

Chapter 9

Firm-level evidence of heterogeneous investment finance and its implications for the sluggish recovery in investment¹

Chapter at a glance

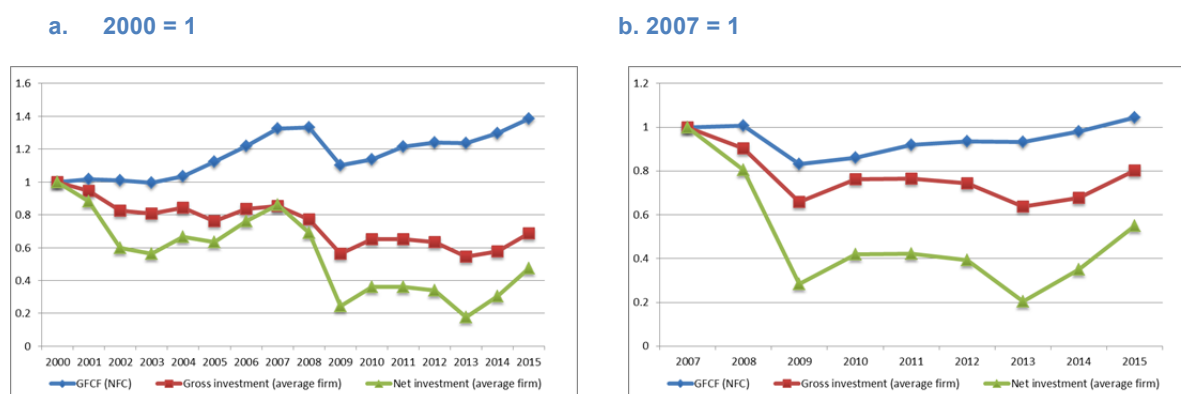
- *This chapter examines the effect of access to different forms of external finance on firms' investment in two different types of assets: tangible and intangible. Two different analyses are performed: a dynamic analysis focusing on 2000–16 period matches information from the European Investment Bank Investment Survey with firm-level data from financial statements; and a static analysis focusing on 2016 only and based solely on information derived from the survey.*
- *While the analysis cannot identify specific relations of causality, it allows for establishing new facts regarding the impact of investment finance on firms' investment choices including three main findings.*
- *First, firms have access to external finance mostly to finance tangible assets. In fact, firms whose external finance accounts for more than 50% of their total financing increase tangible investment more – an effect driven by small and medium-sized enterprises (SMEs).*
- *Second, both SMEs and large enterprises have access to bank debt (short- and long-term), mostly to increase tangible assets. Large firms can also use bank debt to finance intangible assets, while SMEs have to rely on internal finance and trade credit to finance them.*
- *Third, trade credit financing became important for both SMEs and large firms for tangible investment during the period of recovery from the 2008 global financial crisis.*
- *The static analysis, using a different approach based on the proportions of investment and sources of finance as reported by firms in the EIBIS, confirms the above results. In particular, firms are signalling the relevance of internal finance to facilitate investment in intangible assets. For SMEs, bank finance is available to support investment in tangible more than for intangible assets.*
- *Grants are used to a large extent by both large and small enterprises to finance expenditures on land, buildings, and infrastructure, possibly due to policy objectives to enhance energy efficiency that are associated with these grants.*
- *Grants positively influence SMEs' research and development (R&D), but not investment in software and information technology (IT). This may be because policy objectives behind grants tend to focus on R&D alone, disregarding the strong needs for software and IT upgrades in the current technological transformation phase. For SMEs' R&D investment, market finance, and insider finance also play a relevant role.*
- *Overall, a "pecking order" theory of finance emerges in which internal finance is key to supporting intangible investment, bank finance is more related to tangible assets, and trade finance, market-based finance and grants provide a lifeline to support investment in R&D for SMEs.*
- *From a policy point of view, issues in the financing of intangible assets that need to be addressed include (1) creating incentives for banks, (2) implementing targeted guarantee schemes and (3) better incentivising firms' own resources and shareholders' equity.*

¹ This chapter was prepared as a presentation for the European Investment Bank's 2017 Annual Conference by Sebnem Kalemli-Ozcan (University of Maryland, CEPR and NBER), Annalisa Ferrando (European Central Bank) and Carsten Preuss (University of Potsdam), with input from Marcin Wolski (European Investment Bank).

1 From aggregate business investment to firm-level investment rates

Business investment might be affected by the type of financing available. Although aggregate corporate investment has recovered since the global financial crisis, as documented in the first part of this report, firm-level net and gross investment has still not yet reached its pre-crisis levels (as shown in Figure 1, which compares investment rates levels against 2000 and 2007 levels). This chapter investigates the heterogeneity behind the recovery in business investment, focusing on the heterogeneous effects of investment finance. If access to external finance is key to fuelling investment expenditures during boom years, and if this access varies by firm size, then during the recovery period when this type of finance is scarce one should expect different sizes of firms to recover at different speeds. This process will not only create heterogeneity in investment recovery rates but also slow the aggregate recovery (EIB, 2016, Chapter 7).

Figure 1. Aggregate and average firm-level investment over time



Sources: Authors' calculations based on Eurostat, EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: Aggregate gross fixed capital formation (GFCF) at current prices of non-financial corporations (NFCs) in EU28 countries. For firm-level data, averages of net and gross investment are reported. Net investment is defined as the annual change in total fixed assets, while gross investment is the annual change in total fixed assets plus depreciation.

Firm-level financial data combined with survey data provide a unique panel focusing on types of business investments. By relying on the unique dataset that combines the EIBIS with firm-level balance sheet information from Bureau van Dijk's ORBIS database, this chapter focuses for the first time on different types of tangible and intangible investments as a function of their financing before and after the crisis. The ORBIS database entails balance

sheets of firms, whereas the EIBIS provides information on the different types of investment by firms. Data from the EIBIS is cross-sectional for 2016 with reference to 2015 financial statements, whereas firm-level financial statements from ORBIS are longitudinal starting in 2000. Once the two datasets are combined,² it is possible to run a panel analysis of firms' investment dynamics focusing on different types of investment as a function of their financing before and after the crisis. Hence, it is possible to analyse the time series dimension of the financial condition of firms before and at the time of the collection of the survey responses.

The EIBIS provides information about six different types of tangible and intangible assets in which firms have invested (EIB, 2017). For tangible investments, the survey asks about expenditures on (1) land, business buildings and infrastructure and (2) machinery and equipment. For intangible investments, the survey asks about (1) expenditures on R&D (including the acquisition of intellectual property), (2) software, data, IT networks and website activities (software and databases), (3) training of employees and (4) organisation and business process improvements (including restructuring and streamlining).

Survey data include some intangible investments that are not visible in the balance sheet data. The aforementioned six investment types reflect broad coverage of a firm's tangible and intangible investment outlays.³ Table 1 shows that not all investment expenditures reported in the survey are capitalised as capital formation in accounting data. Because of the difficulty of measuring future benefits, intangibles such as organisational capital and training are treated as intermediate costs in the financial statements. The expensing of these intangible asset types, rather than the capitalisation, is in contrast to the treatment of tangible assets, which are capitalised initially and then depreciated. Thus, while the tangible asset expenditures on land, buildings and infrastructure or machinery and equipment are captured as investment in firm accounts, only a few intangible asset types, such as R&D and software databases, are captured as such. As a result, information from the survey on investment in training of employees or making organisational and business improvements is not even part of the total investment information provided by the balance sheet data.

²Annex A contains detailed information on the characteristics of the dataset (see Table A1). See also the Data Annex Methodological Annex at the end of this report.

³ Especially for intangible investment expenditures, EIBIS data provide information that is in line with the conceptual classification of Corrado, Hulten and Sichel (2005) (see Chapter 3 in this report). Their categorisation of computerised information includes assets of purchased as well as self-created software. This is under the software and databases category in the survey. Innovative property captures assets that may include intellectual property protection such as R&D, design, and artistic originals, as well as new product development that is not necessarily leading to a patent or copyright, which in the survey is represented by R&D. Economic competencies are a range of assets that firms invest in to run their business, such as the value of brand names and other knowledge value in firm-specific human resources and organisational structures. This category is broadly covered in the survey under investment expenditures on training of employees and organisation and business process improvements.

Table 1. Investment types according to EIBIS and accounting data

Asset category	Types of asset captured in the EIBIS	Captured as investment in accounts	
Tangible fixed assets	Land, buildings and infrastructure	✓	} Tangible assets
	Machinery and equipment	✓	
Computerized information	Software, data, IT networks and website activities	✓	} Intangible assets
Innovative property	Research and development	✓	
Economic competency	Training of employees	✗	
	Organisation and business process improvements	✗	

Source: Prepared by the authors based on Corrado, Hulten and Sichel (2005).

Note: EIBIS: European Investment Bank Investment Survey.

However, only a limited range of intangible assets is considered as investment in the financial statements. A complete consideration of intangible investment in accounting data would require that information on intangible expenditures be collected from profit and loss data, and that some hypotheses be made about their average life span and the amortisation rate necessary to capitalise them. Although difficult, this is the procedure that has been followed in the literature (see Long and Malitz, 1985, for US-listed companies; Hunter, Webster and Wyatt, 2005, for a methodological review; and Andrews and Criscuolo, 2013, for Organisation for Economic Co-operation and Development countries). In our empirical analysis, it was not possible to pursue this avenue due to the lack of availability of information on profit and loss accounts, as very few companies report intangible expenses. Hence, we use the investment types captured in the balance sheet data (shown with check marks in Table 1).

A directly comparable investigation of investment using survey-level and accounting data relates to four categories of investment: (1) land, buildings and infrastructure; (2) machinery and equipment; (3) R&D; and (4) software databases. These four categories represent 83% of total investment reported by the firms in the survey. Of this share, firms have on average invested 73.8% in tangible fixed assets (which include land, business buildings and infrastructure, and machinery and equipment), 7.5% in R&D, and 18.8% in software databases, as shown in Table 2 based on the 2016 EIBIS.

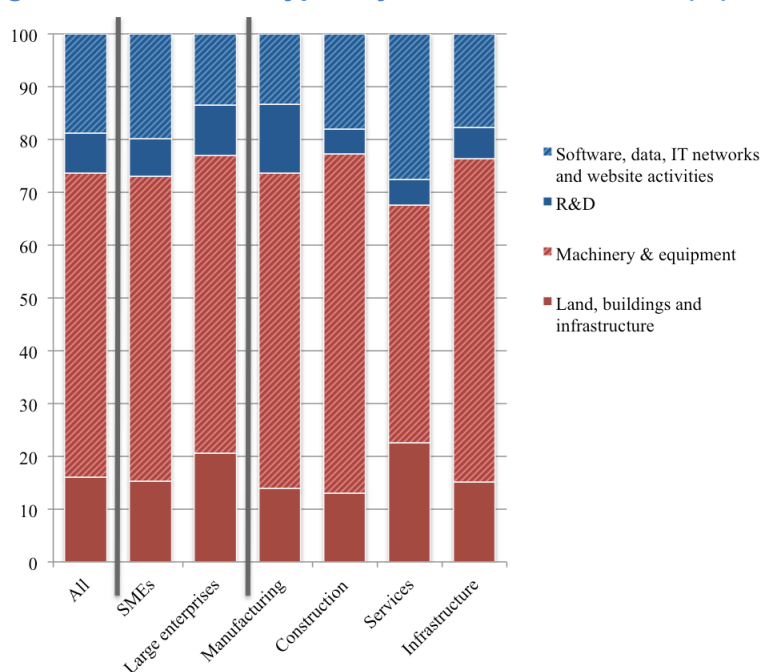
Table 2. Distribution of investment types

Type of investment	Unweighted average (%)	Standard deviation
Land and buildings	16.1	29.5
Machinery and equipment	57.7	38.8
R&D	7.5	19.7
Software and databases	18.8	30.4

Source: Authors' calculations based on EIBIS2016.

