

2022

2022

INVESTMENT REPORT
2022/2023

Resilience and renewal in Europe



023

Data annex

EUROPEAN INVESTMENT BANK INVESTMENT REPORT
2022/2023

Resilience and renewal in Europe

Data annex



European
Investment Bank

Investment Report 2022/2023: Resilience and renewal in Europe.

© European Investment Bank (EIB), 2023. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted in the original language without explicit permission provided that the source is acknowledged. All other permission requests should be addressed to publications@eib.org

About the report

The annual EIB report on investment and investment finance is a product of the EIB Economics Department. The report provides a comprehensive overview of the developments and drivers of investment and investment finance in the European Union. It combines an analysis and understanding of key market trends and developments, with a thematic focus explored in greater depth. This year, the focus is on how Europe is progressing towards a digital and green future amid an energy crisis. The report draws extensively on the results of the annual EIB Investment Survey (EIBIS) and the EIB Municipality Survey, combining internal EIB analysis with contributions from leading experts in the field.

About the Economics Department of the EIB

The mission of the EIB Economics Department is to provide economic analyses and studies to support the Bank in its operations and to help define its positioning, strategy and policy. The director of the Economics Department, Debora Revoltella, heads a team of 40 economists.

Main contributors to this year's report

Report director: Debora Revoltella

Report coordinators and reviewers: Laurent Maurin and Atanas Kolev

Introduction: Atanas Kolev.

Chapter 1: Andrea Brasili, Jochen Schanz (lead authors), Alfredo Baldini, Peter Harasztosi and Bertrand Magné.

Chapter 2: Atanas Kolev (lead author), Koray Alper, Peter Bauer (European Commission, Box F), Andrea Brasili, Julie Delanote, Peter Harasztosi, Fotios Kalantzis, Bertrand Magné, Wouter Torfs (European Investment Fund), Annamaria Tieske, Wouter van der Wielen, Christoph Weiss, Marcin Wolski and Sabina Zajc.

Chapter 3: Laurent Maurin (lead author), Antonia Botsari, Helmut Krämer-Eis, Frank Lang, Rozalia Pal, Ricardo Santo, Wouter Torfs, Alex Coad, Peter Bauer, Clemens Domnick and Peter Harasztosi (Box A), Frank Betz and Luca Gattini (Box B) and Wouter van der Wielen (Box C).

Chapter 4: Désirée Rückert, Jochen Schanz, Patricia Wruuck (lead authors), Andrea Brasili (Box B), Matteo Gatti (Box C), Annamaria Tieske (Box B) and Wouter van der Wielen (Box C).

Chapter 5: Peter Harasztosi, Désirée Rückert, Christoph Weiss (lead authors), Nihan Akhan, Bianca Brunori, Julie Delanote, Clémence Faivre, Valentina Di Girolamo (European Commission, Box A), Alessio Mitra (European Commission, Box A), Giacomo Casali (Box C) and Andrea Coali (Bocconi University, Box C).

Chapter 6: Fotios Kalantzis (lead author), Frank Betz, Francesco Cimini, Emmanouil Davradakis, Bertrand Magné, Giorgio Musto, Désirée Rückert and Christoph Weiss.

Scientific advisory committee: Jos Delbeke (European University Institute), Robert Koopman (American University), Catherine L Mann (Bank of England), Steven Ongena (University of Zurich), Evi Pappa (Universidad Carlos III de Madrid), Dirk Pilat (The Productivity Institute and Valencia Institute of Economic Research), Peter Praet (Université Libre de Bruxelles), Istvan Szekely (European Commission), Jan Svejnar (Columbia University) and Reinhilde Veugelers (KU Leuven).

Published by the European Investment Bank.

Printed on FSC® paper

Disclaimer

The views expressed in this publication are those of the authors and do not necessarily reflect the position of the EIB.

Acknowledgements

Julie Callaert (Centre for Research and Development Monitoring, KU Leuven), Giacomo Casali and Serena Sorrentino provided research assistance.

