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FOREIGN INVESTMENT IN THE EU
The FOWN dataset

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Abstract

This report describes the process to construct the foreign ownership dataset called FOWN. It includes three pieces of data: i) public and private firms located in Europe controlled by non-European investors, ii) Mergers and Acquisitions (M&A) of firms located in Europe done by non-European investors, and iii) greenfield investments aiming at setting-up an installation in Europe by non-European investors. This document details the raw data used, the assumptions necessary to construct the dataset and limitations of FOWN.

1 Introduction

The present report describes the procedure followed in the construction of the database on **foreign ownership dataset (FOWN)**. The report highlights the challenges encountered in identifying foreign investments and discusses the choices made along the way. The purpose of FOWN is to single out the **non-European ultimate owners of companies active in EU28 not the whole shareholding structure of each company**. We do not reconstruct firm's tree, but we deal with ownership in order to recover who, ultimately, owns a company, hence take the strategic decisions.

FOWN has been created to support the EU regulation on FDI screening (Regulation EU 2019/452[1]) and covers the period 2007-2018. We retrieve the ownership structure of each firm active in Europe (EU28) to correctly assess whether a company established in one EU country is actually domestic or foreign controlled. Similarly to previous works (e.g. Kalemli-Ozcan et al., 2015), we account for the complexity of the ownership data by identifying and tracking the global ultimate owner for each firm over the period.

The FOWN database being based on firm-level data allows to investigate the expected long-term investment in the EU. Users could track the change over time in ownership of EU companies owned by non-EU companies aiming at discovering the origin country of the ultimate investor, and which sectors of activity are targeted by foreign investment. Beyond the evolution of the stocks of ownership, the database also provides through the collection of M&A and greenfield projects the trend in the latest foreign investment into EU by origin country and by sector. Our raw data are from Bureau Van Dijk (BvD, a Moody's activity). The products we used are i) Orbis for firm-level data, ii) Zephyr for M&A transactions and iii) Crossborder Investment for greenfield data.

Regarding Orbis one limitation is that financial data shows a gap of 2 years. This gap accounts for the yearly nature of balance sheet data and the time needed by the data provider to make the updates. In order to provide latest information on foreign investment we integrate firm level data with information about M&A deals and greenfield projects, which are up to date.

Regarding firm-level data, Orbis is a comprehensive dataset available for EU28 countries. The closest competitor of BvD is Dun&Bradstreet (D&B). Geographically, BvD has a better coverage of Europe and of the Asia/Pacific region, while D&B has a far better coverage for the US. Given the European focus of this exercise, we excluded D&B. Other possible datasets are Compustat and Worldscope[2] but they only cover listed firms. For M&A data the closest competitor to BvD Zephyr data is Thomson Reuters Dealogic Merger and Acquisitions data. Stiebale and Trax, 2011[3],

[1]The full text can be found here: https://eur-lex.europa.eu/eli/reg/2019/452/oj.
[2] Worldscope-RIMES contains approximately 108000 listed firms, mainly in the US.
[3] Stiebale, J., and Trax, M., (2011). The effects of cross-border M&As on the acquirers' domestic performance: firm-level evidence. Canadian Journal of Economics, 44(3), 957-990.

find that Zephyr and Dealogic have similar coverage of transactions for M&A deals above USD 10 million. The added value of Zephyr is the link to Orbis (hence to all ownership, financial and economic information) through the unique BvD identifier for the investor and the acquired company. The same advantage is offered by Crossborder Investment a new BvD product that allows to track cross-border greenfield investments since 2013. We observed a good coverage of greenfield projects in Germany (BvD has exchange of information agreements with the German Bundesländer) and a relatively poor coverage for investments in other countries such as France and Italy, if compared with the closest competitor fDi-Market. The dataset is however improving in quality and coverage.

To identify foreign ownership we rely on the residency of the ultimate owner, which is the shareholder controlling the firm. We discuss the appropriateness of our approach with respect to private and listed firms, especially those with a dispersed shareholder structure.

The report is organised as follows:

Section 2 provides the rational for the construction of the dataset using micro-data.

Section 3 presents firm data coming from Orbis. It describes the steps followed for identifying public and private firms located in Europe controlled by non-European investors. This section also includes the comparison of the foreign ownership dataset with the official statistics on firms, discussing differences in definitions and results.

Section 4 presents data on Mergers and Acquisitions (M&A) retrieved from Zephyr. It describes the strategy to identify M&A of firms located in Europe done by non-European investors and the variables available such as nationality of the acquirer's ultimate owner, nationality of target firm and sector of activity.

Section 5 presents data on greenfield investment using Crossborder Investment, which correspond to the activity of setting-up, relocating or expanding an installation. We report general statistics on the trends of these types of investment over the period 2013-218Q1.

Section 6 concludes and discusses possible developments, left for future work.

2 Rationale for a firm-level dataset

International financial flows have been heavily analysed in the aftermath of the financial crisis. The reliance on volatile cross-border banking flows to finance EU economies has been deemed insufficient to feed stable development (Milesi-Ferretti & Tille, 2011). Foreign direct investment (FDI), instead, appeared more resilient than banking flows or portfolio investments, as they imply the acquisition of control over cross-border economic activities. The relative stability of FDI in EU (Bussière et al., 2016) is positive as it goes in parallel with an enhanced financially globalised Europe as shown by the capital openness index (Chinn-Ito, 2006).

However, this changes in the composition of investment in Europe also brought significant changes in the patterns and origin of investment, which induced researchers to wonder who actually owns companies in Europe (Kalemli-Ozcan et al., 2014) and attract substantial attention from single member states and policy makers. Foreign investments may be a driver of economic growth, but at the same time, they could raise concerns deriving from excessive concentration in specific sectors considered of a national interest.

Firm-level data provides information to measure the concentration by detailed sector and origin of the ultimate owner. In particular, firm-level data become increasingly relevant for analysing globalisation or productivity research as macro-data shows an increase divergence between what they measure and what they represent in reality. Latest research on macro-data highlights that, in 2017, nearly 40% of inward worldwide Foreign Direct Investment (FDI) are so called “phantom” FDI as they pass through empty corporate shells and are not profiting the real economy (Damgaard, 2019).

Usually cross-border investments are measures using FDI statistics coming from National Accounts that cover all cross-border transactions and positions between the reporting country and the first partner country. In 2017 foreign FDIs positions into EU (7.5tn Euro) represented 49% of EU GDP. A big chunk of these FDIs is due to multinational enterprises (MNEs), as over 80% of inward FDI in 2017 is represented by equities. If in the past physical location of headquarters matched with actual productive activity, in the last couple of decades the structure of MNEs has become increasingly complex in order to manage global production chains and minimize tax and regulatory burdens. Today, MNEs organization based on financial holdings located in several countries, has decoupled productive activities from the location of headquarters of controlling parent through investment involving Special Purpose Entities (SPEs), offshore financial centres or through the acquisitions of intangibles assets e.g. intellectual property right. For the aggregated level in 2017 as much as 58% of EU28 net inward FDI and 46% of net outward FDI is done via SPEs (with huge differences across countries, e.g. from nearly 100% for Malta and Luxembourg for both inward and outward net FDIs to 3% of inward and 16% of outward for Spain).

The first source of concern in using FDI for tracking foreign investments is that international reporting standards (EUROSTAT-ESA2010, IMF-BPM6 and OECD-

BMD4) request FDI statistics to record the investment between the declaring country and the first reporting (or partner) country. Information on the ultimate investor or the ultimate investing country is provided on a voluntary bases and it is often missing in OECD data (EUROSTAT and IMF data do not contain information on ultimate investor either). The question of ultimate investing country is a well-known issue for international organizations collecting data and at the moment, a pilot study for the FDI statistics based on the ultimate ownership concept is ongoing, but no large scale implementation is yet in place.

Another reason to avoid using FDI data from National Accounts for describing foreign investments in EU is the issue of asymmetries in declarations of assets and liabilities (or inward and outward flows[4]). If we were to use bilateral FDI to analyse foreign investments, we would have two options: use either EU countries declarations of the domestic assets hold by foreigners or use foreign countries declarations on the assets they hold in Europe. These two declarations usually do not coincide. The mismatch in the valuation of assets/liabilities (or inward/outward directs investments) is a well-known problem in bilateral official statistics on FDI declarations: the valuation of country A's assets in country B is in general different from the valuation of B's liability from A. This differences can be huge. For example, the 2016 net equity position of US in South Korea was of $56.5bn according to US declarations and of $29.3 according to South Korean declarations. The mismatch is mainly due to different valuation methods for assets and liabilities. Consistent valuation methods are only requested for listed companies, which at the end of 2010, represented only the 4.1% of gross direct investment positions in the Euro-area (assets and liabilities) and 5.1% of assets and 3.4% of liabilities outside the euro area[5]. The correct evaluation of unlisted equities is therefore crucial for the reliability of FDI declarations.