SMEs invest less in tangible assets and R&D but more in software and databases than large companies. The breakdown of investment by sector and firm size in Figure 2 largely reflects expected differences between the two size groups and between industry sectors. When considering only the four investment types, the decomposition of investment outlays reveals that large enterprises invest on average a higher share in tangible assets than SMEs (77% versus 73%, respectively), which is largely attributable to a higher share of investment in land, buildings and infrastructure. The higher share of R&D investments by large enterprises compared to SMEs (10% versus 7% for SMEs) is in line with findings in the literature suggesting that larger enterprises have a greater propensity to invest in intangibles, particularly in R&D, because they can better exploit economies of scale and are capable of supporting higher risk (Dierickx and Cool, 1989; Ghosal and Loungani, 2009; Arrighetti, Landini, and Lasagne, 2014). As a consequence, larger enterprises have higher current spending. On the other hand, the average share of investment in software and databases is considerably lower for large enterprises than for SMEs (13% and 20%, respectively).

Figure 2. Investment types by firm size and sector (%)



Source: Authors' calculations based on the 2016 EIBIS.

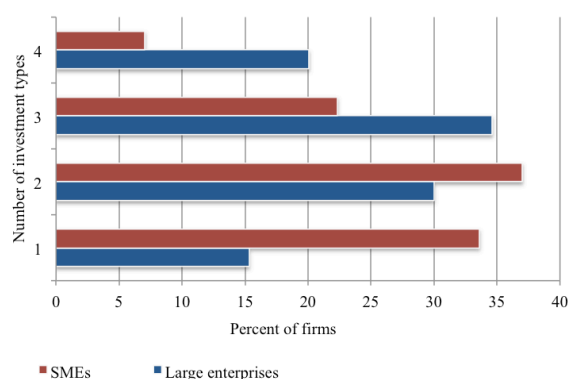
Note: Shares of total investment defined as the sum of the four types of investment: land, buildings and infrastructure, machinery and equipment, research and development (R&D), and software and databases (including IT, information technology). SMEs: small and medium-sized enterprises.

Furthermore, the breakdown of investment types is heterogeneous across industry sectors. Capital-intensive sectors such as construction and infrastructure industries invest most of their outlays in tangible assets, while the service sector has the smallest share of machinery and equipment outlays but the biggest share of investments in software databases.

Unsurprisingly, the manufacturing sector has the largest proportion of R&D outlays (13% compared to 5% in the other sectors).

Differences can also be observed regarding the number of types of investment on which a company relies. Figure 3 shows the percentages of firms that have invested in one or more different types of assets (land and buildings, machinery and equipment, R&D, and software databases) across SMEs and large enterprises. Interestingly, the figure reveals a quite different pattern between SMEs and large enterprises: while most firms overall invest in two different types of assets (43%-45% for both size groups), the distribution for SMEs is skewed towards fewer investment types, and for large enterprises it is skewed towards more investment types. Specifically, only around 17% of SMEs pursued investments in all four asset types, while the figure is almost double for large enterprises. In turn, only 21% of large enterprises invest in only one asset type, while this share is almost double for SMEs. This pattern indicates that large enterprises pursue, on average, a more diversified investment strategy than SMEs.

Figure 3. Frequency of number of investment types by firm size



Source: Authors' calculations based on the 2016 EIBIS.

Note: SMEs: small and medium-sized enterprises.

A new firm-level investment time series is constructed for the analysis. By assuming the EIBIS cross-sectional picture of the investment choices of firms to be constant over time, it is possible to combine the two datasets and undertake a panel analysis of firms' investment dynamics. In order to exploit the time dimension of the matched dataset, we first construct net investment at the firm level using data on the annual change in total fixed assets from the financial statements. For a robustness check we also calculate gross investment by adding depreciation of existing capital. Second, we apply the cross-sectional survey-derived proportions of the different types of investment to total net and gross investment from the balance sheet data. That means the new firm-level investment time series is constructed as follows:

$$\text{Type of investment } (j)_{it} = \text{proportions EIBIS}_{ji} \times \text{Total investment}_{jit} \quad (1)$$

where j denotes the different types of investment for firm i at time t . In this way it is possible to construct a time series for the four types of investment, which vary among firms and over time. The underlying hypothesis is that firms are channelling time-varying amounts of funds to increase time-varying amounts of fixed assets. However, the composition of those fixed assets in terms of different types of investment remains fixed over time. The main idea is that, although the proportions of the different investment types remain fixed for each firm over time, the between-firm variation of investment growth will provide information on how different types of investment behave over time and how the variation can be explained by different financial ratios.

Table 3 reports some descriptive statistics for the constructed gross and net investment variables. Total investment is the annual change in a firm's fixed assets over total fixed assets, while tangible assets (land and buildings, machinery and equipment) and intangible assets (R&D and software databases) are the respective shares of this annual change. We count more observations for net investments (90,436 firm-year observations) due to a lack of data on depreciation in the financial statements in order to calculate gross investment (84,012 firm-year observations). Overall, in terms of the number of firms, out of the 12,468 firms within the matched database, only 8,651 have available information on net investment (corresponding to 90,436 firm-year observations). For gross investment the number of firms is 7,983 (84,012 firm-year observations).

Table 3. Summary statistics for investment

	Observations	Mean	Minimum	Maximum	Standard deviation
Net investment					
Total investment	90,436	0.09	-1	4.16	0.38
Land and buildings	90,436	0.01	-0.92	0.81	0.07
Machinery and equipment	90,436	0.06	-1	1.58	0.26
Research and development	90,436	0	-0.8	1.35	0.05
Software and databases	90,436	0.01	-0.98	1.51	0.1
Gross investment					
Total investment	84,012	0.32	-1	8.06	0.5
Land and buildings	84,012	0.04	-0.91	1.44	0.1
Machinery and equipment	84,012	0.19	-0.92	2.98	0.35
Research and development	84,012	0.02	-0.38	2.53	0.07
Software and databases	84,012	0.05	-0.98	3.44	0.15

Sources: Authors' calculations based on EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: Net (gross) investment in land and buildings, machinery and equipment, research and development, and software databases are the amounts of total net (gross) investment in those categories calculated using the shares reported by firms in the EIBIS divided by lagged fixed assets.

2 Firm-level financing and investment

Firms tend to use mostly internal funds rather than financial debt to finance their investment activity. Nevertheless, trade credit (the provision of credit by suppliers to their customers) also accounts for an important share of investment activity.

In general, firms' investments can be funded by both short- and long-term external finance (debt and equity) as well as by internal finance such as retained earnings and cash and intra-group debts (other current liabilities). Furthermore, firms can also use trade credit, which is an important source of finance, especially when they find it difficult to obtain external funding via credit institutions.

Focusing on the capital structure of firms, panel a in Table 4 shows that a typical firm in the sample reports slightly more total equity than financial debt; in particular, capital represents on average 11% of total assets, while retained earnings count for 27%.⁴ Financial debt, which is the sum of loans up to one year and long-term debt over total assets, is about 19%. In terms of what constitutes the debt, short-term debt (the combination of loans up to one year and trade credit) represents a large source of external funds, with loans up to one year accounting on average for 13% of total liabilities and trade credit for 28%. Firms tend to use more long-term debt (16%) than short-term loans. Cash and intra-group debt is also widely used by firms as reported by other current liabilities (36%).

⁴ By construction, most of the 12,661 firms in the survey are present in the matched database and the total number of firm-year observations ranges between 67,000 and 90,000, depending on the availability of the financial ratio data. All variables are checked to ensure balance sheet identities, and some entries were deleted when they were not meaningful from an accounting point of view. Furthermore, all variables are winsorized at the 1% level, like in Kalemli-Ozcan et al. (2015).

Table 4. Summary statistics of firms' liabilities and investment

Panel a. Capital structure							
	Observations	Mean	Standard deviation	Mean (SMEs)	Mean (Large)	Minimum	Maximum
Retained earnings/Total assets	89,702	0.27	0.3	0.27	0.25	-5.09	0.85
Equity/Total assets	89,730	0.11	0.18	0.1	0.14	-0.84	6.42
Financial leverage/Total assets	73,383	0.19	0.21	0.2	0.19	0	1.49
Short-term loans/Total liabilities	82,642	0.13	0.18	0.13	0.14	0	0.77
Trade credit/Total liabilities	82,300	0.28	0.24	0.29	0.26	0	0.91
Other current liabilities/Total liabilities	76,970	0.36	0.29	0.36	0.34	0	1
Long-term debt/Total liabilities	75,040	0.16	0.21	0.17	0.15	0	0.93

Panel b. Regression variables							
	Observations	Mean	Standard deviation	Mean (SME)	Mean (Large)	Minimum	Maximum
Total investment	90,436	0.09	0.38	0.09	0.09	-1	4.16
Land and buildings	90,436	0.01	0.07	0.01	0.01	-0.92	0.81
Machinery and equipment	90,436	0.06	0.26	0.06	0.05	-1	1.58
Research and development	90,436	0	0.05	0	0	-0.8	1.35
Software databases	90,436	0.01	0.1	0.01	0.01	-0.98	1.51
Internal finance	89,702	0.27	0.3	0.27	0.25	-5.09	0.85
External finance	73,221	0.36	0.25	0.37	0.35	0	1.52
EXT dummy	72,804	0.57	0.49	0.57	0.6	0	1
EXTWTC dummy	72,804	0.24	0.43	0.24	0.25	0	1
Trade credit/Total assets	83,539	0.17	0.18	0.17	0.16	0	1.75
Sales growth	68,057	0.26	2.14	0.27	0.24	-1	95.99
Size	90,434	14.97	2.08	14.42	17.31	4.45	32.51
Cash flow/Total assets	67,717	0.11	0.14	0.11	0.09	-3.45	2.34

Sources: Authors' calculations based on the 2016 EIBIS and the Bureau van Dijk ORBIS database.

Notes: Financial leverage is the sum of short-term loans and long-term debt. Internal finance is defined as the amount of retained earnings to total assets. External finance includes short-term loans, long-term debt and trade credit over total assets. EXT is a dummy variable equal to 1 if the ratio of short-term debt + long-term debt + trade credit to total liabilities is equal to or greater than 50% in a given year. EXTWTC is a dummy variable equal to 1 if the ratio of short-term debt + long-term debt to total liabilities is equal to or greater than 50% in a given year. Sales growth is defined as the annual percentage change in sales revenues. Size is the logarithm of total assets and cash flow is earnings before interest, taxes, depreciation and amortization. SME: small and medium-sized enterprise.

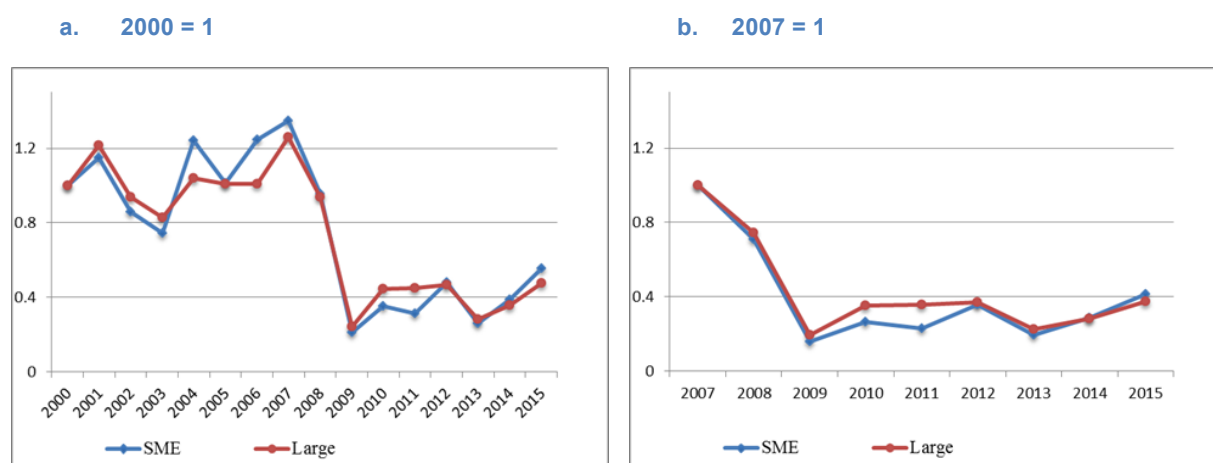
Panel b of Table 4 reports summary statistics for the variables used in the econometric analysis. On average, total net investment covers 9% of capital, whereas most is attributable to fixed tangible investments (7%). Nominal growth of operating revenues (sales growth) is relatively high, although there is quite a large variation across firms, and most firms in the sample are able to generate internal funds and retain cash.