Data annex



Download the complete report:
<https://www.eib.org/en/publications/20220211-investment-report-2022>
www.doi.org/10.2867/307689

Available as:

pdf: ISBN 978-92-861-5506-2 ISSN: 2599-8277

Table of contents

Executive summary	1
Introduction	7
Part I Investment environment in a time of crises	
1. The macroeconomic context	13
2. Investment in Europe	45
3. A corporate sector buffeted by shocks	97
Part II Resilience and renewal	
4. Trends in regional and social cohesion	145
5. Progress on digital transformation	175
6. Green transition and the energy crisis	217
Data annex	251
Glossary of terms and acronyms	259

Data annex

The availability and quality of the data on investment are critical to supporting effective policymaking. In addition to national accounts, economists need to rely on other sources of macroeconomic data to analyse important aspects of investment, including infrastructure investment and intangible investment, and they increasingly make use of firm-level data.

The EIB runs a survey on corporate investment and investment finance and has created a database on patents broken down by activity, based on patent data counted using the European Patent Office's PATSTAT database. Finally it has developed a database on investment in climate change mitigation. This annex outlines these datasets and provides references to detailed methodological notes.

EIB Investment Survey

General module

The EIB carries out an annual survey of firms in the European Union (EIBIS General Module) with the aim of monitoring investment and investment finance activities and capturing potential barriers to investment. The survey covers approximately 12 000 companies across the European Union and slightly more than 800 firms in the United States for the last three waves. It is administered by telephone (in the local language) and takes an average of 20 minutes to complete. The first wave of the survey took place in 2016 and the survey completed its seventh wave in 2022, with interviews held between April and July 2022.

Using a stratified sampling methodology, the EIBIS General Module is representative of all 27 Member States of the European Union and the United States. It is representative of four firm size classes (micro, small, medium and large) and four sector groupings (manufacturing, services, construction and infrastructure) within the individual countries.

Firms have to have a minimum of five employees to be interviewed, with full-time and part-time employees counted as one and employees working less than 12 hours per week excluded. Eligible respondents are employees in senior positions with responsibility for investment decisions.

The survey is designed to build a panel of observations over time, and is set up in such a way that survey data can be linked to firms' reported balance sheet and profit-and-loss data (see EIBIS-Orbis matched dataset below). Approximately 40% of the companies interviewed in each wave are companies that have already taken part in the survey in the previous wave.

The EIBIS General Module complements pre-existing information on investment activities in the European Union. It adds a firm-level dimension to the macroeconomic data available and thus facilitates a more fine-grained analysis of firm investment patterns. It also adds to existing firm-level surveys at a national level by providing full comparability of results across countries. The survey complements the European Commission investment survey by asking a much wider set of qualitative and quantitative questions on firm investment activities. It rounds out the European Central Bank/European Commission SAFE survey by focusing on the link between firm investment and investment finance decisions.

The EIBIS is a very powerful instrument built according to the highest scientific standards. To guarantee top quality, every step of the survey process is executed and closely monitored by experts in the field. All steps — sampling and weighting, questionnaire development and translation, the fieldwork, and quality control and data processing — are also subject to strict controls and validation. More information on these technical aspects can be found in the technical report produced by the market research company conducting the survey (Ipsos MORI, 2020). Table 1 presents key numbers about EIBIS.

Table 1
EIBIS at a glance

27	EU Member States are all consistently represented by the survey — more specifically, non-financial enterprises with at least five employees and belonging to NACE categories C to J.
4	industry groupings and size classes determine the representativeness of the data within almost every member country.
12 021	firms in the European Union participated in the last wave of the survey.
800	US firms participated in the last wave of the survey.
44%	of all firms participating in the last wave responded in at least two consecutive waves.
89%	of firms surveyed in 2022 agreed to be contacted again for next year's survey.