[4] International reporting standards recommend to present aggregate FDI statistics using the asset/liability principle rather than the directional principle as has been the recommendation in previous editions of these international guidelines. With the asset/liability principle, direct investment statistics are presented according to whether the investment relates to an asset or a liability for the country compiling the statistics. Under the directional presentation, the direct investments are organised according to the direction of the investment for the reporting economy — either outward or inward. The main difference is the treatment of reverse investment (when an affiliate invests in its parent). Under the directional presentation, reverse investment to a resident parent is subtracted to derive the amount of total outward investment of the reporting country while for the asset/liability principle reverse investment is considered a liability of the reporting country. Net values are equal in both approaches.

[5] ECB, 2013, page 27.

3 Dataset on foreign ownership of European firms

3.1 Orbis database

The Orbis database comprises non-confidential standardised company information compiled by Bureau van Dijk, a Moody's Analytics Company. Orbis provides information on over 300 million companies across the globe, collecting data from 160 separate providers, and hundreds of our own sources. It allows to compare companies internationally.

ORBIS	Active companies	Inactive companies	Unknown status	Total
Total	**230,532,659**	**61,220,700**	**10,097,958**	**301,851,317**
of which				
Headquarters/single locations	204,443,138	56,734,420	9,181,432	270,358,990
Branch locations	26,089,521	4,486,280	916,526	31,492,327
of which				
publicly quoted	73,899	729	11	74,639
of which				
Industrial companies	95,562,521	30,073,294	3,901,084	129,536,899
Banks	115,405	12,923	1	128,329
Insurance companies	13,329	2,283	136	15,748
of which				
Very large companies	334,514	47,224	5,398	387,136
Large companies	1,545,438	231,402	36,123	1,812,963
Medium sized companies	11,923,276	1,972,891	205,011	14,101,178
Small companies	216,729,431	58,969,183	9,851,426	285,550,040

Source: Orbis-on line, retrieved March 7, 2019

Orbis provides data on firm's financial and production activity from balance sheets and income statements, together with all known firm's ownership information, as well as other company related information (intellectual property, auditors, etc.). Orbis has been designed as a commercial database focused mainly on business activities (such as the screening of new suppliers), and was not originally designed for academic research. This implies that some characteristics of the database need to be carefully considered, when constructing a database for research purposes. BvD collects part of the data itself, but mostly combines and harmonises the data provided by national information providers. An overview of the national information providers can be found in the BvD Orbis Brochure (Bureau van Dijk, 2018a). Not all of the providers cover a single country, but rather several (regional) countries. For example, the provider Cortera makes available ownership information for the US and Canada, Thompson Reuters for US-listed firms, Creditreform is the provider for Austria, Germany and Luxembourg.

The financial and balance sheet information originates from the national Chambers of Commerce, to which the companies are obliged to file their accounting information (in the business registers). The information is then relayed to Orbis via one of its providers. It is BvD's declared goal is to harmonise the information coming from each country and make it internationally comparable. Hence, it provides the financial data in a so-called global format, which has been derived from the prevailing formats used for the presentation of business accounts in Europe.

3.1.1 Structure of the Orbis Database

BvD provides online access to the Orbis information, with the possibility of downloading a certain amount of selected data. However, the download process has several shortcomings, as reported for instance in Kalemli-Ozcan et al. (2015). For example, the presence of a download cap makes the online consultation more appropriate for a search on a specific (limited) set of companies rather than for a massive download of a whole country or industry. Moreover, the occasional reclassification of companies' identifiers (so-called BvD IDs) makes sometimes difficult to match companies' information downloaded at different points in time, since their identifier might have changed. Although BvD provides a correspondence table of BvD identifiers, this does not always help the matching process. Finally, some online ownership information only presents the current situation (such as the current Global Ultimate Owner), but does not allow to reconstruct the historical information.

As an alternative, BvD provides the Orbis data twice a year through the release of flat files, which mirror the online information at a specific point in time. The flat files information has the advantage of being consistent in terms of companies' identifiers, and also provides the full historical ownership information. Although the large size of the files still requires to split them into smaller sets of data, there is no imposed cap on the amount of data that can be processed, being dependent only on the computer's capacity. A reasonable machine allows processing much more information at a time than the download. For these (and other) reasons the foreign ownership database is constructed starting from the flat files.

BvD provides the data in separate files, each containing different parts of the Orbis database[6]. BvD provides also an accompanying document with the list of variables included in each one of the files, together with a brief explanation on their definition.

This report describes the exercise done in 2018 with data spanning from 2007 to 2016 using the flat files.

[6] The first batch of files provides descriptive information of the companies. The second batch provides the accounting data. Additional files contain the historical information on ownership. Further files provide information on the directorates of a company, its advisors, stock market data, and additional information.

The dataset starts in 2007 because although, in principle, financial data go back to the nineties for some countries, but ownership data are poorly covered before 2007. Besides, 2007 is also the year in which the revised classification NACE (rev.2) has been adopted.

The timing of the release of microdata is a limiting factor for this new dataset but also for official business statistics: EUROSTAT Structural Business Statistics and the statistics on multinational enterprises (FATS-AMNE) are published with at least two-years delay. At time of analysis (early 2019) these official statistics were fully covering 2016. Some figures are also available for 2017 but they do not cover all Member States.

3.1.2 Literature

Orbis database has been used in recent studies both in the area of economics and finance. To make some examples, in the context of ownership, it has been used to investigate multinational enterpreses and foreign affiliates (Alabrese and Casella, 2019), the concentration of power in the network of corporate control (Glattfelder and Battiston, 2019), the role of institutional features on group structure (Rungi, Morrison and Pammolli, 2017), and the shareholders of listed firms around the world (Aminadav and Papaioannou, 2018). Moreover, Orbis has been exploited to analyse industry concetration (Bajgar et al., 2019), the role of multinational firms in the international business cycle (Cravino and Levchenko, 2018), corporte bankruptcy (Beaver et al., 2019), foreign investment and productivity (Kalemli-Ozcan et al., 2013). The list is not exhaustive and there are several other recent papers. Importantly, some of these studies describe and discuss methodological aspects of the use of Orbis, usually devoting more details for the crucial aspects under investigation as data extraction and cleaning have to be project specific. Few of them, like Kalemli-Ozcan et al. (2015), or Ribeiro, Menghinello and De Backer (2010), provide a more general discussion of the dataset, including differences between Orbis administrative data and the methodological framework used by National Statistical Offices. Specifically, Kalemli-Ozcan et al. (2015) give a detailed description of challenges and shortcomings of the Orbis database and concrete instructions regarding the download, the methodology and the cleaning process in the construction of panel dataset from Orbis. Furthermore, the authors find a good representativeness of the financial dataset and the ownership information represented in Orbis with data from EUROSTAT and OECD, respectively[7].

[7] See also Hallak and Harasztosi (2019). The authors analyse the representativeness of employment data for EU countries.

3.2 Strategy for the construction of the dataset on foreign owned European firms

Every firm in Orbis is identified by a BvD ID number, a unique identifier that allows merging information from different files. The first two digits of the BvD ID mirror the ISO code of the country where the entity is incorporated.

The rest of the BvD ID is constituted by the company's fiscal identification number, if it is known. Otherwise, the internal identification number of the provider, which has provided the information regarding this particular entity, is employed. In the case of shareholders, some may be individuals rather than firms, in which case the personal fiscal identification number is used. If the information is retrieved by Bureau van Dijk itself, the latter compose an identification number consisting of the ISO country code, an asterisk, followed by numerical digits.

The strategy to identify foreign controlled firms in Europe proceeds with the following steps:

1. Extract all firms located in EU[8].

2. Merge (historical) financial and ownership data for all firms in step 1.

3. Extract from the set of firms in step 2 all firms having an ultimate owner outside EU to populate the Foreign Ownership Dataset.