There are intrinsic differences between SMEs and large enterprises in terms of financing and investment behaviour. In contrast to large enterprises, SMEs have a limited scope of available financing sources and face a higher cost of external finance, as they are the most informationally opaque group of firms. Furthermore, the fact that many smaller enterprises are often owner-managed could imply different growth and investment strategies (Cressy and Olafsson, 1997; Berger and Udell, 1998, 2006; Beck, Demirgüç-Kunt and Maksimovic, 2008). Because the data used here provide a wide spectrum of firm sizes, we investigate the differential effects of financing variables on investment behaviour between SMEs and large

enterprises. The capital structure of SMEs tends to have more retained earnings, less capital, more trade credit and other current liabilities.

Figure 4 shows the development of net investment in the two size groups for total net investment. The investment paths for both follow the same trend, with a sharp drop of investment from 2007 until 2009. In the text that follows, the regression analysis will focus on differences in firm size.

Figure 4. Net investment by firm size over time

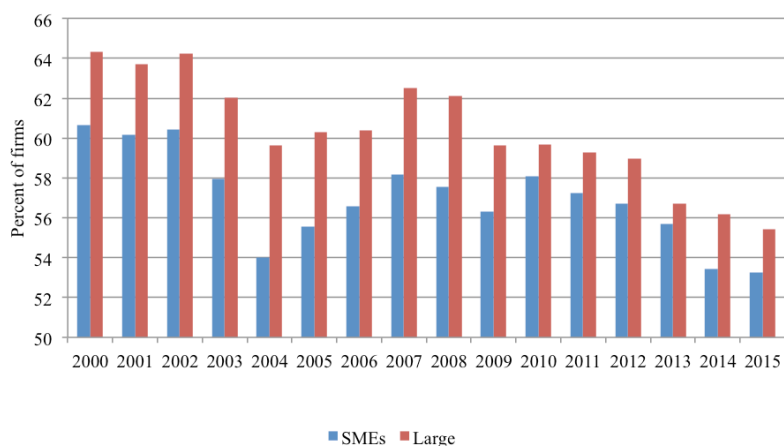


Sources: Authors' calculations based on the 2016 EIBIS and the Bureau van Dijk ORBIS database. Note: Small and medium-sized enterprises (SMEs) are firms with fewer than 250 employees, and large companies are firms with more than 250 employees. Average values are reported.

The use of external finance differs across firm size. The total financing volume is defined based on ORBIS data for internal and external sources. Internal finance is defined as the ratio of retained earnings to total assets, while external finance includes the ratio of short- and long-term debt and trade credit to total assets.⁵ In addition, by defining total liabilities as the sum of short- and long-term debt, trade credit and retained earnings, we construct a dummy variable *EXT* that is equal to 1 if the share of external finance share in firms' total liabilities exceeds 50%. This means that when over half of a firm's total financing is from external sources, we assign a dummy of 1 to that firm and 0 otherwise. Notice that this dummy can vary over time at the firm level. Figure 5 shows the percentages of firms with *EXT* equal to 1 by firm size. On average, 57% of firms make extensive use of external finance. Large firms tend to use more external finance than SMEs.

Figure 5. External finance by firm size over time (%)

⁵ We do not consider intragroup finance, as this type of funding is relevant only for a few subsidiaries in the sample.

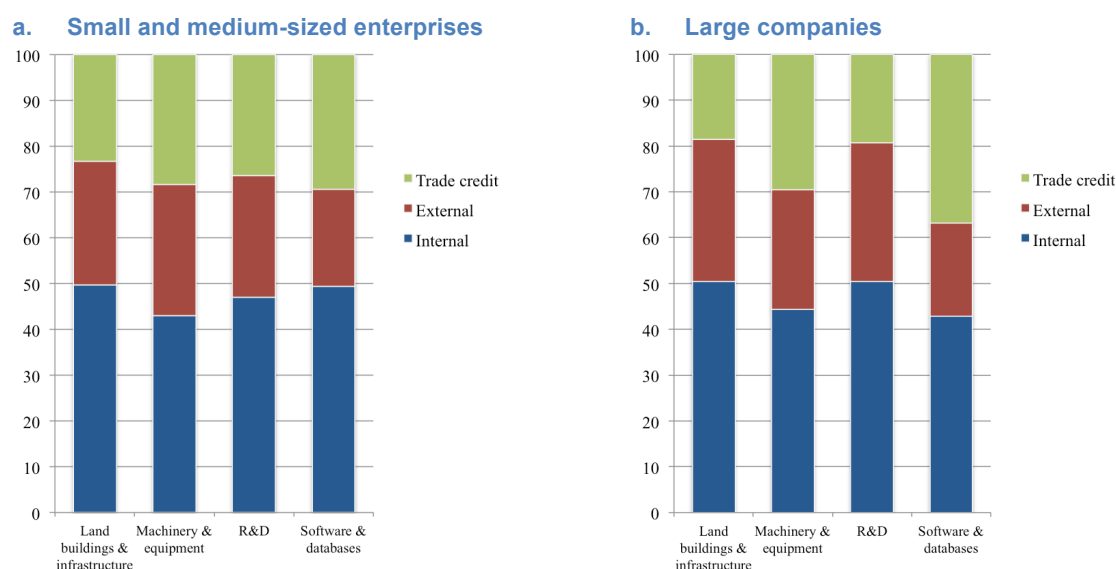


Sources: Authors' calculations based on the 2016 EIBIS16 and the Bureau van Dijk ORBIS database. Note: The figure shows the average percentage of firms with $EXT = 1$, that is, the percentage of firms whose external finance is more than 50% of their total borrowing. SMEs: small and medium-sized enterprises.

As EIBIS contains information about the financing behaviour of firms, it is useful for the analysis to check the use of the different financing sources across both datasets. Hence, before turning to the empirical analysis, it is important to highlight the differences in the definition of external and internal finance as derived from the EIBIS and the ORBIS data.

Figure 6 reports shares of investment finance by external finance (short- and long-term debt), trade credit and internal finance by investment type and firm size. Based on the investment-type information from the EIBIS and the internal and external finance information from the ORBIS, we see that companies rely more on external finance in particular for their investment in machinery and equipment. At the same time, SMEs rely more on trade credit than large companies, while large companies make more use of trade credit for investment in software and databases.

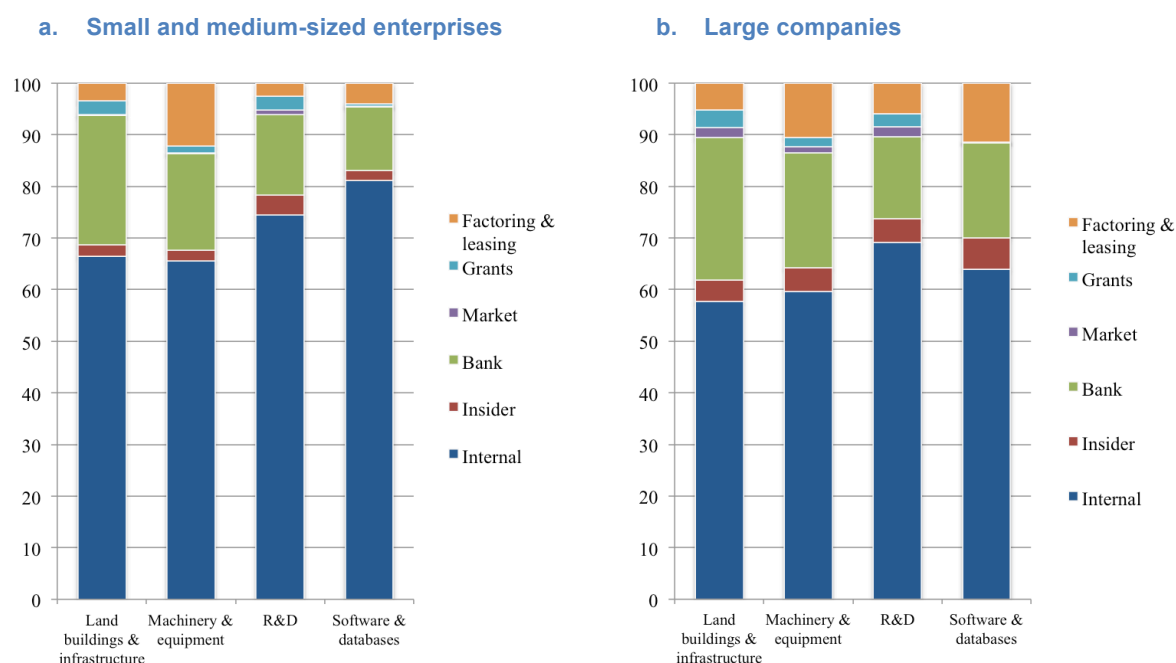
Figure 6. Sources of finance by firm size and investment type: ORBIS data (%)



Sources: Authors' calculations based on the 2016 EIBIS and the Bureau van Dijk ORBIS database. .Note: Each bar shows the average use of the different sources of finance for those firms that have invested the most in each specific type of investment. Financing sources are derived from the Bureau van Dijk ORBIS. Internal finance is defined as the ratio of retained earnings to total financing, while external finance is the ratio of short- and long-term debt to total financing (which includes trade credit). Trade credit is the share of total financing. Small and medium-sized enterprises are firms with fewer than 250 employees and large companies are firms with more than 250 employees.

Figure 7 plots static information from the EIBIS for 2016 on the share of firms that finance different types of investment with different forms of financing. This information seems different from what was just plotted in Figure 6 based on the ORBIS data. Based on the EIBIS, most firms finance all types of investment with internal finance, and SMEs in particular fund most of their intangible investment with internal finance. This type of finance involves retained earnings and cash, whereas bank finance is made up of loans and market finance is comprised of newly issued bonds and equity. The insider finance category captures loans from friends.

Figure 7. Sources of finance by firm size and investment type: EIBIS data (%)



Sources: Authors' calculations based on the 2016 EIBIS

Note: Each bar shows the average use of the different sources of finance for those firms that have invested the most in each specific type of investment. Internal finance is cash and retained earnings. Insider finance consists of intra-group lending and loans from family and friends, bank finance consists of bank loans and other bank finance, and market-based finance consists of issued equity and bonds. Small and medium-sized enterprises are firms with fewer than 250 employees and large companies are firms with more than 250 employees.

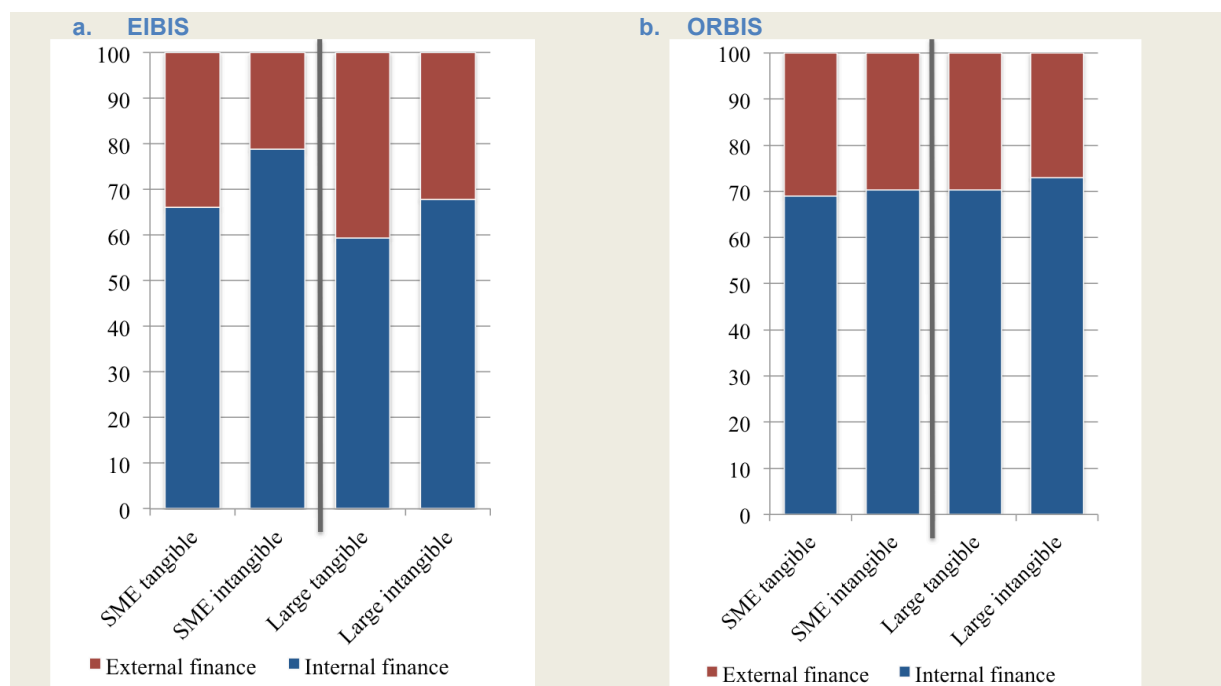
To better understand the origins of the differences in the two datasets, Box 1 provides a detailed comparison of the two definitions and underlines the importance of being aware of the differences when comparing empirical results.