All aggregated data using the EIBIS General Module in this report are weighted by value added to reflect the contribution of different firms to economic output more closely. The aggregate survey data and a detailed account of the survey methodology are available on www.eib.org/eibis.

Representativeness of the general module

The EIB Investment Survey is designed to be representative for the European Union, the United Kingdom and the United States at a country level and for most countries at a country-industry-group and country-size-class level.¹

In an EIB working paper (Brutscher, Coali, Delanote and Harasztosi, 2020), we assessed the data quality of the EIBIS in three steps. First, we benchmarked the sampling frame from which all survey respondents are drawn, the Bureau van Dijk Orbis database, against official statistics to see how well our sampling frame captures the relevant business population.

Second, we compared the final EIBIS sample against firms drawn at random from the same sampling frame and compared statistics constructed from the financial information included in that sampling frame. The purpose of this exercise was to assess whether and to what extent firms' willingness or unwillingness to participate in the survey may have led to a selection bias.

Last, we compared aggregate statistics calculated from the final EIBIS sample to corresponding statistics from Eurostat and the Organisation for Economic Co-operation and Development (OECD). In addition, we compared statistics based on financial information calculated from the EIBIS to the counterpart data obtained from the CompNet database. This purpose of this exercise was to evaluate both the level and dynamics of the financial information calculated from firm-level data.

Overall, the results from all three steps are very positive. First, the assessment of the sampling frame (a comparison of the Bureau van Dijk Orbis dataset with the Eurostat Structural Business Statistics (SBS) for the European Union and the United Kingdom² for the relevant sector/size classes) showed coverage ratios (number of firms in Orbis/number of firms in the SBS database) between 75% and 100% for the majority of countries. The ratio is between 50% and 75% in a few countries, and in only four — Cyprus, Greece, Luxembourg and Poland — does the coverage ratio fall below 50%.³

The sampling frame must cover a high percentage of the population of interest for the EIBIS survey results to reflect what is happening in the non-financial corporate sector in the European Union. However, this condition alone is not sufficient because, like any other survey, the EIBIS runs the risk of selection bias if there are systematic differences between firms that are willing to participate in the survey and firms that are not.

1 The EIBIS included the United Kingdom from 2016 to 2019. It has not covered the country since it left the European Union.

2 For the United States, the statistics were compiled from the US Census Bureau and the Bureau of Economic Analysis.

3 An important driver of the positive coverage ratio is that the EIBIS samples firms with five or more employees. Coverage ratios tend to be higher for larger firms, so excluding the smallest firms from sampling significantly boosts coverage.

Secondly, to test whether (and if so, to what extent) the EIBIS sample is subject to such selection issues, we compared the distribution of a set of financial ratios in the final EIBIS sample against those of five samples drawn at random from the same sampling frame. The financial ratios were calculated using information in Orbis. The idea was that statistically identical distributions between the EIBIS sample and the random samples would provide evidence that selection bias does not pose a major issue for representativeness and vice versa.

Using a Kolmogorov-Smirnov approach to compare the two samples, we find that for almost all countries, the percentage of variables for which the null hypothesis of equal distribution in the EIBIS and random samples is rejected is very low, suggesting a high degree of resemblance between EIBIS and the random sample.⁴ In other words, comparing the final EIBIS sample with a series of random samples from the same sampling frame provides little evidence of sampling bias in our data.

Finally, a comparison of the financial information from Orbis for firms in the final EIBIS sample to CompNet data also suggests good coverage of both EIBIS and Orbis information. The CompNet data are based on a “distributed micro-data approach.” Relevant data are extracted from often-confidential firm-level datasets available within national central banks or national statistical institutes and aggregated so that the confidentiality of firm data is preserved. The outcome of CompNet is a wide range of indicators at the country-sector-size-class level.

To assess the final EIBIS sample, we reproduced the same country-sector-size-class level indicators using the Orbis information for firms in the EIBIS (where possible) and compared them to those in the CompNet dataset. What we found is a very close match between the two datasets, with the financial variables in the EIBIS and the CompNet database showing very similar trends.

