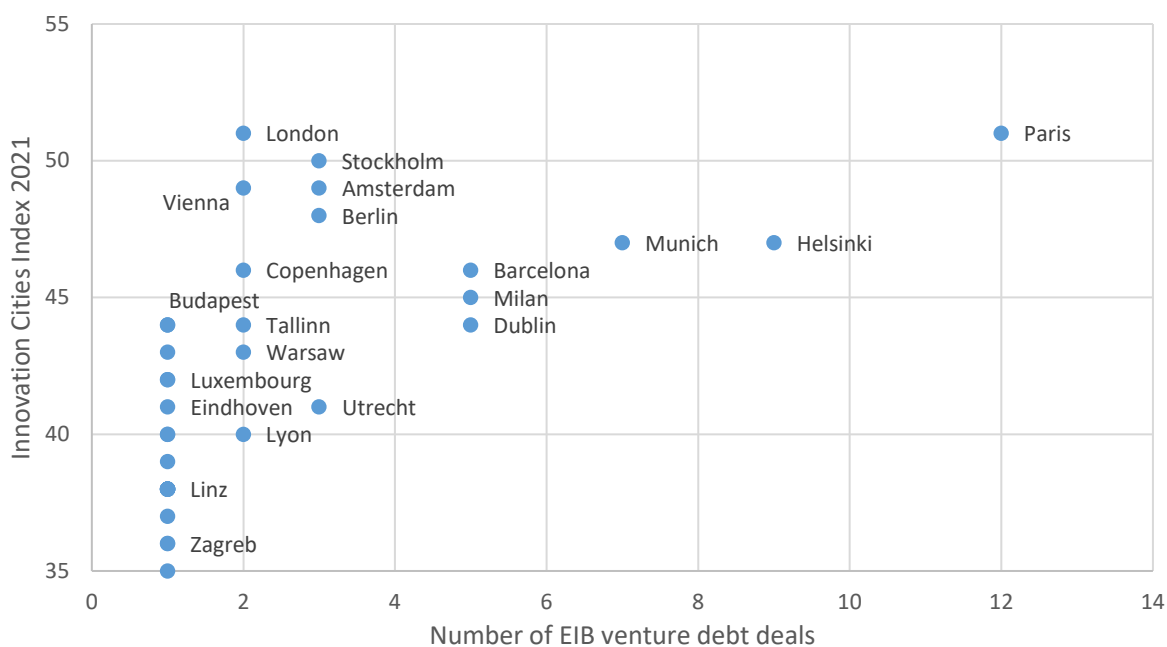
NACE Sector	Volume				Beneficiaries	
	Disbursed (mEUR)	To disb. (mEUR)	Total			
			mEUR	% Share	Count	% Share
C. Manufacturing	466.3	276.5	742.8	28.1%	41	30.6%
D. Electricity, gas, steam and AC	24.5	32.5	57.0	2.2%	4	3.0%
G. Wholesale and retail trade	6.7	0.0	6.7	0.3%	1	0.7%
H. Transportation and storage	50.0	7.0	57.0	2.2%	2	1.5%
J. Information and communication	475.5	225.5	701.0	26.6%	41	30.6%
K. Financial and insurance activities	7.0	28.0	35.0	1.3%	2	1.5%
M. Professional, scientific and techn.	493.8	478.5	972.3	36.8%	39	29.1%
Q. Human health and social work	43.5	24.5	68.0	2.6%	4	3.0%
<i>Total</i>	<i>1,573.3</i>	<i>1,066.5</i>	<i>2,639.8</i>	<i>100.0%</i>	<i>134</i>	<i>100.0%</i>

Notes: The table reports (to be) disbursed volumes and number of beneficiaries by sector. Based on the NACE sector codes as reported in Serapis.

Source: EIB staff calculations based on EIB Serapis.

Within countries, there is concentration of venture debt activities in capitals and other major cities functioning as hubs. When ranking European cities by the number of respective venture capital and venture debt deals (as included in our database of both EIB deals and non-EIB deals in Europe), capitals tend to rank high: Berlin (rank 1), Paris (2), Stockholm (3), London (5), Helsinki (6), Amsterdam (7) and Copenhagen (8), pointing to agglomeration effects. In addition to Berlin's dominant role, Germany also does features the largest variety of cities among the European cities with the highest number of deals, e.g. Munich (4), Hamburg (9), Cologne (13) and Frankfurt (14). The EIB venture debt portfolio by itself similarly features several cities more frequently, e.g. Paris (with 10 deals), Helsinki (9 deals), Munich (7 deals), and Barcelona, Dublin and Milan (with 5 deals each). The frequency of EIB venture deals, moreover, shows a correlation with the cities' innovativeness (Figure 9), as measured by an innovation index.