Box 1. Internal and external finance from the EIBIS versus standard balance sheet practice definitions: A comparative exercise

To understand the differences highlighted in the main text on the use of different financial instruments to finance investment, it is important to focus on the definition of internal and external finance derived from the two databases used for the analysis in this chapter.

First, the EIBIS treats the liability and asset sides of the balance sheet together as sources of financing. Perhaps more importantly, the EIBIS does not ask about trade credit, and cash is included in the definition of internal finance. To clarify this issue, we compare internal and external finance as derived from the European investment bank Investment Survey (EIBIS) (Figure 1, panel a) with a revised version of the similar definition of internal and external finance from the Bureau van Dijk ORBIS database. That is, we exclude trade credit from total financing in ORBIS data and add cash and cash equivalents (which is under short-term assets) to internal finance.

Figure 8. Internal and external finance by firm size and investment type (%)



Sources: Authors' calculations based on the 2016 EIBIS16 and the Bureau van Dijk ORBIS database.

Note: Panel b excludes trade credit from external finance and includes cash and cash equivalents in internal finance. Small and medium-sized enterprises (SMEs) are firms with fewer than 250 employees and large companies are firms with more than 250 employees. Average values are reported. Tangible includes all firms that have invested 50% or more in tangible assets. Intangible includes all firms that have invested 50% or more in intangible assets.

As a result, the share of internal finance across all firms in the ORBIS database (Figure 1, panel b) becomes more similar to the average use of internal finance in the EIBIS (around 70%). However, in contrast to the EIBIS, we cannot observe a significantly higher use of internal finance for firms that invest mainly in intangible assets.

To summarise, taking away trade credit from external finance and including cash in internal finance shows a convergence of the shares of internal versus external finance in the ORBIS database towards those in the EIBIS. However, it is important to take into account that in the EIBIS, firms were asked about the amount of finance that was meant exclusively for their investment activity, while the financial data from the balance sheets cannot be assigned to any specific purpose.

Since one aim of the analysis is to consider the role of trade credit, the empirical analysis in the next section will use the definition of external and internal finance based on time series information from the ORBIS data instead of the static information presented from the EIBIS data above. Furthermore, ORBIS data definitions are more in line with standard balance sheet practice that focuses mainly on the liability side of the financial statements for internal and external finance. Most importantly, this will allow us to focus on the special role of trade credit in external finance.

3 Characterising the role of external finance in firm-level investment

Econometric specification

The various types of investment are regressed on the type of financing and control variables. To analyse the impact of the various sources of finance on the different types of investment, we employ the following specification:

$$\begin{aligned} \text{Type of investment (j)}_{it} = & \alpha_i + \omega_{cst} + \beta_1 EXT_{i,t-1} + \beta_2 EXT_{i,t-1} * Size_{i,t-1} + \\ & + \beta_3 sales\ growth_{i,t-1} + \beta_4 Size_{i,t-1} + \beta_5 cash\ flow_{i,t-1} + \varepsilon_{ics}, \end{aligned} \quad (2)$$

where for each firm i at time t , *Type of investment* is total net investment and its four components: (1) land and buildings; (2) machinery and equipment; (3) R&D (including the acquisition of intellectual property); and (4) software databases. In the baseline specifications the four investment types are grouped under tangible and intangible investment. In other regressions, the four types of investment are considered separately, but results are similar to the grouped tangible and intangible investment categories, which are reported in the next section.

In the equation above, α_i are firm fixed effects, and ω_{cst} country-sector-time fixed effects. The former allows for identifying within-firm variation and the latter controls for demand effects. *EXT* is a dummy that takes the value of 1 if a firm's external finance is more than 50% of its total liabilities in a given year. In a further step, trade credit is disentangled from external finance and included as an additional explanatory variable (trade credit over total assets). In this case, *EXT* is redefined as a new dummy *EXT_WTC*. In addition, the *EXT* and *EXT_WTC* dummies are interacted with firm size to see if the effect of external finance on the various types of investment changes depending on the size of the firms. We further split the sample into SMEs and large firms to analyse the level effect of *EXT* within these groups. Additional ratios are included in the investment function as control variables: (1) sales growth, defined as the annual percentage change in sales revenues; (2) size, which is the logarithm of total assets; and (3) cash flow, which is the ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) to total assets. Standard errors in all specifications are clustered at the firm level. All control variables are lagged in order to eliminate simultaneity.

External finance has a higher correlation with tangible assets while internal finance has a higher correlation with intangible assets. Annex A reports the correlation matrix of the main variables, which shows that investment is positively correlated with the firms' financial

performance, in terms of either growth opportunities or the ability to generate internal funds. External and internal finance are positively correlated with the four types of investment, whereas external finance has a higher correlation with tangible asset investment and internal finance seems to play a relatively more important role in intangible asset investment.

These results add to the scarce literature on how the forms of financing are used for different types of investment. Although there are several papers that examine the impact of financial variables on investment, specific literature on how different forms of finance are used for different types of investment is rather scarce. Contrasting the irrelevance theorem by Modigliani-Miller (1958), which states that a firm's capital structure does not matter for its value, several studies have proved that capital structure influences investment decisions through different theoretical angles, including agency theory (Jensen and Meckling, 1976), static trade-off theory (Myers, 1977; Jensen, 1986) and pecking order considerations (Myers and Majluf, 1984). However, most of the existing studies consider financing and investment choices separately and focus on one instrument or investment type at a time.

More recently, a small empirical literature has investigated the effect of different types of financing on investment, but mainly focuses on the choice between debt and equity financing across firm size (Covas and Den Haan, 2012; Begenau and Salomao, 2016). Assuming that there are differences in funding needs and financial frictions across firms,⁶ it is often found that, in good times, smaller firms respond to increased growth opportunities by investing and raising more funds following a pecking order from internal funds to debt and then equity. Closer to the analysis in this chapter, Grundy and Verwijmeren (2017) find that investment with more volatile cash flows, like R&D investments, tends to be equity-financed. Investment in tangible assets, on the other hand, is mostly debt-financed. However, differently from this chapter, Grundy and Verwijmeren (2017), due to their limited sample of listed firms from the US, do not consider either internal financing or financing by bank loans and credit lines, but rather focus primarily on debt and equity securities that are issued to finance new investment.

Link between tangible and intangible investment and external finance

Firms, for which external finance accounts for more than 50% of their total financing, increase tangible investment more. Following much of the investment literature, the main results are based on net instead of gross investment. Table 5 displays the results from the main specification. To start with, all standard determinants come in with the expected sign: firms with greater cash flow and more growth opportunities invest more, while firms invest less as they grow in size. Firms that mostly finance themselves with external finance

⁶ First, smaller firms have higher funding needs because they are farther away from their efficiency scale and, second, debt financing is generally more costly to them as they have less pledgeable collateral.

increase their tangible investment more, conditional on all other determinants of investment. The economic magnitude of this effect is significant: for firms whose external finance share is relatively high, tangible investment is 16 percentage points higher than that of firms with lower shares of external finance. A further investigation within the two different types of tangible investment indicates that the additional investment related to high external finance levels is mainly related to the acquisition of machinery and equipment. The interaction with size shows that this positive effect declines for larger firms, but not much (less than 1 percentage point). In the case of intangible investments, the share of external finance has no significant effect, as shown in column 3 in Table 5.

Table 5. Investment and external finance

	(1)	(2)	(3)
Variables	Total	Tangible	Intangible
EXT	0.1793*** (0.0510)	0.1605*** (0.0429)	0.0188 (0.0172)
Size (t-1) * EXT	-0.0093*** (0.0032)	-0.0084*** (0.0027)	-0.0008 (0.0011)
Size (t-1)	-0.1785*** (0.0072)	-0.1467*** (0.0061)	-0.0318*** (0.0025)
Sales growth (t-1)	0.0027** (0.0012)	0.0019** (0.0010)	0.0008** (0.0004)
Cash flow (t-1)	0.2872*** (0.0266)	0.2227*** (0.0228)	0.0645*** (0.0077)
Observations	51,837	51,837	51,837
R-squared	0.0805	0.0757	0.0307
Number of firms	6,120	6,120	6,120
Country-sector-year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Clustered standard errors	Yes	Yes	Yes

Sources: Authors' calculations based on the 2016 EIBIS and the Bureau van Dijk ORBIS database. Note: EXT is a dummy variable equal to 1 if the ratio of short-term debt + long-term debt + trade credit to total liabilities is equal to or greater than 50% in a given year. Sales growth is defined as the annual percentage change in sales revenues. Size is the logarithm of total assets, and cash flow is the ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) to total assets. Standard errors are clustered at the firm level. *** $p < 0.01$. ** $p < 0.05$, * $p < 0.1$.

Looking at the characteristics of firms with high external finance levels, a simple t-test reveals that those firms tend to generate less cash flow and hold less cash than less-leveraged firms. By contrast, they have greater growth opportunities and, in the case of SMEs, more collateral to post, which partly justifies their ability to keep more debt on their balance sheet (see Table A3 in Annex A).

SMEs have access to external finance mostly to finance tangible assets. To understand the role of size better, Table 6 runs the same regression for SMEs and large firms separately. The table shows that the effect we have found in the previous table is driven by SMEs' tangible investment, since the share of external finance seems to have no role in investment for large firms. In fact, it can be seen that within the group of SMEs, the effect of external finance on investment also decreases with firm size. But even when this is taken into account, tangible investment of SMEs, which mostly use external finance, is 16 percentage points higher. Interestingly, the significant effect is concentrated on the acquisition of machinery and equipment.

Table 6. Investment and external finance: SMEs and large firms

Variables	(1)	(2)		(3)	(4)	(5)		(6)
	Total	SME		Intangible	Total	Large		Intangible
		Tangible				Tangible		
EXT	0.1898*** (0.0687)	0.1724*** (0.0576)		0.0164 (0.0232)	-0.1173 (0.1304)	-0.0892 (0.1082)		-0.0270 (0.0489)
Size (t-1) * EXT	-0.0097** (0.0045)	-0.0090** (0.0038)		-0.0006 (0.0015)	0.0067 (0.0073)	0.0051 (0.0061)		0.0016 (0.0028)
Size (t-1)	-0.1781*** (0.0088)	-0.1479*** (0.0075)		-0.0301*** (0.0028)	-0.1923*** (0.0132)	-0.1515*** (0.0108)		-0.0406*** (0.0057)
Sales growth (t-1)	0.0027 (0.0017)	0.0018 (0.0014)		0.0009 (0.0006)	0.0029** (0.0014)	0.0023** (0.0011)		0.0006 (0.0004)
Cash flow (t-1)	0.2975*** (0.0304)	0.2325*** (0.0262)		0.0648*** (0.0086)	0.2181*** (0.0490)	0.1625*** (0.0383)		0.0558*** (0.0170)
Observations	39,129	39,129		39,129	12,708	12,708		12,708
R-squared	0.0791	0.0748		0.0306	0.1029	0.0963		0.0505
Number of firms	4,815	4,815		4,815	1,305	1,305		1,305
Country-sector-year fixed effects	Yes	Yes		Yes	Yes	Yes		Yes
Firm fixed effects	Yes	Yes		Yes	Yes	Yes		Yes
Clustered standard errors	Yes	Yes		Yes	Yes	Yes		Yes

Sources: Authors' calculations based on the 2016 EIBIS and the Bureau van Dijk ORBIS database. Note: EXT is a dummy variable equal to 1 if the ratio of short-term debt + long-term debt + trade credit to total liabilities is equal to or greater than 50% in a given year. Sales growth is defined as the annual percentage change in sales revenues. Size is the logarithm of total assets, and cash flow is the ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) to total assets. SMEs are firms with fewer than 250 employees and large companies are firms with more than 250 employees. Standard errors are clustered at the firm level. *** $p < 0.01$. ** $p < 0.05$, * $p < 0.1$. SMEs: small and medium-sized enterprises.