More information on both the general module and the add-on module in the EIB Investment Survey is available upon request by email to eibis@eib.org.

EIB Municipality Survey 2022

In 2022, the EIB Municipality Survey polled 750 municipalities in the European Union on their infrastructure investment activities and associated barriers.

The survey was administered by telephone (in the local language) among mayors, treasurers and/or municipalities’ chief civil engineers. It took a median average of 20 minutes to complete. Fieldwork took place between June and August 2022. As part of the survey, 750 municipalities were interviewed in all 27 Member States, split across the following country groupings (regions).

The sample frame from which municipalities were randomly selected was a comprehensive list of European municipalities. All larger municipalities were eligible to be included in the exercise.

Regional and European Union-wide figures are weighted based on the urban population in each country to take size differences into account.

EIBIS-Orbis matched dataset

This report includes analysis based on a dataset that combines firm-level information from Bureau van Dijk’s Orbis with the EIBIS — the EIBIS-Orbis matched dataset. The matching was carried out by the current survey provider Ipsos to preserve firms’ anonymity. Orbis is a proprietary dataset that contains firm-level

⁴ The Kolmogorov-Smirnov (KS) test is a non-parametric statistical test for the equality of probability distribution between two samples. Unlike a t-test, KS does not just compare the means of a variable, but also tests the null hypothesis that two samples are drawn from the same distribution by quantifying the distance between the empirical distribution functions of two samples. It therefore compares the shapes of the two distributions and evaluates whether the vertical differences between them are statistically significant.

accounting information and ownership data, gathered and standardised according to a global format that makes accounting data comparable across jurisdictions. Items from the balance sheet and profit-and-loss accounts have been used to construct standard financial ratios for firms that reflect financing activity and financial health. All data were reviewed following standard cleaning procedures to eliminate outliers and inconsistencies. Negative values for fixed assets, total assets and other stock variables were removed and all ratios have been winsorised at 1%.

The matched dataset complements the cross-sectional perspective of the EIBIS with time series information starting in 2000. Custom panel datasets used in several analyses in this report were constructed thanks to this dataset.

Patent data

Patents grant the applicant exclusive rights to produce or use a specific new device, apparatus or process for a limited period. More specifically, the legal protection gives patent-holders the exclusive right to make, use, sell or import the patented invention for a set period of time, usually 20 years from the filing date, in the country or countries covered.

By providing protection and exclusivity, a patent encourages investment in research and the subsequent innovative work that will put inventions to practical use. By providing temporary exclusive rights to intellectual property, patents give their holders a competitive advantage. Patents can also be licensed or used to help create or finance a spin-off company. Patent-holders, therefore, can derive value from patents even if they are unable to manufacture the product (as is the case of universities, for instance).

A patent filing contains a wealth of technical information that can be useful for follow-up inventions. In addition, the elaborate and well-structured information stored in patent documents facilitates systematic and objective quantitative analyses that can provide insights into technological progress. Indicators based on patent statistics are widely used to assess the inventive and innovative performance of a country or a region. As such, patents reflect a country's inventive activity and its capacity to use and develop knowledge for potential economic gain.

In addition to containing technical details about the innovation in question, patent applications also disclose material on prior inventions, such as any other relevant patents. While patent statistics can be used to measure innovation, statistics on patent citations can be used to assess the spread of knowledge and technology.

Nevertheless, some caveats exist for patent-based indicators. First of all, the propensity to patent varies by technological domain and country. Second, not all innovations are patented (for reasons of secrecy, for example), and not all patented inventions are innovative or even marketable products. Obtaining a patent does not necessarily mean the patented technology is important or has any commercial value. The value of patents varies widely. Last, some patent activity stems from strategic behaviour (such as blocking out or scaring off potential competitors) rather than innovative and valuable R&D efforts.