Figure 10. EIB venture debt deals vs. cities' innovation index



Notes: The figure plots the number of EIB venture debt deals by city relative to the cities' innovation index for those cities where an index is available. The overall correlation between both series is 62%.

Source: EIB Serapis and [2thinknow](#) Innovation Cities Index.

Finally, a relatively small share of EIB venture debt is located in cohesion regions, as over three quarters of the volumes are located in more developed regions. A last eligibility criterion opens the door provides targeted access to borrowers from cohesion regions not making any other criterion. However, as venture debt activities remain concentrated in capitals and major cities with high technology clusters (developed regions), this is also reflected in the breakdown of volumes by cohesion and non-cohesion cities. Table 7 reports the breakdown of signed venture debt volumes across regions, both using the 2014-2020 and new 2021-2027 cohesion region classifications. Irrespective of the definition, over three quarters of signed volumes are allocated to more developed regions. Using the 2014-2020 definition, that was in force over the time horizon covered by the database, the share of more developed regions approaches 88%.

Table 7. Distribution of signed volumes across cohesion regions

	(a) Definition 2014-2020		(b) Definition 2021-2027	
	<i>Mln EUR</i>	%	<i>Mln EUR</i>	%
Less developed	191.5	8.0%	101.5	4.2%
Transition	105.0	4.4%	412.0	17.3%
More developed	2,091.8	87.6%	1,799.8	75.4%
UK			75.0	3.1%
Total	2,388.3	100%	2,388.3	100%

Notes: The table reports the signed EIB venture debt volumes by type of Cohesion region. Panel (a) shows the decomposition for the Cohesion Policy 2014-2020 classification. Panel (b) shows the decomposition for the Cohesion Policy 2021-2027 classification. Data cover signatures for which the NUTS2 codes are reported in ORBIS.

Source: EIB staff calculations based on EIB Serapis, matched to ORBIS Bureau van Dijk.

ANNEX 3: METHODOLOGY

Identifying the control group

We identify control firms using three main criteria: innovation, age, and financial variables. In particular, we obtain information from Preqin on approximately 12,000 firms that were founded between 2005 and 2018 and that receive venture capital (VC), but did not receive venture debt (VD). We then restrict our sample of 12,000 firms to 3,697 EU firms that reported data from ORBIS, a Moody's Analytics - Bureau van Dijk dataset containing information on firms' financials.

We further restrict the set of control firms by selecting those firms that are closest to the set of treated firms based on their key characteristics prior to receiving venture debt. More specifically, we select the control firms that are the most similar to the set of treated firms on balance sheet variables in the three years before signing the venture debt contract. We select firms using propensity score matching (PSM), a multidimensional statistical methodology that chooses as controls those firms with the higher likelihood (or score) of receiving an EIB venture loan based on the following variables: firm age, number of employees, total assets, fixed assets and long-term debt.¹⁷

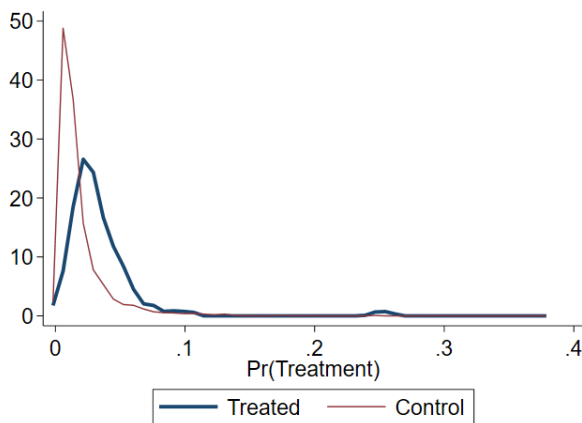
We assessed the quality of the control group selected with propensity score matching. Panel (a) in Figure 10 shows the distribution of the score, the likelihood of being treated, for both the treated and the control groups. The graph shows that the scores obtained for each of the firm groups have a comparable, but small probability of obtaining an EIB venture debt contract. Panel (b) shows instead that the matched sample experienced a large reduction in the standardized bias between treated and control group, if compared with the unmatched sample. Dots show the standardized percentage bias between treated and control groups across covariates, while crosses show the same standardized bias when the matched control group is considered. The figure in panel (b) thus shows a consistent drop in the standardized bias following the selection of the control group via the propensity score matching.

Finally, we tested for a variety of alternative specifications to the statistical matching presented in this section. We tested alternative matchings that included: (i) the logarithm of each of the key variables in the three years prior to loan signature; (ii) the variables in levels; and (iii) the average across the pre-treatment period, rather than the individual lags. The estimation results presented above largely hold up irrespective of the matching outcome.