Firms, which obtain most of their external finance from financial institutions, increase their tangible investment more. Large firms also use this type of external finance for intangible investment, while SMEs, which rely on trade credit as an alternative source of financing, invest relatively more in intangibles. Trade credit – the provision of credit by suppliers to their customers – is a common business practice in Europe and is regarded as the most important source of financing, especially for small firms (Petersen and Rajan, 1997; Berger and Udell, 1998; Bourgeois, Mateut and Mizen, 2009; Carbo-Valverde, Rodriguez-Fernandez and Udell, 2016; Kalemlı-Ozcan, 2016). Most of the literature emphasises that firms, and particularly SMEs, use trade credit when banks are unwilling to provide loans (Boissay and Gropp, 2007; Cunať, 2007). This is particularly true in situations of financial distress such as that experienced by European companies during the financial crisis.

In order to further analyse the role played by trade credit, Table 7 displays the econometric results when trade credit is disentangled from overall external finance. Trade credit has a positive impact on both tangible and intangible investment for SMEs, as expected. The *EXT_WTC* dummy, which takes the value of 1 when firms' external finance in terms of short- and long-term debt exceeds 50% of their total financing, is still positive and significant for tangible investment for SMEs. Interestingly, this dummy is positive and significant for both tangible and intangible investment for large firms, whereas the role of trade credit finance for large firms is insignificant.

Table 7. Investment and external finance: The role of trade credit

	(1)	(2)	(3)	(4)	(5)	(6)
	SME			Large		
Variables	Total	Tangible	Intangible	Total	Tangible	Intangible
Trade credit (<i>t</i> -1)	0.1302*** (0.0258)	0.1092*** (0.0226)	0.0330*** (0.0096)	0.0767 (0.0476)	0.0635 (0.0408)	0.0176 (0.0167)
EXT_WTC	0.3111*** (0.0756)	0.2780*** (0.0669)	0.0367 (0.0234)	0.4626*** (0.1538)	0.3821*** (0.1384)	0.1023** (0.0461)
Size (<i>t</i> -1) * EXT_WTC	-0.0166*** (0.0049)	-0.0149*** (0.0044)	-0.0017 (0.0015)	-0.0239*** (0.0086)	-0.0197** (0.0077)	-0.0053** (0.0026)
Size (<i>t</i> -1)	-0.1680*** (0.0084)	-0.1471*** (0.0073)	-0.0282*** (0.0028)	-0.1655*** (0.0119)	-0.1371*** (0.0101)	-0.0360*** (0.0052)
Sales growth (<i>t</i> -1)	0.0007 (0.0017)	0.0003 (0.0014)	0.0004 (0.0006)	0.0038*** (0.0014)	0.0029*** (0.0011)	0.0011* (0.0006)
Cash flow (<i>t</i> -1)	0.3128*** (0.0288)	0.2552*** (0.0254)	0.0752*** (0.0094)	0.2355*** (0.0526)	0.1864*** (0.0414)	0.0609*** (0.0197)
Observations	35,982	35,982	35,982	11,696	11,696	11,696
R-squared	0.0817	0.0775	0.0313	0.1057	0.0991	0.0525
Number of firms	4,793	4,793	4,793	1,302	1,302	1,302
Country-sector-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Clustered standard errors	Yes	Yes	Yes	Yes	Yes	Yes

Sources: Authors' calculations based on the 2016 EIBIS and the Bureau van Dijk ORBIS database.
Note: *EXT_WTC* is a dummy variable equal to 1 if the ratio of short term debt + long term debt to total liabilities is equal to or greater than 50% in a given year. Sales-growth is defined as the annual percentage change in sales revenues. Size is the logarithm of total assets. Trade credit is accounts payable over total assets, and cash flow is the ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) to total assets. SMEs are firms with fewer than 250 employees and large companies are firms with more than 250 employees. Standard errors are clustered at the firm level.
*** $p < 0.01$. ** $p < 0.05$, * $p < 0.1$.

The crisis and the sluggish recovery

During the period of recovery from the 2008 global financial crisis, trade credit financing became important for tangible investment for both SMEs and large firms. Access to finance became difficult immediately after the crisis, but the extraordinary monetary policy efforts to lower the cost of external finance should have eased conditions for financing investment. It should be expected, on the one hand, that external finance would have become more

important for investment relative to internal finance in the years after the financial crisis. But, on the other hand, for those firms that lacked external finance and were planning to invest, trade credit might have become the alternative source of financing. To check this hypothesis, the main empirical strategy is replicated by splitting the sample in the period before and after the financial crisis. Table 8 reports the estimated coefficients for the period before and after the financial crisis for the specification with trade credit and the split of the sample by firm size.

The period before 2008 was a boom period when investment was still growing and firms were generating increasing cash flows. Hence during this period firms that used more external finance increased their investment. The results are similar to those in the previous table, where SMEs that relied on trade credit as an alternative source of financing invested relatively more in intangible assets, and SMEs whose share of external finance was high (where this finance came from financial institutions) increased their tangible investment more. Large firms that obtained most of their financing from financial institutions increased both tangible and intangible investment.

During the period of recovery from the 2008 crisis, companies that were able to obtain trade credit are those that were recovering faster with their investment activity, irrespective of their size. Results in the last four columns of Table 8 that focus on the post-crisis period are drastically different from those in the pre-crisis period. Trade credit became a significant source of finance for tangible investment for large firms, and SMEs seemed to have made use of trade credit for both tangible and intangible investment. These results are most likely due to the stark changes in the availability of external finance from financial institutions. Similarly, Carbo-Valverde et al. (2016) find that the capital expenditure of credit-constrained Spanish SMEs was increasingly funded with trade credit during the Great Recession.

During the recovery, by “defreezing” the liquidity squeeze and re-establishing trust among business partners, trade credit regained its role before the increase in the availability of bank lending. Consequently, the buffering role of trade credit took on particular importance for all companies at times when firms found it difficult to obtain loans from credit institutions.

Table 8. Investment and external finance: Recovery from the financial crisis

Variables	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	2000-2007								2008-2015							
	SME				Large				SME				Large			
	Tangible	Intangible	Tangible	Intangible	Tangible	Intangible	Tangible	Intangible	Tangible	Intangible	Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
Trade credit (<i>t</i> -1)	0.0438 (0.0431)	0.0532*** (0.0171)	-0.0201 (0.0621)	0.0254 (0.0295)	0.1448*** (0.0329)	0.0229** (0.0116)	0.1763** (0.0698)	-0.0126 (0.0261)								
EXT_WTC	0.3078** (0.1420)	0.0690 (0.0525)	0.6546** (0.2579)	0.1743** (0.0804)	0.2632*** (0.0700)	0.0139 (0.0233)	0.2830 (0.2074)	0.0140 (0.0626)								
Size (<i>t</i> -1) * EXT_WTC	-0.0158* (0.0094)	-0.0034 (0.0034)	-0.0346** (0.0146)	-0.0089* (0.0046)	-0.0149*** (0.0046)	-0.0004 (0.0015)	-0.0131 (0.0113)	-0.0007 (0.0034)								
Size (<i>t</i> -1)	-0.2349*** (0.0151)	-0.0476*** (0.0058)	-0.2062*** (0.0220)	-0.0607*** (0.0086)	-0.1849*** (0.0107)	-0.0376*** (0.0047)	-0.1762*** (0.0219)	-0.0243*** (0.0061)								
Sales growth (<i>t</i> -1)	-0.0025 (0.0026)	-0.0008 (0.0008)	0.0031** (0.0015)	0.0006 (0.0006)	0.0006 (0.0018)	0.0006 (0.0009)	0.0024** (0.0011)	0.0015 (0.0011)								
Cash flow (<i>t</i> -1)	0.2778*** (0.0516)	0.0986*** (0.0181)	0.2051*** (0.0737)	0.0939*** (0.0339)	0.2400*** (0.0320)	0.0590*** (0.0115)	0.1795*** (0.0514)	0.0561*** (0.0208)								
Observations	14,275	14,275	5,023	5,023	21,707	21,707	6,673	6,673								
R-squared	0.0808	0.0253	0.1215	0.0705	0.0491	0.0174	0.0598	0.0189								
Number of firms	3,094	3,094	1,026	1,026	4,393	4,393	1,213	1,213								
Country-sector-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes								
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes								
Clustered standard errors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes								

Sources: Authors' calculations based on the 2016 EIBIS and the Bureau van Dijk ORBIS database. Note: EXT_WTC is a dummy variable equal to 1 if the ratio of short-term debt + long-term debt to total liabilities is equal to or greater than 50% in a given year. Sales growth is defined as the annual percentage change in sales revenues. Size is the logarithm of total assets. Trade credit is accounts payable over total assets and cash flow is the ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) to total assets. SMEs are firms with fewer than 250 employees and large companies are firms with more than 250 employees. Standard errors are clustered at the firm level. *** $p < 0.01$. ** $p < 0.05$, * $p < 0.1$.

It is important to remember that the use of trade credit by a firm is twofold. A firm is not only a customer whose accounts payable are its borrowing from suppliers (on the liability side, as explored in this chapter). A firm can also be seen as a supplier, and therefore its accounts receivable (on the asset side) are a proxy for how much it lends to customers. Usually, firms that receive trade credit from their own suppliers are more likely to extend trade credit to their customers (Ferrando and Mulier, 2013). Box 2 explores the interlinkages of accounts payable and receivable and their impact on tangible investment.

Box 2. Net trade credit as a coordination device for investment for distressed companies

The chapter highlights the positive impact of trade credit on the financing of tangible investment since 2008. This box expands the analysis by going beyond firm's access of credit to examine their extension of trade credit to their customers. It uses a large sample of non-financial corporations in the European Union.

Most trade credit theories relate the use of trade credit to the presence of information asymmetries and the monitoring advantage that suppliers have over banks. This mainly considers the liabilities side, that is, accounts payable, as is done in this chapter. However, a growing strand of the literature also focuses on the importance of trade credit as a liquidity management tool, that is, mainly in the form of accounts receivable – the assets side) (see Ferrando and Mulier, 2013, for a review of the literature). This box focuses on *net* trade

credit, or the relative trade credit exposure between firms' customers and suppliers – that is, the difference between accounts receivable and accounts payable – and its link with investment.

Despite the wide body of literature on net trade credit, the evidence of the impact of net trade credit on investment is inconclusive. Coricelli and Frigerio (2016) argue that net trade credit is liquidity-absorbing and therefore has a negative impact on investment. They suggest that an increase in net trade credit drains liquid resources that firms could otherwise invest or use to support current production, even when controlling for a variety of firm- and country-specific characteristics. Furthermore, such a liquidity squeeze is particularly acute for small and medium-sized enterprises (SMEs).

On the other hand, Dass, Kale and Nanda (2015) show that the provision of trade credit to business partners can serve as a commitment device for making relationship-specific investments. Trade credit naturally emerges as a quality guarantee mechanism when the downstream company is uncertain about the quality of acquired goods and is affected by investment dynamics. The reverse effects – that is, the impact of trade credit on investment – are left unaddressed.

The analysis for this box finds that, whereas net trade credit has an overall negative impact on capital formation due to liquidity effects, the effect is less pronounced for firms that are in financial difficulties (distressed companies) than for non-distressed companies. The idea behind this is that through capital expenditure, distressed companies try to maintain vital business relations with their customers in order to participate in the final profits through trade credit repayments.

For the exercise we use a large panel of non-financial corporations in 23 EU countries derived from the Bureau van Dijk ORBIS database.⁷ The sample is comprised of around 9 million firm-year observations for the period 2004–14.

To identify distressed firms the analysis is based on three distinct definitions, as outlined below.

EIBIS index

First, we consider a novel financial distress index that is calculated using the information derived from the 2016 wave of the European Investment Bank Investment Survey (EIBIS). This is the credit-constrained index presented in Chapter 1. As a reminder, the survey considers financially constrained companies to be those that are dissatisfied with the amount of finance obtained (received less), sought external finance but did not receive it (rejected), and/or did not seek external finance because they thought borrowing costs would be too high (too expensive) or they would be turned down (discouraged). The probability of being constrained among firms surveyed in the EIBIS is regressed on a set of indicators of their financial situation (profitability, growth opportunities, financial leverage and cash holding) as well as on sector and country dummies. The estimated coefficients are then fitted to our sample of European firms.⁸ The resulting score is used to rank the firms according to their probability of being credit-constrained. For each year, financially constrained firms are identified as those with a score greater than a country threshold, which is directly derived from the survey.⁹

⁷ The following countries are excluded due to poor financial data coverage: Cyprus, Greece, Lithuania, Malta and Poland.