3.3 Dataset of EU firms

The construction of a dataset always entails a number of ad-hoc choices. We report below the most relevant assumptions for the construction of the sample:

1. BvD collects ownership information using several sources and infra-yearly updates are all reported. When multiple updates are reported, for each year we select the most recent one.
2. For each firm in EU we extract its unconsolidated balance sheet[9].
3. Financial files include balance sheet items and profit and loss accounts. In this report, we extract total assets, sales and number of employees. **Table 12** in Annex I offers the detailed definitions.
4. An additional BvD file including firm information is used to retrieve the core sector of activity of each company. When it is not available we use the secondary sector. Still the NACE information is missing for 16% of the observations in our sample. We keep this observation in our analysis classifying these firms in an artificial sector, "Z-Not identified". The detailed analysis of these firms is left for future work. We use the NACE[10] (4 digits level) statistical classification for economic activities. The present analysis

[8] We do not limit the size of the firm extracted, bearing in mind that small and very small firms are, for some EU countries, poorly represented in ORBIS.
[9] Unconsolidated balance sheet is the balance sheet of the firm itself without considering its subsidiaries or its controlling parent.
[10] Nomenclature générale des Activités économiques dans les Communautés Européennes.

refers to the most updated version (NACE rev.2) introduced in 2007. It accounts for the rise of new activities in recent years and guarantees an international compatibility, due to its alignment with the ISIC (integrated system of statistical classifications), the international classification of economic activity[11]. The NACE Code is defined by a hierarchical structure:

1st level - Section: Sections are defined by an alphabetical code (e.g. A-Agriculture Forestry and Fishing, B-Mining and Quarrying, C-Manufacturing).

2nd level - Division: The divisions are designated by a two-digit code (e.g. within section C, Division 10 is manufacturing of food products).

3rd level - Group: Groups are identified by a three-digit code, which adds a third digit to the division (e.g. within division 10, the group 10.1 is preserving and processing meat and production of meat products)

4th level - Class: Classes are identified by the four-digit NACE Code, which adds a fourth digit to the group (e.g. within group 10.1, the class 10.11 is preserving and processing meat).

In this report we present the results at the section level, but all results are available at a more granular level.

5. When observations are missing in term of total assets and employees in time t-1 and t+1 we fill-in observations in time t with the average of the two values. Differently, we avoid imputation for revenues and sales as they may change considerably across years. We drop 1,161,492 observations for which total assets are missing or lower than zero.

The resulting sample of firms incorporated in EU (both domestically and foreign owned) for the period 2007-2016 includes 52,778,456 observations. **Table 1** provides a set of summary statistics. **Table 14** in the Appendix provides details on the number of firms by country and year.

Looking at the overall sample (Panel A of **Table 1**) we can notice that the size of companies varies substantially from micro to very large firms. Consistently with the feature of the EU economy represented mainly by small and medium sized firms (SMEs), the majority of our sample is dominated by the same typology of firms. The number of employees is on average 34 but the median is 3 denoting the abundance of very small firms. Total assets are, on average, greater than 19 million euro but the median lays around 190,000 euro (again indicating the large amount of small business). The distribution of the other financial variables displays similar characteristics.

[11] The classification in Orbis has evolved over time. Previous versions were based on existing national classification and lacked international compatibility.

Table 1 provides summary statistics by sector (Panel B). Number of firms as well as average values differ substantially across sectors. For example, financial and insurance activities are characterized by a limited number of firms with very large market shares and assets. In contrast, other sectors are much more fragmented, i.e. services. Panel C in **Table 1** distinguishes between listed and unlisted firms These two subsamples differ substantially[12] in terms of number of firms and associated total assets.

Table 1 Summary statistics of the sample EU.

2.1 Panel A: overall sample EU

	N	Mean	P.tile 50	St. dev.	P.tile 1	P.tile 99
Total assets	52778456	19061.88	194.10	2512920.21	0.00	92936.08
Sales	28245652	6451.55	145.54	342699.40	0.00	66189.38
Employees	26515634	33.87	3.00	980.54	0.00	375.00

2.2 Panel B: sectors (NACE rev.2, sections)

	N	Mean	P.tile 50	St. dev.	P.tile 1	P.tile 99
A-Agriculture, forestry and fishing						
Total assets	870504	2659.29	340.69	33053.93	0.09	29763.21
Sales	583515	1548.18	103.28	24304.76	0	19276.11
Employees	513075	17.4	3	419.91	0	151
B-Mining and quaring						
Total assets	133024	156070.36	998.36	3392129.78	0	1763014.9
Sales	69939	120793.77	647.61	4027672.89	0	554330.72
Employees	66318	163.8	9	2668.34	0	1937
C-Manufacturing						
Total assets	5268430	16258.78	586.6	569437.51	0.11	141998.05
Sales	3568824	15209.68	680.08	553134.85	0	163607.25
Employees	3360868	64.15	10	1074.78	0	709
D-Electricity, gas, steam and air conditioning supply						
Total assets	396469	72691.42	1191.4	1413042.67	0.12	911016
Sales	226937	47634.33	157.35	667036.92	0	764033.6
Employees	122077	90.65	3	957.81	0	1534
E-Water supply: sewerage, waste management and remediation activities						
Total assets	255991	21177.43	665.34	341416.23	0	233293.39
Sales	160967	8100.08	823.92	52913.78	0	117628.48
Employees	145846	60.07	9	293.19	0	846
F-Construction						

[12] Differences are statistically significant for all four variables.

Total assets	5607732	4270.28	294.23	149777.17	0.04	44130.16
Sales	3180692	2298	209.56	43544.45	0	26788.93
Employees	2531426	19.2	5	239.72	0	197
G-Wholesale and retail trade, repair of motor vehicles and motorcycles						
Total assets	10241328	4399.98	230.75	238840.64	0.09	38444.05
Sales	6874793	7245.81	268.23	245282.29	0	78775.2
Employees	6235495	24.23	3	960.15	0	213
H-Transportation and storage						
Total assets	1804386	13078.19	248.77	438508.42	0.05	92550.49
Sales	1156305	6948.32	258.88	150651.87	0	75708.36
Employees	1099129	55.67	4	1393.88	0	539
I-Accommodation and food service activities						
Total assets	1960710	2815.53	126.15	69238	0	31665.02
Sales	1237518	1238.32	122.21	57176.56	0	11820.09
Employees	1108560	29.73	5	1442.9	0	258
J-Information and communication						
Total assets	2636990	10991.71	82.11	649134.3	0	56356.05
Sales	1140252	7082.08	120	233936.44	0	65655.16
Employees	1016442	39.85	3	727.17	0	448
K-Financial and insurance activities						
Total assets	3638504	188965.23	595.38	10678056.2	0	1064824.8
Sales	686204	16285.58	56.72	783612.02	0	156783.12
Employees	868517	67.2	2	1890.77	0	662
L-Real estate activities						
Total assets	4418110	7589.16	583.84	152426.2	0	96088.16
Sales	2296562	1088.48	52.94	22334.74	0	15290.61
Employees	1263739	8.99	1	158.49	0	111
M-Professional, scientific and technical activities						
Total assets	6600277	14829.9	86.58	777108.35	0	115098.1
Sales	2807893	3303.06	59.31	140095.34	0	34661.27
Employees	2615369	30.06	2	965.38	0	308
N-Administrative and support service activities						
Total assets	3108012	16450.24	117.69	1317157.22	0	133813.61
Sales	1093418	4498.27	147.85	121842.81	0	54466.69
Employees	1077525	69.77	4	2052.56	0	938
O-Public administration and defence, compulsory social security						
Total assets	27268	62929.07	296.53	922974.32	0	849884.69
Sales	6976	36234.7	410.71	587234.95	0	444916.28
Employees	9719	171.38	12	1016.47	0	4274
P-Education						
Total assets	474236	1488.82	51	21797.72	0	24083.09
Sales	246037	859.4	50.33	5864.98	0	14307.37
Employees	211493	27.95	3	161.71	0	403
Q-Human health and social work activities						
Total assets	1126909	3353.24	106.23	72824.67	0	51615.52

Sales	599421	2590.97	90.6	22443.17	0	50853.32
Employees	586201	56.56	3	364.87	0	1008
R-Art entertainment and recreation						
Total assets	737140	3451.7	82.16	93228.49	0	37823.98
Sales	354204	2409.31	71.96	54410.71	0	26818.31
Employees	306017	24.82	3	232.46	0	337
S-Other service activities						
Total assets	966277	5638.11	44.84	733226.63	0	29776.97
Sales	402282	1305.22	35.33	23721.84	0	15832.46
Employees	395294	24.32	3	317.22	0	330
T-Activities of households as employers, undifferentiated goods and services producing activities of households for own use						
Total assets	431434	98.9	3.97	4433.48	0	703.77
Sales	409	691.89	23.47	3609.6	0	24050.34
Employees	2648	58.91	3	720.93	0	589
U-Activities of extraterritorial organisational and bodies						
Total assets	5746	6469.79	64.95	52605.4	0	217908.48
Sales	2075	2067.33	0	24351.88	0	20155.27
Employees	515	163.35	4	814.76	0	5532
Z-Not identified						
Total assets	2068979	41171.06	6.01	5533828.65	0.00	54451.05
Sales	745614	529.37	4.90	14766.64	0.00	7340.84
Employees	810133	13.24	0.00	748.71	0.00	98.00

2.3 Panel C: listed and unlisted firms

	N	Mean	P.tile 50	St. dev.	P.tile 1	P.tile 99
Listed firms						
Total assets	107503	1929356	19752	35445807	34	22649252
Sales	72295	519144	8773	5599564	0	9809497
Employees	75910	1973	67	15059	0	40523
Unlisted firms						
Total assets	52670953	15124.69	192.88	1931151.55	0.00	85923.95
Sales	28173357	5135.94	144.59	191336.02	0.00	62095.74
Employees	26439724	28.31	3.00	549.84	0.00	354.00

Notes: Panels A, B, C show summary statistics of total assets, sales and number of employees for firms incorporated in EU, period 2007-2016. Panel A shows summary statistics for the overall sample, Panel B provides separate statistics by sector (sections) and Panel C for listed and unlisted firms separately. Financial values are in thousands of Euro. N stands for the number of firms for which the variables are available. The rest of the headings refer to mean, percentiles and standard deviation of the variables themselves (e.g. for 107,503 listed firms we observe the total assets which are on average equal to 1,929 bn Euro).