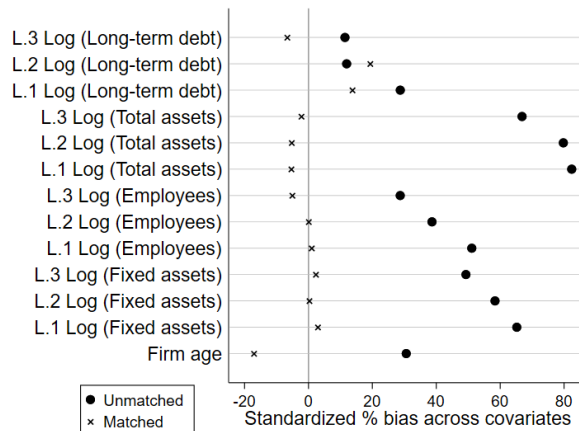
¹⁷ See Caliendo and Kopeinig (2008) for a detailed overview of method and its possible applications.

Figure 11. Performance of the matching of the control group

(a) Probability density from scoring (blue = EIB beneficiaries, red = control firms)



(b) Comparability of control group to EIB beneficiaries, before and after matching



Notes: The two graphs report performance statistics on the matching of the EIB beneficiaries (i.e. treated firms) to a control group. Panel (a) reports the distribution of the estimated propensity score, the likelihood of being treated, for both the EIB beneficiaries (in blue) and the control firms (in red). Panel (b) reports the standardized bias of the matched and unmatched control groups.

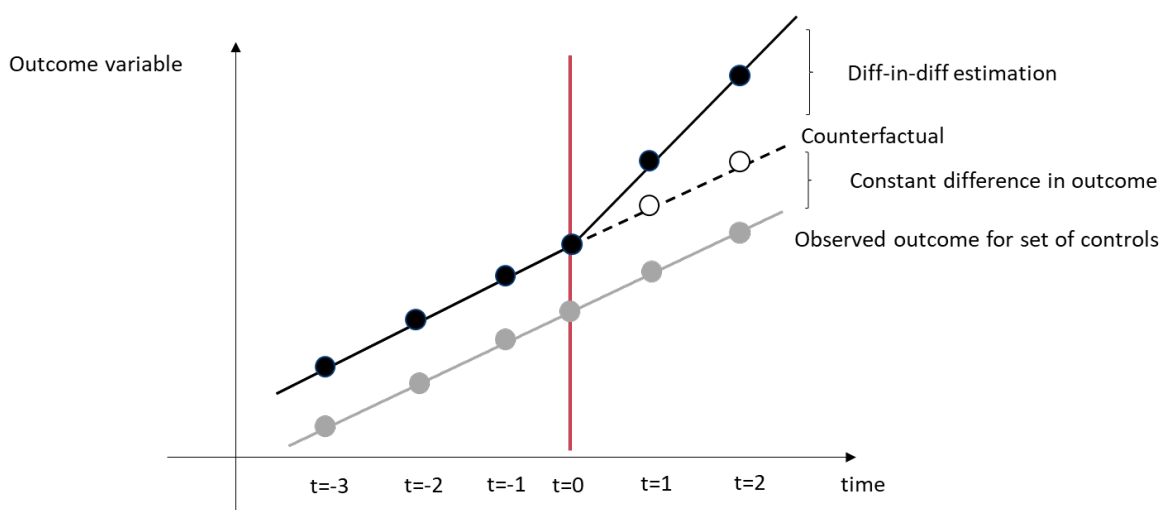
Source: ECON estimations based on EIB allocation data from Serapis and ORBIS Bureau van Dijk.

Estimation approach

We use a difference-in-differences model to estimate the impact of venture debt on firm performance. Difference-in-differences models capture the effect EIB venture debt (treatment effect) on firm performance by comparing firms that receive venture debt (the treatment group) with those firms that do not receive it (the control group), before (pre-period) and after (post-period) treatment.

Figure 13 illustrates the difference-in-differences set-up. The black dotted line represents the outcome variable of interest for the treated group at different points in time. The white dots show the unobservable counterfactuals for the treated group, while the grey line shows the outcome of interest for the control group. The red vertical line at $t=0$ shows the moment of treatment. The method estimates the impact of venture debt as the difference between in outcomes between treatment and control group before and after treatment. In a nutshell, the method assumes that, if treated and control group show parallel trends before receiving venture debt in $t=0$, the control group can be used as a good counterfactual to show how the treated group would have behaved in the absence of treatment. As illustrated in Figure 13, treatment and control groups do not necessarily need to be identical before the treatment. Rather, it is important that the treated and control group share similar trends in the pre-period.