⁸ The methodology is similar to the one used in Ferrando, et al. (2015) based on the Survey on the Access to Finance of Enterprises (SAFE) conducted by the European Central Bank and European Commission.

⁹ The threshold is defined as the top x% of the distribution of calculated scores by country, where x is the percentage of firms that reported being financially constrained in the first wave of the EIBIS.

Distressed firms (OECD definition)

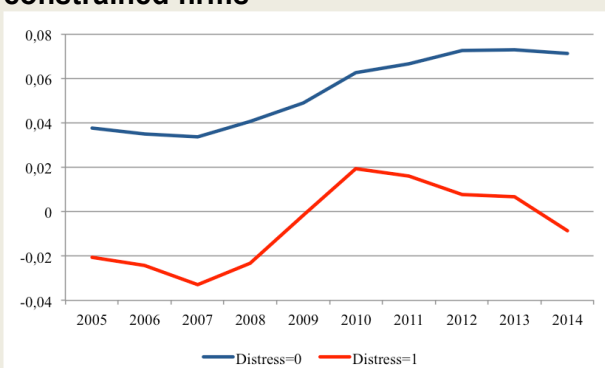
The second classification of distressed companies is derived from the definition proposed by the Organisation for Economic Co-operation and Development (OECD) (McGowan, Andrews and Millot, 2017). Distressed companies are firms more than 10 years old with negative profit or interest coverage ratio less than 1 for more than three consecutive years.

Distressed firms (Bank of England definition)

Lastly, a very broad definition proposed by the Bank of England (2013) selects companies with negative profits for three consecutive years.

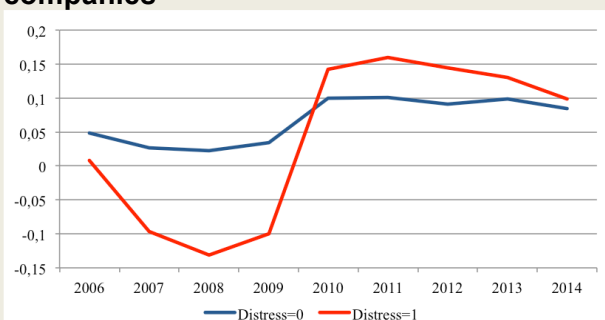
Figures 1–3 display the trend of net trade credit (defined as net trade credit over gross sales) between distressed and non-distressed firms for the three indicators. For two classifications (the EIBIS and Bank of England), the net-trade-credit ratio is always positive and higher for non-distressed companies. In the case of the OECD classification, distressed companies increased their use of net trade credit more after the financial crisis.

Figure 9a. EIB index: Net trade credit among financially constrained and not-constrained firms



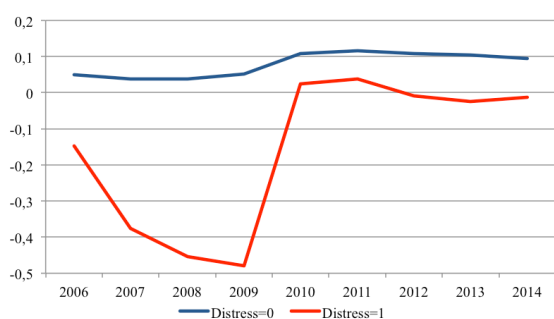
Sources: Authors' calculations based on EIBIS 2016 and the Bureau van Dijk ORBIS database.

Figure 9b. OECD definition: Net trade credit among distressed and non-distressed companies



Sources: Authors' calculations based on the Bureau van Dijk ORBIS database.

Figure 9c. Bank of England definition: Net trade credit among distressed and non-distressed companies



Source: Authors' calculations based on the Bureau van Dijk ORBIS database.

To detect the relationship between investment and net trade credit, our main identification strategy is as follows:

$$\frac{I_{icst}}{K_{icst-1}} = \beta_1 NTCS_{icst} \times D_{icst} + \beta_2 NTCS_{icst} + \beta_3 D_{icst} + \beta_4 X_{icst-1} + \beta_5 v_i + \beta_6 \mu_{cst} + \varepsilon_{icst},$$

where I corresponds to the actual investment levels, taken as the year-on-year change in tangible capital stock, K is the tangible capital level, $NTCS$ is the ratio of net trade credit to gross sales level, D denotes the distress dummy, and X is a vector of control variables, including the year-on-year growth in sales, the ratio of cash to total assets, the ratio of tangible assets to total assets, profitability as the ratio of profit/loss before tax to total assets, and the logarithm of total assets. Financial leverage is taken as the ratio of short- and long-term debt to total assets. The model is saturated by the company-specific fixed effects v_i and a vector of country-sector-year fixed-effects μ_{cst} , with sectors characterised at the four-digit level of the NACE Rev. 2 classification. Error terms are represented by ε_{icst} , where subscripts i , c , s and t correspond to the firm, country, sector and time dimensions, respectively.

To address possible endogeneity issues, the lagged distress indexes are considered in an alternative specification. Due to the short-term nature of net trade credit, the variable can enter the model specification at time t only. A further investigation, including instrumental variable estimates, suggests that the main model results still hold when controlling for aggregate demand dynamics. The main results are presented in Table 1.

Table 9. Impact of net trade credit on investment among distressed companies

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Distress definition	EIBIS	EIBIS	OECD	OECD	Bank of England	Bank of England
NTCS x DISTRESS	0.010*** (0.003)		0.010*** (0.002)		0.008*** (0.002)	
NTCS x DISTRESS (lag)		0.013*** (0.004)		0.008*** (0.002)		0.007*** (0.002)
DISTRESS	-0.038*** (0.009)		-0.027*** (0.002)		-0.106*** (0.004)	
DISTRESS (lag)		-0.014*** (0.004)		-0.073*** (0.004)		-0.088*** (0.005)
NTCS	-0.024*** (0.002)	-0.022*** (0.002)	-0.014*** (0.002)	-0.011*** (0.002)	-0.014*** (0.001)	-0.012*** (0.001)
Company fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Additional firm controls	Yes	Yes	Yes	Yes	Yes	Yes

Country x sector x year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	7,827,925	5,818,617	6,436,679	4,915,309	9,449,680	7,129,311
R ²	0.271	0.278	0.294	0.305	0.285	0.293
Adjusted R ²	0.087	0.082	0.091	0.089	0.090	0.084

Sources: Authors' calculations based on the Bureau van Dijk ORBIS database..

Note: The dependent variable is net investment defined as investment at time t divided by the value of tangible capital at time $t-1$. Distressed companies are classified in line with the EIBIS (columns 1a and 1b), OECD (columns 2a and 2b), and Bank of England (columns 3a and 3b) methodologies. Additional firm-level controls include lagged sales growth, the lagged cash-to-assets ratio, lagged tangibility ratio, lagged profitability ratio, lagged log of total assets, and lagged financial leverage. NTCS: is the ratio of net trade credit to gross sales level. Standard errors are clustered at the firm level and are reported in parentheses, where * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

It can be readily observed that the results hold for financially constrained firms as well as for distressed companies in terms of statistical significance and, to a large extent, in terms of magnitudes. First, we confirm the negative impact of net trade credit on investment in non-distressed companies, confirming the liquidity-drain channel presented by Coricelli and Frigerio (2016). Similarly, distressed companies invest less, on average, than non-distressed companies. However, we find that when a company is under distress, the negative effect of net trade credit is less severe.¹⁰

It appears that the mechanisms behind net trade credit are more nuanced for distressed firms. Troubled companies operate in a difficult market environment, often under a stigma, with mistrust and in isolation. Established corporate relations, often supported by trade credit, appear to be a vital source of revenues. Capital expenditures sustain, if not improve, the quality of produced goods, allowing the company to keep its business relations and participate in the final profits through the trade credit repayment. Consequently, trade credit is important for the investment decisions of distressed firms, supporting their role throughout the supply chain. Because of such a mechanism, the existence of some distressed companies might be prolonged, locking in capital and labour resources and, consequently, decreasing aggregate allocative efficiency.

Note: This box was prepared by Annalisa Ferrando (European Central Bank) and Marcin Wolski (European Investment Bank).

The analysis developed up to now shows the relevance of different external financing sources with respect to different types of investment. While trade credit became particularly important for SMEs in the recovery period, the results indicate the crucial role of external finance from financial institutions for tangible investments. A natural next step is to see what effect these particular external finance sources could have on different types of investment. Thus, this chapter continues with a static analysis using the EIBIS data, where it is possible to take a closer look at the different types of investment and see whether the main results can be verified.

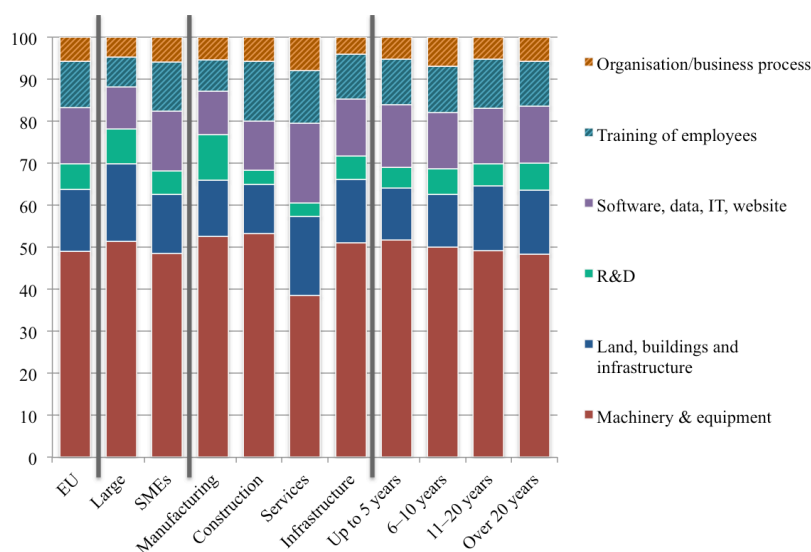
¹⁰ It is worth noting that when accounts receivable and payable are considered separately in the specification, the results in the main text are confirmed insofar as accounts payable have a positive impact on investment while accounts receivable have a negative one.

4 A pecking order theory of finance for investment: A static approach

As explained at the beginning of the chapter, EIBIS data include additional types of intangible investment that are usually not capitalised as investment expenditures in firms' accounts. Such expenditures include training of employees and organisation and business process improvements (like restructuring and streamlining activities).

As explored in Chapter 3, these types of investment represent an important share of firms' total investment outlays (17% on average) (Figure 8). Especially for SMEs, these investment types play a significantly bigger role in their total investment than do such investments by large enterprises (18% versus 12%). Therefore, it is important to also consider these investment types in the financing-investment analysis.

Figure 10. Average share of investment types across firm size, sector and age (%)



Source: EIBIS2017.

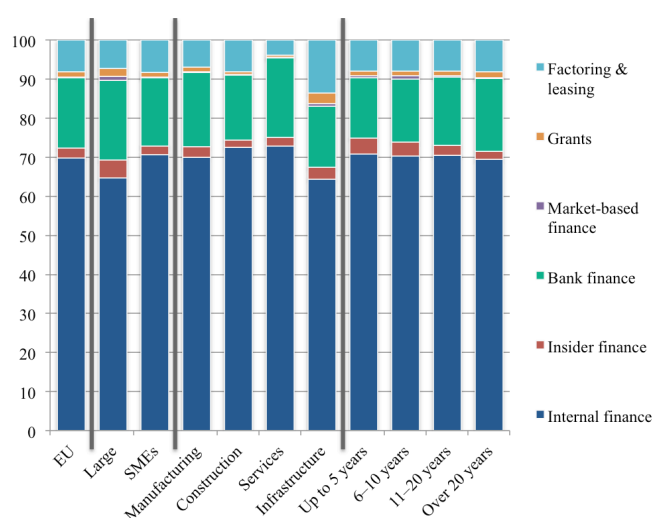
Note: IT: information technology; R&D: research and development; SME: small and medium-sized enterprise.