The NACE category Z-Not identified has been created ad hoc to gather all the companies for which the NACE classification is not available. This is systematic for

some countries (e.g. UK). According to data providers, the companies with missing NACE have no sectoral information also in the original accounts. This is largely due to national legislations. In Denmark, for example, firms are given the option to indicate 'no sectoral code' when producing their accounts. Other countries foresee simplified accounting rules without the indication of NACE for certain categories of firms. For example, in France SNC, Affaires Personnelles, Coopératives, SCI, Administration, Associations, GIE; in Luxembourg, enterprise individual, SECS SENC, Asbl, etablissement public, foundation, GIE; in the Netherlands Sole Traders, Federations, Foundations and participations, which are consolidated in holding and companies for which a liability guarantee is filed.

Two countries UK and CY explicit mentions exceptions of NACE declaration related to foreign controlled firms:

- UK grants exceptions for NACE declaration to Unlimited, LP, Royal Charter, European Economic Interest Grouping, and foreign companies.
- CY grants exceptions for NACE declaration to partnerships and business names, and to overseas companies (branches of foreign companies) if not taxed in Cyprus.

3.4 Definitions and issues in identifying controlling shareholders

The ownership file includes historical information regarding the link between a subsidiary and its parent. BvD collects ownership information directly from multiple sources including the company (annual reports, web sites, private correspondence), official regulatory bodies (when they are in charge of collecting this type of information) or from the associated information providers (who, in turn, have collected it either directly from the companies or via official bodies). Disclosure of ownership information varies by company type and depends on regulation and corporate governance practices: listed firms are obliged to declare percentages above a given country-specific threshold while unlisted are usually not legally obliged.

The ultimate owner (UO) is the first independent shareholder in the hierarchy above the subsidiary that holds a minimum percentage of ownership shares (direct or total), according to a specific value of interest (for example 50%). An entity is defined to be independent when none of its shareholders holds more than the chosen percentage of its shares. Additionally, all shareholders belonging to one of the following three entity types are also considered independent: Individuals and Families, Public authorities/State, or Employees/Managers/Directors.

BvD distinguishes UOs based on their country of registration, defining the Domestic Ultimate Owner (DUO) as one located in the same country as the respective subsidiary, while the Global Ultimate Owner (GUO) can be located worldwide. As for the possible choices of percentages, Orbis presents the options of UOs based on a minimum of 25% or 50% of ownership. Any shareholder that is located in the

hierarchy in-between the subsidiary and the UO must in turn likewise hold either minimum 25% or 50% of the shares of its subsidiary, i.e. the chosen percentage defines the minimum ownership of all companies appearing in the path to the UO.

In some cases the UOs are not reported simply because they do not exist according to the chosen definitions. For example, if a firm does not have any shareholder holding more that 25% of its shares, then none of the above eight types of UOs will exist. On the other hand, if some of its shareholders hold more than 25% but none more than 50%, then the GUOs/DUOs based on a 25% definition might exist, while those based on a 50% threshold are not defined.

Figure 1 Ownership structure: example**.**

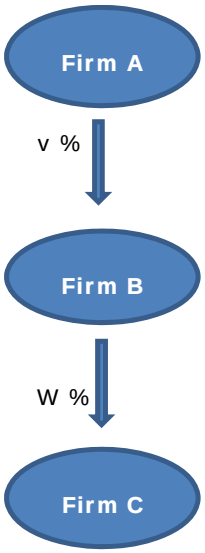


Figure *1* provides an illustrative example to understand how the definition of GUO affects the identification of the controlling shareholder of a firm.

Firm A hold v % of Firm B, which holds w % of Firm C. Firm A is independent. Based on the percentage owned there may three possible scenarios:

1. The GUO of C is A. This is the case when v % > 50.01 and w %>50.01.
2. GUO of C is B. This is the case when v % < 50.01 and w %>50.01.
3. GUO of C is C itself. This is the case when v % < 50.01 and w %<50.01.

The last scenario identifies cases in which a firm is independent.

GUO is a convenient summary statistic that overcomes cumbersome calculations based on linked percentages of shareholding. The reconstruction of each firm's tree based on simple shareholder percentages collides with ownership structures which

are not always fully populated (especially for non-listed firms) and with total ownerships percentages that exceed 100% when summed up across the various hierarchical levels of the firm's tree[13]. Besides, the reconstruction of firms' tree across all years of our sample has been proved nearly impossible (see Altomonte, Ottaviano and Rungi, 2018). Notice that the variable GUO, as reported by BvD, is constructed also using qualitative information, therefore, disregarding the GUO would imply missing all these soft sources often more important than a simple percentage.

Using the GUO has some disadvantages too. First, a shareholder could control a firm having a percentage lower than 50.01%, this happens when the remaining shareholders hold much smaller shares. Thus we may 'wrongly' classify a firm as independent while in reality it is controlled by another entity. While for unlisted firms this is a minor issue, for listed firms with more dispersed shareholder structure the questions is surely relevant.

Finally, we are fully aware that our sample is as good as the information sources it's made with. The GUO is often voluntary disclosed by firms, hence sometimes incomplete or biased. The additional manipulation made by BvD, that collects and systematize the data could further bias the information, ignoring for example some sources (see also Kalemli-Ozkan et al., 2015 for a discussion on the ownership dataset). Orbis is nonetheless the best option being the richest database available for European firms and that used also by official statistical offices to complete official statistics.

3.5 Foreign Ownership Dataset

To create the Foreign Ownership Dataset, we distinguish two typologies of firms:

- **Unlisted companies**: we associate to each firm the GUO defined as the global ultimate owner with a minimum of 50.01% at each step of the ownership path (henceforth **GUO50**). This definition enables to detect the dominant shareholder controlling the firm (select directors, monitor and supervise managers, etc.) and having the stronger incentives to act in the interest of the corporation as compared to minority shareholders. We consider both corporate and non-corporate ultimate owners (see below). This is the threshold considered by the literature (for example Altomonte et al., 2018 and Kalemli-Ozcan et al., 2015, Lensink et al., 2008)[14] and by some of the international agencies (e.g. UNCTAD[15] data on business groups).

[13] These cases are mostly due to the multiplicity of information sources that report different percentages.
[14] To systematically compare ownership structures other indicators are frequently used, such as the Herfindahl index or its modifications, however such indicators aim to capture the concentration of shareholders.
[15] UNCTAD, World Investment Report, 2016 and 2017.

- **Listed companies:** we consider the owner with the largest direct stake in the firm (percentage of shares)[16].

We consider a firm as foreign controlled if the GUO is registered in a country outside EU. To identify the country of the shareholders we rely on the BvD ID number. For each firm i by comparing the country of incorporation, c_i, and the country of his GUO $c_{GUO,i}$, we can define a GUO as domestic (i.e. belonging to EU) if $c_{GUO,i} \in EU = \{1 \dots 28\}$, foreign otherwise[17]. Independent companies are by definition considered domestically owned as $c_i = c_{GUO,i}$.

In case of shareholders with unknown country, BvD assigns as country code WW for individuals and YY for companies. An additional code, ZZ*, is used for entities without any official identifier formed by more than one company, or mixed with individuals. For these shareholders no country identification is possible and we exclude them from our sample.

The ownership dataset is based on yearly files for the period 2007-2016. When information about the value of the GUO in time t is missing, but it is available in time t-1 and t+1 and no change in the GUO is observed, we assume that the GUO is the same also in t and fill-in the corresponding observation. Being interested in the nationality of the GUO, we adopt this very conservative imputation strategy to avoid manipulating the data as much as possible. Kalemli-Ozkan et al. (2015) in a similar exercise, use a much more extensive fill-in strategy exploiting previous or consecutive non-missing values.