PATSTAT

The patent data used in this chapter are sourced from PATSTAT (Worldwide PATent STATistical Database). PATSTAT is a patent statistics database held by the European Patent Office (EPO) and developed in cooperation with the World Intellectual Property Organization (WIPO), the Organisation for Economic Co-operation and Development (OECD) and Eurostat.

PATSTAT was founded in 2006 and concentrates on raw data, leaving it up to licensed users to create indicators. PATSTAT's raw patent data are collected from more than 100 regional and national patent offices worldwide, including the most important and largest offices such as the EPO, the United States Patent and Trademark Office (USPTO), WIPO, the Japanese Patent Office (JPO) and the Chinese Patent Office (SIPO).

PATSTAT is a relational database: more than 20 related tables contain information on relevant dates (filing, publication, grant, etc.), applicants and inventors, technological domains, references to prior art, etc. The database is updated twice a year, in the spring and autumn. The data sourced for this report were produced in collaboration with the Centre for Research and Development Monitoring (ECOOM) in Belgium.

Investment in climate change mitigation

Climate change mitigation investments are spread across many economic sectors, they have diverse effects on greenhouse gas emissions and the data sources have varying degrees of accuracy and consistency. The estimates drawn together in this report are organised under the headings renewable energy and energy networks, energy efficiency, transport infrastructure, agriculture forestry and land use, and R&D spending on low-carbon technologies.

These categories match the EU taxonomy nomenclature: low-carbon activities (such as renewables, electric vehicles and afforestation that are compatible with a 2050 net zero carbon economy); transition activities (such as building renovation that contribute to a transition to a zero net emissions economy in 2050 but that are not currently operating at an expected optimal level); and enabling activities (such as smart technologies and R&D that facilitate low-carbon performance, substantial emissions reduction or environmentally sustainable investments).

Renewable energy

The International Energy Agency (IEA) provided estimates of total investment in renewable energy for the regional blocs (European Union, United States and China). These are based on public information and IEA estimates of capacity additions, combined with estimates of investment costs. End-use renewables (such as rooftop solar thermal) are included in renewable generation. The amount is larger for China than for the United States and European Union.

A proportion of investment in networks is assigned to renewable energy. First, network investment is divided between maintenance (replacement of existing lines) and expansion. All expansion is assigned to renewables, as very little non-renewable capacity is being installed.

The remaining investment in maintenance is divided between renewable and non-renewables according to the share of renewable energy in total generation capacity.

Energy efficiency

The IEA provides estimates of investment in energy efficiency for the United States, China and the European Union from 2014 to 2021. In broad terms, the methodology for calculating these estimates looks at the additional cost of an energy-efficient alternative over and above the less efficient alternative that serves a similar purpose. In the automotive sector, for example, many manufacturers make more efficient models that are more expensive than conventional models. The cost difference, under the IEA methodology, is assigned to energy efficiency investment. The IEA describes the methodology in detail in its Energy Efficiency Investment Report.

Transport infrastructure

Transport investments combine rail and inland waterways. The OECD International Transport Forum (ITF) collects data annually from its member countries as well as other key emerging economies including China, covering investment, maintenance spending and capital value of transport infrastructure. Data are collected from transport ministries, statistical offices and other institutions designated as official data sources.

The lack of common definitions and practices to measure transport infrastructure spending hinders cross-country comparisons. While the survey covers all sources of financing, a number of countries

exclude private spending. Coverage of urban spending also varies between countries. Indicators such as the share of gross domestic product (GDP) needed for investment in transport infrastructure depend on a number of factors, such as the quality and age of existing infrastructure, maturity of the transport system, geography of the country and transport intensity of its productive sector. Caution is therefore required when comparing investment data between countries. However, data for individual countries and country groups are consistent over time and useful for identifying underlying trends in levels of spending. Definitions and methods are addressed in a companion report (ITF, 2013). Data are available from ITF/OECD until 2020 for most countries and is extrapolated to 2021 using a constant ratio to total gross fixed capital formation (GFCF) for both rail and inland waterway investments.