Furthermore, the survey provides information about firms' investment finance with a different breakdown (as explored in Box 1). To recap, firms were asked what proportions of their finance for investment came from either internal finance or retained earnings (for example, cash or profits), intra-group lending from parent companies, or external finance. Furthermore, firms also reported the proportions of external finance used for their investment activities. Rather than distinguishing by maturity of external finance, as is the case for balance sheet data, the EIBIS instead asked for the specific type of financing instrument.

For the econometric analysis, we combined the information on the different types of finance and grouped them into six different categories according to their inherent characteristics. Internal finance is directly taken from the survey. Insider finance includes intra-group lending and loans from family, friends and business partners, which is distinguished by the fact that the lender has at least some insider information on the borrowing company. Bank loans and other bank finance, such as overdrafts or other credit lines, are grouped under bank finance. Market-based finance is comprised of the proportions of newly issued bonds and equity. Grants – defined as support from public services – are taken from the survey.

Figure 9 shows that firms across all sizes, sectors and age groups tend to finance their investment predominantly through internal finance (70%, on average). Bank finance and factoring and leasing play a predominant role among the external financing sources, while market-based finance, insider finance and grants only make up a small share.

Figure 11. Average share of financial sources across firm size, sector and age (%)



Source: EIBIS 2017.

Note: SME: small and medium-sized enterprise

To assess the different financing behaviour for investment activities of SMEs versus large companies, we use a standard investment specification based on variables exclusively derived from the survey. Beside the variables on the different sources of finance, some control variables – similar to those introduced in the previous sections – are added to the specification. These are a profitability dummy, as a proxy of the financial health of the firms, and a dummy for the willingness to invest more, which proxies their growth opportunities.¹¹

¹¹ The variable *profitable* takes the value 1 if the firm reported being profitable or breaking even and 0 otherwise. The variable *willingness to invest* is equal to 1 if the firm reported a willingness to invest more or about the same amount in the next financial year and 0 otherwise.

In order to account for the fact that both the investment and the financing variables are proportions of total investment and total financing, we apply a multinomial fractional response model to estimate the expected conditional mean:¹²

$$E(y_{i,k}|x_i) = G(\beta_0 + \beta_j \text{Fin}_{i,j} + \gamma_l \text{Con}_{i,l} + \delta_{i,m} + \varepsilon_i) \quad (3)$$

where y is a vector of the k proportions of types of investment for firm i . Fin denotes a vector of the j different proportions of the financial instruments (bank finance, market-based finance, insider finance, grants and other finance), Con is a vector of the control dummy variables (profitability and willingness to invest more), and δ a set of dummy variables to account for firms' heterogeneity in terms of $m \in \{\text{age, sector, country group}\}$.

The relevance of internal finance to allow for investment in intangibles is confirmed and, for SMEs, bank finance is available to support investment in tangibles more than for investment in intangibles. Table 9 reports the average partial effects of the regression results of the sample split between SMEs and large enterprises.¹³ SMEs (panel a) exhibit different financing behaviour than large enterprises (panel b), as the financial sources show different significant impacts for certain investment types. For instance, for SMEs, the additional use of bank finance compared to internal finance exerts, on average, has a positive impact on all tangible investment types and a negative impact on intangible investment, while for large enterprises, bank finance is only significantly positively associated with investment in land, buildings and infrastructure.

For SMEs' R&D investment, market finance and insider finance also play a relevant role. In line with earlier research,¹⁴ non-bank-related external financing instruments, such as market-based finance, insider finance and grants, play an important role in SMEs' R&D financing. Furthermore, the fact that most of the financial variable coefficients are negative for intangible investment by both SMEs and large enterprises confirms the importance of internal funding for these types of investment. The economic impact of external finance is sizeable. If a small-sized company increases bank finance relative to internal finance by 1

¹² See Preuss (2017) for details of the methodological approach.

¹³ There are some important shortcomings to bear in mind when considering the estimation results. First, the endogeneity of the financing choices as investment and financing decisions might be simultaneously influenced by private information that is only observed by the firm. Second, there is possible reverse causality, as it is often unclear whether investment opportunities affect financing decisions or whether financing conditions affect investment decisions. Thus, although no causal interpretation should be inferred from the econometric exercise, the results are used to detect interesting linkages once other firms' characteristics are taken into account (Roberts and Whited, 2013).

¹⁴ See Hall and Lerner (2009) and Thum-Thyssen et al. (2017).

percentage point, investment in land, buildings and infrastructure is on average expected to increase by 0.074 of a percentage point.

Grant financing is used to a large extent by both large and small enterprises to finance land, buildings and infrastructure. The results show the relative importance of grants for infrastructure investment (accounting for around 0.13 to 0.17 of a percentage point more investment), which is possibly due to policy objectives to enhance energy efficiency. Leasing is crucial for machinery and equipment (more investment of about 0.4 of a percentage point for SMEs and 0.3 of a percentage point for large companies).

Grants positively influence SMEs' R&D, but not their investment in software and IT, possibly because policy objectives behind grants tend to focus on R&D only, disregarding the strong needs for software and IT upgrades in the current technological transformation phase.

To summarise, the results indicate that SMEs are more sensitive to external financing sources than large enterprises. As few coefficients point to statistical differences in the use of internal versus external finance for large enterprises, this is confirmation that large enterprises could be more indifferent to the choices of financial instruments used for their investment.

Overall, a pecking order theory of finance emerges from the analysis. Internal finance is key to supporting intangible investment, while bank finance seems to be more related to investment in tangibles. Trade finance, market-based finance and grants play an important role in supporting investment in R&D by SMEs.

Table 10. Investment and finance: Static analysis (average partial effects)

PANEL a. SMEs						
Variables	(1) Land, buildings, infrastructure	(2) Machinery, equipment	(3) Research, development	(4) Software, data, IT networks	(5) Training	(6) Organisation, process improvements
Bank finance	0.074*** (0.010)	0.077*** (0.015)	-0.012* (0.007)	-0.079*** (0.011)	-0.052*** (0.010)	-0.007 (0.007)
Market-based finance	0.178** (0.091)	-0.116 (0.160)	0.099*** (0.032)	-0.004 (0.117)	-0.160 (0.108)	0.003 (0.064)
Insider finance	0.048* (0.026)	-0.029 (0.037)	0.040*** (0.013)	-0.031 (0.023)	-0.038* (0.022)	0.010 (0.017)
Grants	0.125*** (0.034)	0.017 (0.056)	0.045** (0.018)	-0.164*** (0.040)	-0.023 (0.044)	-0.000 (0.025)
Other finance	-0.114*** (0.019)	0.408*** (0.022)	-0.050*** (0.012)	-0.135*** (0.017)	-0.094*** (0.016)	-0.016 (0.011)
Observations	6,980	6,980	6,980	6,980	6,980	6,980
Controls (profitability, willingness to invest more)	Yes	Yes	Yes	Yes	Yes	Yes
Age, sector, country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

PANEL b. Large enterprises						
Variables	(1) Land, buildings, infrastructure	(2) Machinery, equipment	(3) Research, development	(4) Software, data, IT networks	(5) Training	(6) Organisation, process improvements
Bank finance	0.076*** (0.027)	0.023 (0.034)	0.008 (0.016)	-0.059*** (0.017)	-0.027* (0.015)	-0.020* (0.012)
Market-based finance	0.340*** (0.107)	-0.477*** (0.183)	0.204*** (0.065)	0.109* (0.061)	-0.098* (0.054)	-0.078 (0.048)
Insider finance	-0.075 (0.058)	0.033 (0.066)	0.035 (0.025)	-0.011 (0.026)	0.001 (0.019)	0.017 (0.017)
Grants	0.172*** (0.063)	0.001 (0.093)	-0.081* (0.047)	-0.039 (0.067)	0.011 (0.051)	-0.065 (0.042)
Other finance	-0.177*** (0.052)	0.268*** (0.057)	0.017 (0.030)	-0.044** (0.022)	-0.032* (0.020)	-0.032 (0.021)
Observations	1,112	1,112	1,112	1,112	1,112	1,112
Controls (profitability, willingness to invest more)	Yes	Yes	Yes	Yes	Yes	Yes
Age, sector, country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' calculations based on EIBIS 2017.

Note: Average partial effects of quasi-maximum likelihood estimations of a multinomial fractional response model with a logistic functional form. Robust standard errors are in parentheses. Dependent variables (columns 1 to 6) are bounded continuous variables $[0, 1]$ and sum up to 1 (unity). The same holds for the independent financial sources variables (Bank finance - Other finance). The reference group for independent financial sources variables is internal funds. The dummy variable "profitable" takes on the value 1 if the firm has reported being profitable or breaking even and 0 otherwise. The dummy variable "invest more" takes on the value 1 if the firm has reported a willingness to invest more or about the same amount in the next financial year and 0 otherwise. Significance levels indicated as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. FE: fixed effects; SME: small and medium-sized enterprise.

Conclusion and policy implications

Overall, the results show the importance of the availability of finance in determining investment. Since external finance, mainly from banks, was available to all sizes of firms to a

certain degree before the crisis, it has played a key role in financing investment in tangible assets during the boom. During the bust, SMEs financed intangible investments with internal sources. They also relied on alternative external financing, like trade credit. This pattern is true in particular for firms at an early stage of development, which are typically SMEs (Berger and Udell, 1998). Surprisingly, the analysis found that large firms are also tapping trade credit to finance their tangible investments during the recovery period, probably crowding out small firms to a certain extent. If small firms shift the available trade credit to finance tangible investment instead of intangible investment – since they have not been able to access other forms of external finance during the post-crisis period – this might have serious consequences in terms of long-term growth. R&D investment is a big part of intangible investment, but it will not be undertaken given the lack of finance available for doing so.

Combining financing with different types of investment, the analysis puts forward a pecking order theory of finance: internal finance is key to supporting intangible investment, bank finance seems to be more related to tangible investments, and trade finance, market-based finance and grants provide a lifeline for SMEs to support investment in R&D.

From a policy point of view, there are issues in the financing of intangible assets that need to be addressed by creating incentives for banks, implementing targeted guarantee schemes, and incentivising their own resources and shareholders' equity for more firms.

Furthermore, the results highlight the importance of liquidity, especially for SMEs, during times of crisis. If debt to suppliers and contractors is the only external finance available to fund tangible and intangible investment besides internal finance, and if this holds for large firms as well, then SMEs will be crowded out of the market. Policies that make external finance available to both small and large firms during crises will be beneficial in this regard.

Annex A. Data characteristics

EIBIS sample characteristics

Table A1 displays the final sample distribution once the responses in the first wave of the European Investment Bank Investment Survey (EIBIS) are matched with the financial statements for those firms for which data on total investment can be derived from the balance sheet accounts (8,651 firms). The dataset contains around 90,000 observations, with 81% from SMEs. In terms of sectors, 32% of observations are from firms in manufacturing, 21% in construction, 23% in services and 25% in infrastructure.

Table A1. Distribution of the matched EIBIS and ORBIS data: Number of observations by country, size and sectors, 2000–15

Country	Total	Size		Sector			
		SMEs	Large enterprises	Manufacturing	Construction	Services	Infrastructure
Austria	1,976	1,425	551	513	449	470	544
Belgium	5,208	4,109	1,099	1,759	892	1,101	1,456
Bulgaria	2,440	1,729	711	732	621	591	496
Croatia	4,503	3,859	644	1,330	961	1093	1,119
Cyprus	251	242	9	111	3	129	8
Czech Republic	2,963	2,255	708	1,382	507	504	570
Denmark	4,747	4,027	720	1,574	1,024	1,074	1,075
Estonia	2,930	2,833	97	876	646	659	749
Finland	4,221	3,473	748	1,284	905	960	1,072
France	5,099	3,998	1,101	1,866	887	934	1,412
Germany	2,603	1,940	663	694	573	553	783
Greece	2,583	2,204	379	810	463	839	471
Hungary	4,110	3,199	911	1,121	912	1,031	1,046
Ireland	3,934	3,796	138	1,106	857	1,087	884
Italy	4,962	3,553	1,409	1539	992	1,112	1,319
Latvia	2,311	2,161	150	654	393	713	551
Lithuania	1,626	1,280	346	616	463	263	284
Luxembourg	983	808	175	226	270	230	257
Malta	1,232	1,196	36	260	122	705	145
Netherlands	3,650	3,133	517	1,246	653	686	1,065
Poland	2,977	2,041	936	849	590	450	1,088
Portugal	3,629	2,933	696	860	956	894	919
Romania	3,327	2,734	593	1,086	839	631	771
Slovakia	2,586	2,280	306	1,216	279	700	391
Slovenia	3,407	3,002	405	1,024	625	966	792
Spain	4,574	3,308	1,266	1,449	881	1,095	1,149
Sweden	4,552	3,602	950	1,351	1,114	879	1,208
United Kingdom	3,052	2,195	857	1,064	733	348	907
Total	90,436	73,315	17,121	28,598	18,610	20,697	22,531

Sources: Authors' calculations based on EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: SMEs: small and medium-sized enterprises.