Additional variables associated to the ownership can be used in the analysis. BvD provides information regarding the type of entity of most of the shareholders. The classification is as follow: insurance company (A), bank (B), industrial company (C), unnamed private shareholders (D), mutual and pension funds, nominee, trust and trustee (E), financial company not elsewhere classified (F), foundation/research institute (J), individuals or families (I), self-ownership (H), other unnamed private shareholders (L), employees, managers and directors (M), private equity firms (P), branch (Q), public authorities, states and government (S), venture capital (V), hedge fund (Y), and public quoted companies (Z).

The label is assigned by BvD following the following procedure. First the type is assigned based on NAICS or NACE Rev 2 codes. When the industry code does not correspond to a unique type of entity, the company name is analysed looking at relevant keywords. BvD implements several checks to assure the validity and coherence of the attributed types. Still, there might be some concerns as the definition of types is not always clear. The entity type variable should be seen as

[16] The literature has often associated ownership to a given threshold of shares (see e.g. La Porta, et al. 1997), but is not unanimous in indicating a clear-cut threshold as reference point. Nonethless, our choices of the GUO 50 and the largest shareholder, respectively, for unlisted and listed firms are good approximation

[17] This definition of domestic-owned firms include both properly domestic firms, $c_i = c_{GUO,i}$, and firms with GUO in other EU countries, $c_i \neq c_{GUO,i}$.

indicative rather than as a precise measure. This variable is available for half of our sample only[18].

3.5.1 Indicators of foreign ownership

We construct a measure capturing the share of foreign owned firms with respect to the EU economy as follows.

$\text{share}^{x}_{F,t} = \frac{\sum_1^F x_{i,t}}{\sum_1^{TOT} x_{i,t}}$	(1)

In the baseline, equation (1) defines the share of foreign owned firms in time t as the number of firms F with a foreign GUO (a GUO located outside EU) with respect to the sum of all firms in EU 28.

In addition to the number of firms, we consider as x total assets and number of employees and compute the corresponding ratios as in equation 1, which provide indicators of relative share of assets ($\text{share}^{\text{Assets}}_{F,t}$) and relative share of employees ($\text{share}^{\text{Employees}}_{F,t}$), respectively.

By looking not only at the number of firms, but also at the relative share of assets we aim to capture the relative importance in term of market size. In addition, the indicator computed with number of employees provides a measure of employment in foreign-owned firms.

Table 2 supplies an illustration of how, with the same number of firms, the picture given by the foreign ownership indicator can substantially change when other variables such as assets or employment are considered. We create an economy with five firms, four domestically owned, firms 1-4, and one firm, firm 5, foreign-owned. We consider five different scenarios.

Case 1. All firms have the same amount of total assets and number of employees. The indicators are all equal to 0.20, $\text{share} - \text{n}_{\text{CASE1}} = \text{share} - \text{assets}_{\text{CASE1}} = \text{share} - \text{employees}_{\text{CASE1}}$.

Case 2. It presents a scenario in which firm 5, compared to firms 1-4, has a much larger amount of assets and larger number of employees. The three resulting indicators provide completely different numbers (0.20, 0.44 and 0.33) with $\text{share} - \text{assets}_{\text{CASE2}} > \text{share} - \text{employees}_{\text{CASE2}} > \text{share} - \text{n}_{\text{CASE2}}$.

[18] In certain countries, the actual influence on firms' behaviour could be exerted independently from company type. As noticed by Scissors (2018), "there is no difference in the control the Communist Party can exercise over private firms and state owned firms [in China]. There is no rule of law in the People's Republic of China no court or media through which private Chinese firms can resist party orders…".

Case 3. It is similar to the previous one but this time the foreign owned firm has a smaller number of employees, as a result $\text{share} - \text{employees}_{\text{CASE3}} = 0.09$ and $\text{share} - \text{n}_{\text{CASE3}} > \text{share} - \text{employees}_{\text{CASE3}}$.

Case 4. This time we vary the total assets and the number of employees of two domestically owned firms. Specifically, by having larger assets and employees in firm 1 and firm 2, we obtain as always $\text{share} - \text{n}_{\text{CASE4}} = 0.20$ but $\text{share} - \text{assets}_{\text{CASE4}} = 0.11$ and $\text{share} - \text{employees}_{\text{CASE4}} = 0.14$. This implies that $\text{share} - \text{n}_{\text{CASE4}} > \text{share} - \text{assets}_{\text{CASE4}}$ and $\text{share} - \text{n}_{\text{CASE4}} > \text{share} - \text{employees}_{\text{CASE4}}$.

Case 5. This scenario is the same as in case 4, with the exception that now firm 1 and firm 2 have a lower number of employees as a result $\text{share} - \text{employees}_{\text{CASE5}} = 0.26$ and $\text{share} - \text{employees}_{\text{CASE5}} > \text{share} - \text{n}_{\text{CASE5}} > \text{share} - \text{assets}_{\text{CASE5}}$.

Table 2 Illustrative example of the indicator of foreign ownership.

	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5	Foreign share
GUO nationality	*Domestic*	*Domestic*	*Domestic*	*Domestic*	*Foreign*	
Case 1						
N	1	1	1	1	1	0.20
Assets	50	50	50	50	50	0.20
Employees	5	5	5	5	5	0.20
Case 2						
N	1	1	1	1	1	0.20
Assets	50	50	50	50	160	0.44
Employees	5	5	5	5	10	0.33
Case 3						
N	1	1	1	1	1	0.20
Assets	50	50	50	50	160	0.44
Employees	5	5	5	5	2	0.09
Case 4						
N	1	1	1	1	1	0.20
Assets	160	160	50	50	50	0.11
Employees	10	10	5	5	5	0.14
Case 5						
N	1	1	1	1	1	0.20
Assets	160	160	50	50	50	0.11
Employees	2	2	5	5	5	0.26

Our indicator of foreign-owned firms deserves additional considerations.

The use of EU market as benchmark may dilute the measure, especially for some sectors (highly concentrated in some countries). An alternative definition could be the ratio between total assets of a given company and total amount of assets in a

given sector within in a country $\frac{\sum_1^F firm_{f,s,t}}{\sum_1^{C=c} firm_{f,s,t}}$. In this case just the domestic market would be considered as 'relevant market'.

This formulation would be appropriate whenever sectors are indeed country-specific (e.g. agriculture). When sectors are broader (e.g. automotive or aerospace) a supra national dimension is more relevant. For the economy of the document we only present here results for NACE sectors (at section level) and with EU as benchmark.

Notice also that there are sectors with very few firms while others with thousands of firms. By using a share instead of a mere counting of the number of foreign firms, we avoid capturing the sector size effect and facilitate country comparisons over time.

An indicator based on shares has also the advantage of smoothing sudden drops in the absolute number of firms. Sample variation is mainly due to two elements:

(1) Orbis coverage. As documented above, the sample size varies substantially especially for some countries due to BvD acquiring new sources of information either for the financial data and/or the ownership information.

(2) Firms' exit rate. Exit rate affects the size of our sample especially given that the financial crisis and the post crisis period are covered by our sample with the consequent increase in the bankruptcy rate.

3.6 Listed firms

In this section we provide some details regarding listed firms. As already mentioned in Section 3.5, listed firms have been analysed separately from the rest of the sample for several reasons. First, theoretical literature suggests significant differences between public and private (unlisted) firms. In the life cycle view of a firm, publicly traded firms are usually more mature, considering for example age. The reason to go public can be also related to funding needs (Pagano et al., 1998 and Zingales, 1995). Indeed, public firms compared to private firms have lower cost of debt, easier accessibility to debt market and better bond ratings (Saunders and Steffen, 2011; Kovner and Wei, 2014). Second, when a company is listed, a relatively small percentage of shareholding could be enough to have the control of the firm (this is the case of Geely, a large Chinese automaker that has bought 9.7 percent stake in German car and truck maker Daimler on February 2018). Using our definition of ultimate owner (50%), we would have classified as independent companies all those that are effectively controlled by one, or a group of, influencing shareholders but not reaching the 50% threshold. Hence, in what follows we assign the control of the firms to the largest shareholder, the one holding the largest percentage of shares, and look at its nationality. The BvDID identifies the country of incorporation of the shareholder and thus if a firm is foreign controlled.

3.6.1 Dataset construction and summary statistics

To construct the sample of listed firms we retain all firms in the EU set that are classified as listed or delisted. We combine this information with the IPO (Initial Public Offering[19]) date and the delisting date to construct a panel of firms-years. In matching firms' financials with ownership data, we give the priority to unconsolidated balance sheets, when not available we use the consolidated ones.