For the United States, the data sources have changed since 2004. The data cover only Class 1 Railroads. Class 1 Railroad capital expenditure accounts for roughly 94% of total railroad capital expenditure.

Forestry

Eurostat data for gross fixed capital formation (GFCF) in forestry up to 2019 are available for the European Union. Data are extrapolated to 2021 assuming a constant ratio to total GFCF whenever data availability allows, or derived from GFCF and value added for the aggregate sector agriculture, forestry and fishing when forestry data are missing, preserving GFCF and value-added ratios between forestry and the aggregate sector. For the United States, data are available from the Bureau of Economic Analysis up to 2020. No data are available for China.

Research and development

The latest research results on the status, forecasts and R&D investment figures for low-carbon technologies are sourced from JRC-SETIS (Joint Research Centre Strategic Energy Technologies (SET-Plan) Information System). Government R&D figures are sourced from the IEA, International Monetary Fund, OECD and various government agencies and are available until at least 2020. Corporate R&D is sourced from the Joint Research Centre of the European Commission for key quoted companies in all clean energy sectors according to Energy Union priorities and are available until 2019. The data were made available in current prices in billions of euros rounded to the nearest hundred thousand. Missing data are extrapolated by assuming, for example, a constant R&D to GDP ratio or a constant share to total R&D by research and innovation priority.

Inflation and exchange rates

Data are presented in real 2021 EUR million. Source data are on different bases and the following procedures were used to convert them to real 2021 EUR million.

- IEA investment data

IEA investment data are in real 2021 USD billion. These were converted to real 2021 euros by applying the average 2021 exchange rate (from Eurostat). Where necessary, the data are further converted to current EUR million using the GDP deflator for the European Union. The GDP deflator is derived from the Eurostat data by rebasing to 2021=100. This rebasing preserves the implied inflation rates year by year.

For the real data in euros, these procedures preserve the growth rates in the IEA data.

- OECD data and Eurostat data on forestry and transport

These data are in current prices in euros and are converted to real 2021 euros using the applicable GDP deflators. The country-by-country deflators are derived from the Eurostat data and rebased to 2021=100 as described above. Use of the country-specific deflators takes account of differences in inflation in different countries. This is the best procedure for making country comparisons. However, note that the method does not necessarily maintain additivity — the sum of the deflated countries does not equal the deflated total.

References

- Ang, B. (2015). "LMDI decomposition approach: a guide for implementation." *Energy Policy*, 86, 233-238.
- Brutscher, P.B., Coali, A., Delanote, J. and Harasztosi (2020). "EIB Group survey on investment and investment finance: A technical note on data quality." EIB Working Paper 2020/08.
- Bureau of Transportation Statistics (2005). "Transportation Investment and GDP, Some Concepts, Data, and Analysis – 2004." Washington DC: US Department of Transportation.
- Ferrando, A., Ludice, M., Altomonte, C., Blank, A., Felt, M.H., Meinen, P., Neugebauer, K. and Siedschlag, J. (2015). "Assessing the financial and financing conditions of firms in Europe: the financial module in CompNet." ECB Working Paper No 1836.
- Haskel, J. and Westlake, S. (2018). *Capitalism without capital: The rise of the intangible economy*. Princeton University Press.
- Ipsos MORI (2020). "EIB Group survey of investment and investment finance." Technical Report. November 2020. London, Ipsos MORI
- ITF (2013). "Understanding the Value of Transport Infrastructure – Guidelines for macro-level measurement of spending and assets." Paris: OECD.
- 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.
- Wagenvoort, R., de Nicola, C. and Kappeler, A. (2010). "Infrastructure Finance in Europe: Composition, Evolution, and Crisis Impact." EIB Papers 15 (1), 16–39. Luxembourg, European Investment Bank.