Figure 12. The difference-in-differences set-up



We estimated the difference-in-differences model using the following specification:

$$y_{it} = \beta(T_i \times post_t) + \gamma_i + \delta_t + \varepsilon_{it} \quad (\text{eq. 1})$$

where y_{it} is the outcome variable of interest for firm i in year t , with subscript t denoting time relative to the year of treatment, namely standardized to 0 in the year the treated firms signed their EIB loan. Dummy variable T_i equals 1 for the firms that received EIB financing, and zero otherwise. The dummy $post_t$ defines pre- and post- periods and it equals 1 when $t \geq 0$ and 0 otherwise. The coefficient β is the coefficient of interest, as it quantifies the causal effect of receiving EIB venture loan on the outcome variable of interest, e.g. firm's assets. In addition, the model also controls for firm fixed effects (γ_i) and year fixed effects (δ_t). Finally, ε_{it} denotes the idiosyncratic errors.

Estimation results show that EIB venture debt loans lead to higher firm growth, greater long-term debt and higher value added. Table 8 reports the estimation results for the difference-in-differences model specified in (eq. 1). Coefficients reported in the table are semi-elasticities and need to be multiplied by 100 for an easier interpretation. For example, EIB venture debt beneficiaries' total assets are on average 32% larger than of their peers' following the signature of EIB venture debt. Firms receiving EIB venture debt also show an increase in the number of employees, which constitutes an alternative dimension of firm growth. However, we don't find the increase in the number of employees to be statistically significant. Given the currently limited number of observations after contract signature, one explanation of the positive, but insignificant results could be that these effects might require more time to materialize. In the years following the loan signature, beneficiaries do report a substantially higher level of crowding-in of additional

debt. EIB venture debt also has a strong additionality in terms of beneficiaries' value added relative to that of comparable firms that did not receive EIB venture debt financing.¹⁸

Table 8. Difference-in-differences estimation results

	Total assets	Number of employees	Additional debt	Cost of debt	Value added	Turn-over	Patent applications
Post x Treatment	0.32** (0.14)	0.16 (0.15)	3.35*** (1.19)	-0.09 0.07	0.69*** (0.23)	0.31 (0.25)	0.13 0.12
Firm FE	yes	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes	yes
Balanced panel $-3 \leq t \leq 1$	yes	yes	yes	yes	yes	yes	yes
Number of observations	514	509	449	319	119	413	728
Number of treated firms	43	43	11	33	7	41	61
Number of control firms	36	36	61	17	11	21	49

Notes: Standard errors are noted in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Post x Treatment report the causal effect of interest on different outcome variables; Firm FE and Time FE, indicate that the model includes firm fixed effects and time fixed effects respectively. These two terms remove any variation due to (i) firms' time invariant characteristics, such as firms' ability, location, sector; or (ii) firm invariant characteristics, such as changes in aggregate financing conditions, GDP growth rates, etc.

Source: ECON estimations based on EIB allocation data from Serapis and ORBIS Bureau van Dijk.

The casual interpretation of venture debt in difference-in-differences models is ensured by a “parallel-trends assumption”, which states that firms receiving EIB venture debt would have behaved similarly to those in the control group in the absence of treatment. As shown in Figure 13, this assumption relies on evidence showing that treated and control groups shared similar trends in the pre-period. Evidence of parallel trends before treatment (absence of pre-trends) provides supporting evidence that any difference in the post-period between the two groups is due to venture debt.

We estimate an event-study that formally tests for parallel trends in the pre-period by including time-varying coefficients to the baseline difference-in-differences specification. The estimation results presented above show a significant and positive impact following the signature of venture debt contracts, but they do not rule out any alternative mechanism explaining the positive impact. For example, the positive effect reported in Table 8 could be explained by the fact the EIB selects firms that are already growing, showing higher value added and greater turnover, irrespectively of whether they receive venture debt. To rule this out and to claim a causal effect of venture debt on firms' performance, we test whether the effect estimated in the difference-in-differences predates the time when firms receive venture debt. We do this by estimating the following model, which deviates from a plain difference-in-differences specification as it includes time varying coefficients:

¹⁸ A firm's value added is defined as the sum of taxation, net income, cost of employees, depreciation and interest paid.

$$y_{it} = \sum_{\tau=-4}^{-2} \beta_{\tau} T_i 1(t = \tau) + \sum_{\tau=0}^2 \beta_{\tau} T_i 1(t = \tau) + \gamma_i + \delta_t + \varepsilon_{it} \quad (\text{eq. 2})$$

Where (β_{τ}) are the time-varying coefficients estimated separately for each point in time.¹⁹ We normalized the coefficient at time $t=-1$, β_{-1} , equal to 0 coefficients so that the other coefficients can be interpreted as the cumulative impact with respect to this baseline. Results of the event study estimation are included in the main text (Section 4.2) and confirm the positive impact of EIB venture debt on firm growth, added value and crowding-in of additional debt. Moreover, the lack of a clear trend prior to the time of the loan signature, supports a causal interpretation.

¹⁹ The indicator function $1(t = \tau)$ equals one when t equals τ .

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Impact Assessment of EIB Venture Debt



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