Table 3 Summary statistics of EU listed firms, 2007-2016.

	N	Mean	P.tile 50	St. dev.	P.tile 1	P.tile 99
Total assets	107503	1929356	19752	35445807	34	22649252
Sales	72295	519144	8773	5599564	0	9809497
Employees	75910	1973	67	15059	0	40523

Notes: The table shows summary statistics of total assets, sales and number of employees for firms incorporated in EU, period 2007-2016. Financial values are in thousands of Euro. N stands for the number of firms for which the variables total assets (in th Euro), sales (in th Euro) and employment are available. The rest of the headings refer to mean, percentiles and standard deviation of the variables themselves (e.g. for 107,503 listed firms we observe the total assets which are on average equal to 1.929 tr Euro).

In the sample period 2007-2016, there are 16,137 unique firms, corresponding to 119,553 firms-year observations. After having eliminated observations for which total assets are not available and delisted firms, the resulting final sample amounts to 107,503 observations.

Figure 2 reports the descriptive statistics of the listed firms sample by sector over time. The size of the sample varies across time, with a lower number of firms towards the end of our period, mainly due to the delay of reporting the financial data. The sample also suffers from a selection bias, with some firms exiting this sample due to voluntary delisting, takeovers, or breach of regulation[20]. Looking at the number of companies by sector, we can see a significant number of firms are classified in sections C-Manufacturing and K-Financial and Insurance activities. This is even more evident when looking at our sample in term of total assets (middle panel). The relative size of the banking sector shrinks substantially when considering the number of employees while the one for Manufacturing is invariant. Another important sector is G-Wholesale and retail trade. The relative shares across sectors over time are almost constant.

It is useful to also consider the breakdown by Member State, as there is a significant variation across countries (see Table 4). Our sample consists of all companies listed in EU, and depends upon the different financial market development: we observe countries with relatively many listed companies (i.e. Sweden or Spain) and some others with much smaller percentages (i.e. Italy).

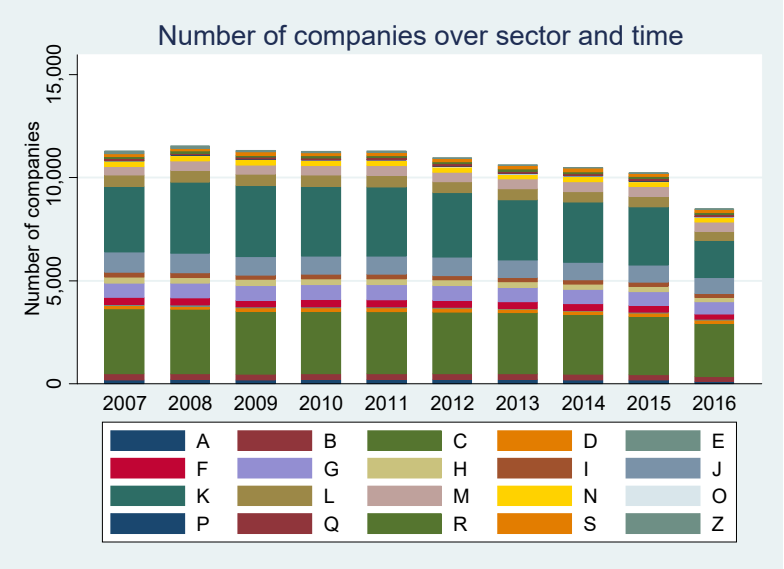
[19] The date in which the firm has been listed in one stock exchange.
[20] More than 6,000 firms in our sample have been delisted. Voluntary delisting and takeovers are quite frequent see e.g. Pour and Lasfer (2013).

In absolute value, the country with the largest number of listed firm is United Kingdom followed by Spain, Poland, France, Sweden and Germany. The picture changes significantly when considering total assets and total employees, with United Kingdom having by far the largest share.

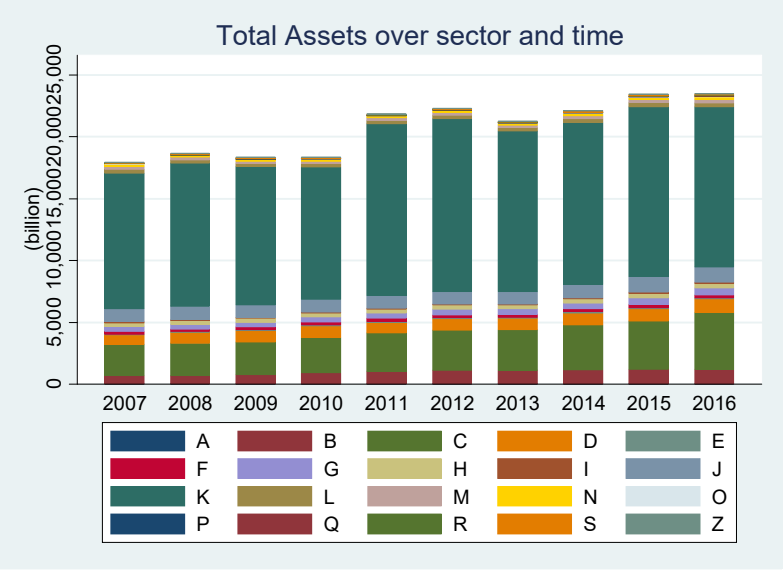
This characteristic of our sample is consistent with previous literature in the field. Significant cross-country differences in the relative importance of public listing as a form of finance are well-documented (see e.g. Pagano, Roell and Zechner, 2002). These differences can be explained by several factors, such as limited institutional investors, regulation, and inadequate legal protection of minority shareholders, tax system or other institutional features.

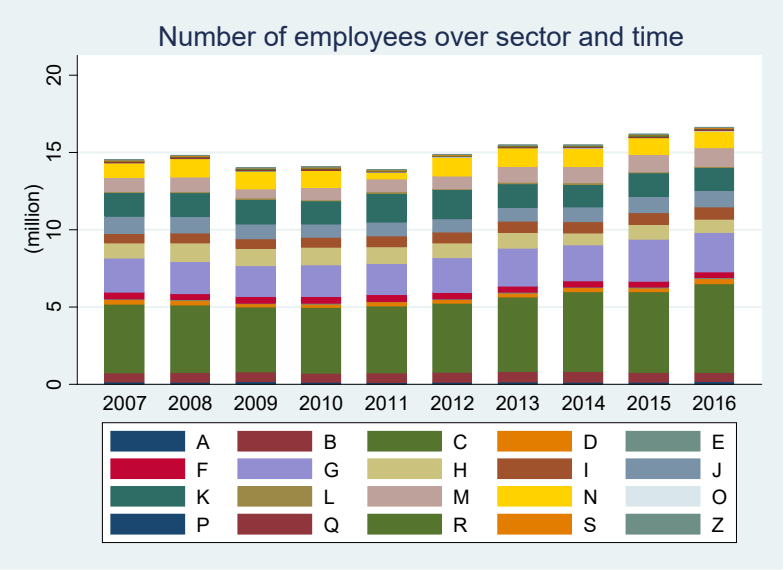
While most of the capital is raised in domestic markets, some companies use also foreign markets, either European or non-European (see e.g. Kim and Weisbach, 2008 and Gozzi et al., 2010)[21]. A major role as financial centre is played by United Kingdom as its deep capital market is able to attract wider groups of global investors. Both for equity and bond United Kingdom is frequently selected for large issuances not only by British firms.

Figure 2 Listed firms by sector and time.



[21] It is also frequent for large companies to be cross-listed (Sarkissian and Schill, 2016).





Source: Orbis, BvD. Notes: The graphs provide an overview of the sample of listed companies over sector (section) and time (period 2007-2016). The upper panel refers to the number of firms, the middle panel to the total assets, and the bottom panel to the number of employees.

Table 4 Listed firms by MS (2016).