Correlation matrix

Table A2 provides some initial insights into the relationship between investment decisions of firms and types of finance used to fund them. Overall, investment is positively correlated with the firms' financial performance in terms of either growth opportunities or the ability to

generate internal funds. However, overall investment shows a negative correlation with size, where the effect is mainly driven by machinery and equipment and software databases. Investment in land and buildings increases with firm size, while no statistically significant link is detected for R&D expenditures. This is in line with what was shown in Figure 2 in the main text: large enterprises reported in the survey having invested a relatively higher share in land and machinery and R&D than smaller enterprises.

External and internal finance is positively correlated with the four types of investment, whereas external finance has a higher correlation with tangible asset investments and internal finance seems to play a relatively more important role in intangible asset investments. This effect is confirmed when looking at the correlation between external-finance-intense firms (*EXT* variable) and tangible and intangible asset investments, where the effect is stronger for investment in tangibles than in intangibles. Moreover, R&D shows a negative, if any, correlation with external finance in general.

Table A2. Correlation matrix of regression variables

	Machinery and equipment				Software and databases		Sales growth			Trade credit			
	Total	Land and buildings	R&D	Internal (t-1)	External (t-1)	EXT	EXTWTC	Size (t-1)	Cash Flow (t-1)	Trade credit (t-1)			
Total	1												
Land and buildings	0.4494*	1											
Machinery and equipment	0.8808*	0.1928*	1										
R&D	0.2915*	0.0766*	0.1312*	1									
Software and databases	0.5459*	0.1476*	0.2902*	0.2072*	1								
Internal (t-1)	0.0102*	0.0016	0.0103*	0.0141*	0.0090*	1							
External (t-1)	0.0247*	0.0214*	0.0205*	-0.0022	0.0127*	-0.4029*	1						
EXT	0.0189*	0.0147*	0.0163*	-0.0015	0.0112*	-0.5604*	0.7216*	1					
EXTWTC	0.0102*	0.0157*	0.0093*	-0.0011	-0.0016	-0.4016*	0.4736*	0.4856*	1				
Sales growth (t-1)	0.0639*	0.0280*	0.0575*	0.0188*	0.0315*	-0.0283*	0.0139*	0.0153*	0.0110*	1			
Size (t-1)	-0.0953*	0.0110*	-0.0974*	0.0014	-0.0254*	0.0613*	0.0288*	0.0599*	0.0670*	-0.0458*	1		
Cash flow (t-1)	0.1176*	0.0356*	0.1104*	0.0387*	0.0598*	0.3415*	-0.1954*	-0.2233*	-0.1515*	0.0776*	-0.1488*	1	
Trade credit (t-1)	0.0324*	0.0137*	0.0261*	-0.001	0.0166*	-0.2286*	0.4925*	0.3656*	-0.1420*	0.0214*	-0.0559*	-0.1228*	1

Sources: Authors' calculations based on EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: Internal finance is defined as the amount of retained earnings to total assets. External finance includes short-term loans, long-term debt and trade credit over total assets. EXT is equal to 1 for firms whose external finance is more than 50% of their total financing (internal plus external funds) and 0 otherwise. EXTWTC is equal to 1 for firms whose external finance is more than 50% of their total financing (internal plus external funds excluding trade credit) and 0 otherwise. Sales growth is defined as the annual percentage change in sales revenues. Size is the logarithm of total assets, cash flow is the ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) to total assets, and trade credit is accounts payable to total assets. Standard errors are clustered at the firm level. * $p < 0.05$.

Table A3. Differences between firms with high and low extensive margins of external finance

	Large				SMEs			
	EXT=0	EXT=1	Diff	t test	EXT=0	EXT=1	Diff	t test
Sales growth	0.19	0.29	0.09	***	0.21	0.28	0.07	***
Cash flow	0.12	0.07	-0.06	***	0.15	0.08	-0.07	***
Profitability	0.09	0.03	-0.06	***	0.11	0.03	-0.08	***
Cash holding	0.23	0.17	-0.06	***	0.30	0.16	-0.14	***
Collateral	0.47	0.44	-0.03	***	0.36	0.38	0.02	***

Sources: Authors' calculations based on EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: t-test on averages. EXT is equal to 1 for firms whose external finance is more than 50% of their total financing (internal plus external funds) and 0 otherwise. Sales growth is defined as the annual percentage change in sales revenues. Cash flow is the ratio of earnings before interest, taxes,

depreciation and amortization (EBITDA) to total assets, and profitability is profit/loss before taxes to total assets. SME: small and medium-sized enterprise. *** $p < 0.01$.

References

Andrews, D. and Criscuolo, C. (2013). "Knowledge-Based Capital, Innovation and Resource Allocation." OECD Economics Department Working Paper No. 1046. OECD Publishing, Paris.

Arrighetti, A., Landini, F. and Lasagni, A. (2014). "Intangible Assets and Firms' Heterogeneity: Evidence from Italy." *Research Policy*, 43(1), 202–213.

Bank of England. (2013). "Inflation Report." Bank of England, London.

Beck, T., Demirgüç-Kunt, A. and Maksimovic, V. (2008). "Financing Patterns Around the World: Are Small Firms Different?" *Journal of Financial Economics*, 89(3), 467–487.

Begenau, J. and Salomao, J. (2016), "Firm Financing over the Business Cycle." Working Paper 3566. Stanford Business Graduate School.

Berger, A. and Udell, G. (1998). "The Economics of Small Business Finance: The Roles of Private Equity and Debt Markets in the Financial Growth Cycle." *Journal of Banking & Finance*, 22(6–8), 613–673.

Berger, A. and Udell, G. (2006). "A More Complete Conceptual Framework for SME Finance." *Journal of Banking Finance*, 30(11), 2945–2966.

Boissay, F. and Gropp, R. (2007). "Trade Credit Defaults and Liquidity Provision by Firms." ECB Working Paper No. 753. European Central Bank, Frankfurt.

Bougheas, S., Mateut, S. and Mizen, P. (2009). "Corporate Trade Credit and Inventories: New Evidence of a Trade-off from Accounts Payable and Receivable." *Journal of Banking & Finance*, 33(2), 300–307.

Carbo-Valverde, S., Rodriguez-Fernandez, F. and Udell, G.F. (2016). "Trade Credit, the Financial Crisis, and SME Access to Finance." *Journal of Money, Credit and Banking*, 48(1), 113–143.

Coricelli, F. and Frigerio, M. (2016). "Inter-Enterprise Credit and Adjustment During Financial Crises: The Role of Firm Size." CEPR Discussion Paper 11680. Centre for Economic Policy Research, London.

Corrado, C., Hulten, C. and Sichel, D. (2005). "Measuring Capital and Technology: An Expanded Framework." In *Measuring Capital in the New Economy*, edited by Corrado, C., Haltiwanger J. and Sichel, D. Cambridge, MA: National Bureau of Economic Research MA.

Covas, F. and Den Haan, W.J. (2012). "The Role of Debt and Equity Finance over the Business Cycle." *The Economic Journal*, 122(565), 1262–1286.

- Cressy, R. and Olofsson, C. (1997). "European SME Financing: An Overview." *Small Business Economics*, 9(2), 87–96.
- Cuñat, V. (2007). "Trade Credit: Suppliers as Debt Collectors and Insurance Providers." *Review of Financial Studies*, 20, 491–527.
- Dass, N., Kale, J.R. and Nanda, V. (2015). "Trade Credit, Relationship-specific Investment, and Product Market Power." *Review of Finance*, 19(5), 1867–1923.
- Dierickx, I. and Cool, K. (1989). "Asset Stock Accumulation and Sustainability of Competitive Advantage." *Management Science*, 35(12), 1504–1511.
- EIB. (2016). "Investment and Investment Finance in Europe – Financing Productivity Growth. Annual Report." Economics Department, European Investment Bank.
- EIB. (2017). "Surveying Corporate Investment Activities, Needs and Financing in the EU." Economics Department, European Investment Bank.
- Ferrando, A. and Mulier, K. (2013). "Do Firms Use the Trade Credit Channel to Manage Growth?" *Journal of Banking & Finance* 37, 3035–3046.
- Ferrando, A., Ludice, M., Altomonte, C., Blank, S., Felt, M.H., Meinen, P., Neugebauer, K. and Siedschlag, I. (2015). "Assessing the Financial and Financing Conditions of Firms in Europe: The Financial Module in CompNet." ECB Working Paper No. 1836. European Central Bank, Frankfurt.
- Ghosal, V. and Loungani, P. (2000). "The Differential Impact of Uncertainty on Investment in Small and Large Businesses." *Review of Economics and Statistics*, 82, 338–343.
- Grundy, B. and Verwijmeren, P. (2017). "The External Financing of Investment." Unpublished.
- Hall, B.H. and Lerner, J. (2009). "The Financing of R&D and Innovation." NBER Working Papers No. 15325. National Bureau of Economic Research, Cambridge, MA.
- Hunter L.C., Webster, E. and Wyatt, A. (2005). "Measuring Intangible Investment." Melbourne Institute Working Paper No. 15/05.
- Ipsos Public Affairs. (2017). "EIB Group Survey of Investment and Investment Finance. Technical Report." Ipsos.
- Jensen, M.C. (1986). "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers." *American Economic Review*, 76(2), 323–329.
- Jensen, M.C. and Meckling, W.H. (1976). "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure." *Journal of Financial Economics*, 3(4), 305–360.
- Kalemli-Ozcan, S. (2016). "Financial Frictions and Sources of Finance for European Firms." In *Investment and Investment Finance in Europe*. Luxembourg: European Investment Bank.
- Kalemli-Ozcan, S., Sorensen, B., Villegas-Sanchez, C., Volosovych, V. and Yesiltas, S. (2015). "How to Construct Nationally Representative Firm-level Data from the ORBIS Global

Database.” NBER Working Paper No. 21558. National Bureau of Economic Research, Cambridge, MA.

Long, M.S. and Malitz, I.B. (1983). “Investment Patterns and Financial Leverage.” NBER Working Paper No. 1145. National Bureau of Economic Research, Cambridge, MA.

McGowan A., Andrews M. and V. Millot (2017). “The Walking Dead? Zombie Firms and Productivity Performance in OECD Countries.” OECD Economics Department Working Papers, No. 1372. OECD Publishing, Paris.

Modigliani, F. and Miller, M.H. (1958). “The Cost of Capital, Corporate Finance and the Theory of Investment.” *The American Economic Review*, 48(3), 261–297.

Myers, S.C. (1977). “Determinants of Corporate Borrowing.” *Journal of Financial Economics*, 5(2), 147–175.

Myers, S.C. and Majluf, N.S. (1984). “Corporate Financing and Investment Decisions When Firms Have Information that Investors Do Not Have.” *Journal of Financial Economics*, 13(2), 187–221.

Petersen, M.A. and Rajan, R.G. (1997). “Trade Credit: Theories and Evidence.” *Review of Financial Studies*, 10(3), 661–691.

Preuss, C. (2017). “The Nexus Between Corporate Finance and Investment Decisions: A Survey-Based Approach.” Master’s Thesis. University of Potsdam.

Roberts, M.R. and Whited, T.M. (2013). “Endogeneity in Empirical Corporate Finance.” In *Handbook of the Economics of Finance. Volume 2*, edited by Constantinides, G.M., Harris, M. and Stulz, R.M. Elsevier.

Thum-Thysen, A., Voigt, P. Maier C., Bilbao-Osorio B. and Ognyanova D. (2017). “Unlocking Investment in Intangible Assets in Europe.” Presentation at the European Commission’s GPEARI Workshop, Lisbon. June 7.