Country	Firms (%)	Total Assets (%)	Number of employees (%)
AT	0.85%	0.41%	0.71%
BE	1.90%	1.67%	0.81%
BG	3.83%	0.05%	0.34%
CY	0.91%	0.18%	0.37%
CZ	0.32%	0.11%	0.18%
DE	7.39%	6.70%	11.08%
DK	2.17%	2.35%	0.48%
EE	0.24%	0.01%	0.00%
EL	2.20%	1.41%	0.69%
ES	13.51%	9.69%	1.99%
FI	1.64%	0.70%	0.82%
FR	8.59%	7.20%	3.32%
HR	2.70%	0.08%	0.47%
HU	0.54%	0.08%	0.12%
IE	0.93%	2.34%	6.78%
IT	3.65%	2.79%	2.97%
LT	0.35%	0.02%	0.09%
LU	0.66%	0.81%	2.84%
LV	0.38%	0.01%	0.05%
MT	0.29%	0.05%	0.03%
NL	1.89%	4.04%	9.98%
PL	9.55%	0.48%	1.26%
PT	0.73%	0.75%	0.20%
RO	5.26%	0.11%	0.61%
SE	7.77%	1.63%	0.49%
SI	0.53%	0.09%	0.22%
SK	0.83%	0.02%	0.08%
UK	20.39%	56.20%	52.98%

Source: Orbis, BvD. Notes: The table shows the share of firms (column 2), total assets (column 3) and number of employees (column 4) by Member State. Values are in percentages. Data refer to year 2016.

3.7 Comparison with official statistics

In order to evaluate the ability of Orbis data in representing the structure of EU firms we compare them to official statistics, bearing in mind that

1. Orbis underrepresents small firms.
2. Orbis coverage depends on national legislations on balance sheet reporting and on national provides that supply to BvD the raw data.

In evaluating Orbis coverage[22] we analyse two different samples: (a) the set of EU firms no matter who owns those firms and (b) the set of foreign owned firms. We first report the results for the Orbis dataset on EU firms. Foreign owned firms are reported after the results in section 5.

For the comparison we use official statistics. In the case of EU firms we compare Orbis with EUROSTAT and OECD business statistics. The comparison is done by country, sector, and class of variable (number of firms, employment and sales). Official statistics do not offer a perfect match with EUROSTAT and OECD statistics due to differing definitions. In particular:

- Official statistics are more linked with input-output view of economic activities and thus don't provide much information on business characteristics such as total assets.
- The sectors are based on the NACE2 Revision 2 classification (NACE 2 rev.2) managed by EUROSTAT and implemented in 2008 in the official data. Consequently, the first year of observation in EUROSTAT SBS database using this classification is 2008 and the latest most complete available year is 2015 so our comparison focuses on this time interval (analysis performed at the end of 2018).
- Another issue is that the sectorial characteristics in Orbis are not always available. In average for EU Member States, around 15% of the sector (NACE2 rev2.) is not provided but in some cases this rises to more than 30% when considering firms resident in Denmark, United Kingdom, Ireland, Malta and Netherlands. The sample size that we use in the comparison is reduced accordingly.
- Finally, due to legal constraint in the EU on firms we expect that micro-firms do not declare their financial accounts and so do not appear in the financial module in Orbis.

We expect these latest two biases to impact downward three variables common between Orbis and official data namely number of firms (NF), number of employees (NE) and sales (TO).

We proceed in 2 steps: 1) we show graphically a comparison between our dataset and the official by NACE sectors and by class of employment using a measure of coverage at EU level and 2) we propose a second presentation for the same measure in form of table providing details by country.

We first introduce the aggregate statistics that we are using for our comparison and the variables on which the comparison is feasible.

[22] In this document the representativeness is not statistically assessed; we aim at capturing if the coverage of Orbis is close to that of official statistics, see also Kalemli-Ozcan et al. (2015).

3.7.1 EU: comparison with official data for business activities

Official statistics are used for our comparison. These are coming from two sources: EUROSTAT and OECD business statistics. Structural business statistics (SBS[23]) from EUROSTAT describes the structure, conduct and performance of economic activities, down to the most detailed activity level with the exception of agricultural activities, public administration and services as shown in **Table 5**. The data providers of SBS are various as the Regulation leaves to the compiling country the choice of data sources. In most countries, a combination of survey and administrative data is used[24].

In SBS, the enterprise is the smallest combination of legal units that is an organisational unit producing goods or services, which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources. An enterprise may be a sole legal unit. Orbis is having the similar concept for the unit allowing us to compare these datasets.

[23] See http://ec.europa.eu/Eurostat/statistics-explained/index.php/Structural_business_statistics.
[24] It is very hard to assess the accuracy of the administrative data as no quantitative indicator is available.

Table 5 Correspondence table for the sectorial detail present in the official sources of information.

Section	Title	Division	Orbis	SBS
A	Agriculture, forestry and fishing	01-03	✓	
B	Mining and quarrying	05-09	✓	✓
C	Manufacturing	10-33	✓	✓
D	Electricity, gas, steam and air conditioning supply	35	✓	✓
E	Water supply, sewerage, waste management and remediation activities	36-39	✓	✓
F	Construction	41-43	✓	✓
G	Wholesale and retail trade; repair of motor vehicles and motorcycle	45-47	✓	✓
H	Accommodation and food services activities	49-53	✓	✓
I	Transportation and storage	55-56	✓	✓
J	Information and communication	58-63	✓	✓
K	Financial and insurance activities	64-66	✓	(*)
L	Real estate activities	68	✓	✓
M	Professional, scientific and technical activities	69-75	✓	✓
N	Administrative and support activities	77-82	✓	✓
O	Public administration and defence; compulsory social security	84	✓	
P	Education	85	✓	
Q	Human health and social work activities	86-88	✓	
R	Arts, entertainment and recreation	90-93	✓	
S	Other service activities	94-96	✓	✓ only S95(**)
T	Activities of households as employers; undifferentiated goods- and services-producing activities of household for own use	97-98	✓	
U	Activities of extraterritorial organisation and bodies	99	✓	

The division matches to the first 2 digits of NACE2 rev2 (the Division) of the EU firms.

Source: EUROSTAT RAMON - Reference And Management Of Nomenclatures. (*) Data on section K of NACE Rev. 2 (Financial sector) is provided only for Number of enterprises and Number of persons employed. It is partially provided for Turnover and Production value. Financial sector is not included in the total business activity aggregate (the BUS aggregate; currently B-N_S95_X_K = BUS). (**) Division S95 refers 'Repair of computers and personal and household goods'

An alternative provider to EUROSTAT SBS is managed by OECD which collects and disseminates enterprise statistics in its structural business statistics database which includes the Structural Statistics for Industry and Services (SSIC) and the Statistics by Enterprise Size Class (SEC). Since 2004, OECD sources its data from EUROSTAT for EU countries. So firms' data for EU Member States are coherent in both sources. In our study, we use OECD data wherever EUROSTAT figures are missing.

3.7.1.1 Methodology for the comparison: sectors, characteristics

The comparison of Orbis dataset of EU firms with the aggregated official data considers two axis of granularity: the sectorial activities in which the firms are involved and the firms' size. Along these two dimensions we consider three **characteristics** for which the coverage is assessed: number of firms (NF), of employees (NE) and the sales/turnover (TO). These variables are present both in Orbis and the official data as reported in the correspondence **Table 6**.

Table 6 Correspondence table of variables in BvD-ORBIS and in official data.

Category	Characteristics	Acronym	Orbis	Official data
Business Demographic	Number of firms	NF	Count distinct rows in the sample	Number of enterprises (V11110)
	Number of employees	NE	Number of employees (EMPL) included in the company's payroll	Number of persons employed[25] (V16110) – mandatory characteristics
Output related	Turnover	TO	Operating revenue (OPRE) = Net sales + other operating revenue + stock variation of finished goods (excluding taxes)	Turnover or gross premiums written - million euro (V12110) = sales of goods and services (including all taxes but not VAT)

[25] Total number of persons who work in the observation unit (inclusive of working proprietors, partners working regularly in the unit and unpaid family workers), as well as persons who work outside the unit who belong to it and are paid by it (e.g. sales representatives, delivery personnel, repair and maintenance teams). It excludes manpower supplied to the unit by other enterprises, persons carrying out repair and maintenance work in the enquiry unit on behalf of other enterprises.

BvD-Orbis provides the number of employees. The class of employment is created according to the number of employees as found in the official source:

- 1-9 employees;
- 10-49 employees;
- 50-249 employees;
- Over 250 employees.

To allow the comparison we need to restrain our sample to its common dimensions with the official statistics, bearing in mind that while for the number of firms and the employment the definitions coincide, turnover is slightly different in ORBIS with respect to official statistics.

A first needed match is on the sector of activity. Sectorial NACE in Orbis dataset is available at 4 digits. To create sectorial aggregation on Orbis dataset ownership, we extract the first 2 digits of the NACE2 rev.2 (the divisions) which could be translated in official data sector (the sections) as reported in the **Table 5**. The table also recalls the naming of the section as defined in NACE2 rev.2 and provides the list of available Section in the official statistics. We exclude in particular agriculture (section A), public administration (section O), Education (section P), Health (section Q), Arts (section R) and other services activities (sections S, T and U).

On average for EU Member States we retain 84% of the Orbis dataset for which the NACE is available (so its initial size is reduced by 16%). However, this reduction of the sample size represents only 3% for EU when considering the market of employment and to 0.2% when consider the sum of turnover for EU firms. The aggregated figure could hide (and indeed does) very different patterns at the Member State level. Investigations are left for future work.

3.7.1.2 Coverage on EU aggregate

We now examine the characteristics of the Orbis dataset aggregating variables (NF, NE, TO) along the NACE section and the class of employment. We produce a couple of general graphs to visualise how the dataset is compared to the official data. We investigate the coverage of EU dataset using a quantitative measure.

There are thirteen sections of NACE: from B to N and their total and five classes of employment and their total. We can compute statistics in a matrix of coverage having thirteen columns and five rows for each of the characteristics number of firms, number of employees or turnover/sales that are set in different panel. The equation (2) provides the formula for the coverage using the number of firms (NF):

$\text{coverage NF}_{\text{cc,nace\_i,emp\_j}} = \sum_{k=0}^{N} \text{NF}_{\text{Orbis}}^{\text{nace\_i,emp\_j}} \Big/ \text{NF}_{\text{official}}^{\text{nace\_i,emp\_j}}$	(2)

where cc indicates countries that are part of EU sample, NF is the number of firms, N is the number of firms that belongs to the class NACE_i and emp_j where i=1,..13 and j=1..5. The statistics NF would be replaced subsequentially by the other statistics i.e. number of employees (NE) or turnover (TO) to assess all three variables. We expect the value to be between 0 and 1: 1 (or 100%) corresponds to the case in which we obtain a perfect coverage while 0% corresponds to the case in which JRC-ORBIS reports no data.

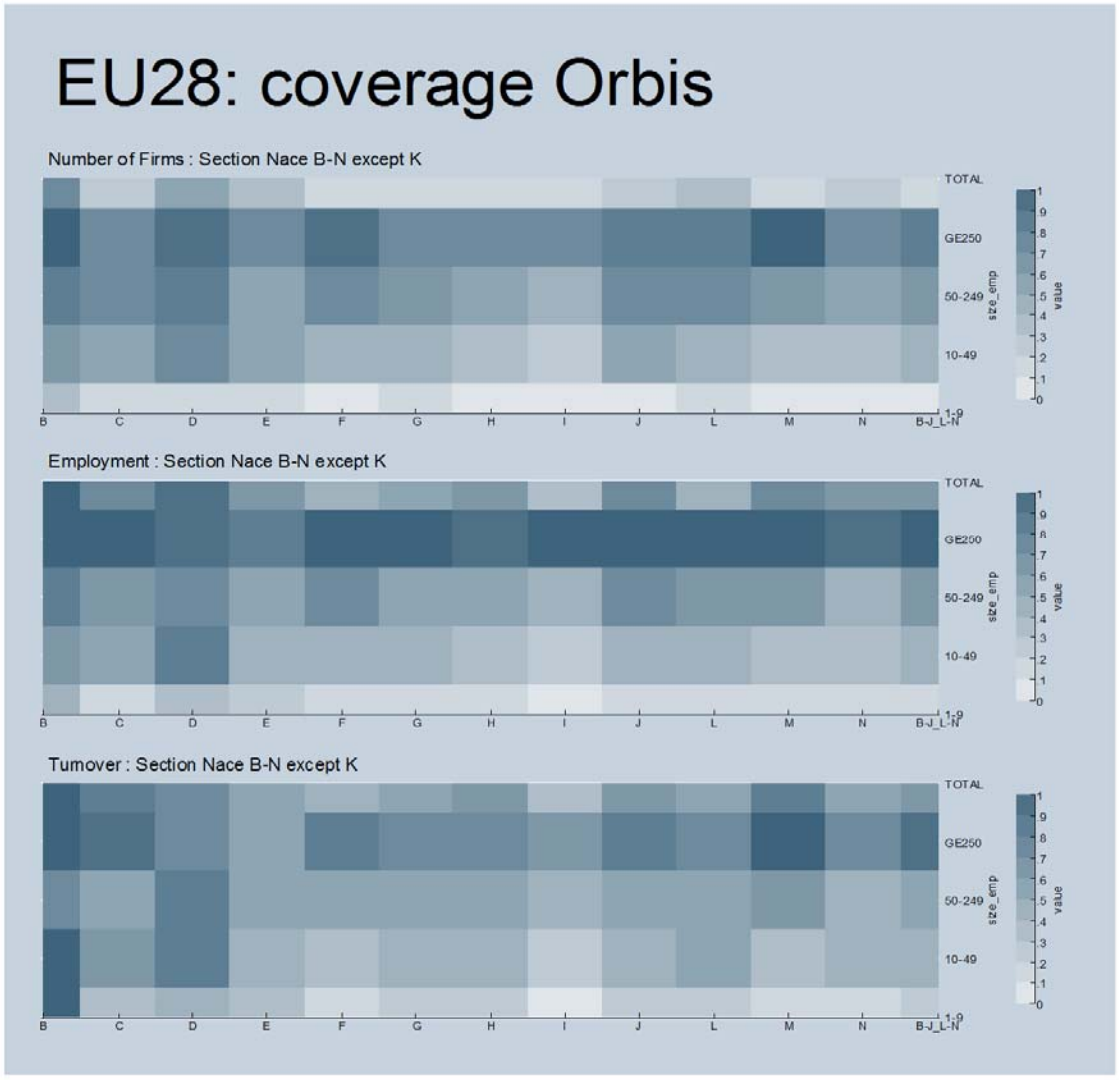
A representation is created on the coverage of Orbis. **Figure 7** shows the values of the matrix of coverage for the EU aggregates. The combined graph contains three rows (one for each characteristics) showing for each a heat map, top panel concerns number of firms, middle panel employment and lower panel turnover. We now describe the construction of a heat map.

In our figure, a heat map contains a shaded matrix of dimension 13 (nace) by 5 (class of employment). On the x-axis, the sectors are listed in alphabetic order: from B to N excluding K. The largest value corresponds to the Total of business sector (Section B to N excluding K). On the x-axis is shown the class of employment: lowest abscise corresponds to the class of firms between 1-9 employees up to the class of firms with more than 250 employees. Once again, the largest value for the x-axis corresponds to Total dataset with no distinction of size. In each heat map's cell (having fix a sector and a size), we report respectively the value of the $\text{coverage NF}_{\text{EU28,nace\_i,emp\_j}}$, $\text{coverage NE}_{\text{EU28,nace\_i,emp\_j}}$ and $\text{coverage TO}_{\text{EU28,nace\_i,emp\_j}}$.

On **Figure 2**, several differences appear and help assessing our dataset at EU level. We list here these variations keeping in mind that part of the difference of coverage is by construction as seen above.

First one can notice some areas in which the coverage is relatively strong (dark colours) especially for the employment set in the middle panel. At the opposite, the number of firms is penalised by the lack of information for the firm having between 1-9 employees. This confirms that the larger the firm the better the coverage in ORBIS dataset. In general, that firms active in I-Accommodation and food services activities and M-Professional, scientific and technical activities are not so well represented in Orbis (under 30%).

Figure 2 Combination of heat map representation on the coverage of Orbis database by class of employment.



Notes: Each cell corresponds to the share from Orbis relative to the official data in one of the 13 sectors defined in rows and one of the 5 classes of employment defined in columns. Each panel corresponds to one characteristic: Number of Firms in the top panel, Employment in the middle panel or Turnover/Sales in the bottom panel. To compute the average coverage on EU, we first compute for each year the coverage with no distinction of countries (summing all values) and then average the results over the 3 years from 2013-2015.

To assess the goodness of the coverage at country level, we create a bucketing of the coverage:

- If coverage>75% we consider that it is good quality and assign +++,
- Otherwise if coverage>50% we consider that it is medium quality and assign ++,
- Otherwise if coverage>25% we consider that it is not good quality and assign +,
- For the remaining, we assign no sign.

Table 7 Goodness of the coverage of a set of categories on three sub-samples of the Orbis by EU Member States.

	1) Overall sample			2) More than 20 employees			3) C: Manufacturing		
	NF	NE	TO	NF	NE	TO	NF	NE	TO
AT	+	++	++	+++	+++	+++	+	+++	+++
BE		++	++	++	+++	+++		++	+++
BG	++	+++	+++	+++	+++	+++	+++	+++	+++
CY			+	++	+++	+++		+	+++
CZ		++	+++	++	+++	+++		+++	+++
DE		++	++	++	++	++	+	++	++
DK	+	+	++	+	++	++	+	+	++
EE	+	+	++	++	++	++	+	++	+++
EL		+	++	+	++	+++		++	++
ES		+	+++	++	+++	+++		++	+++
FI	+	++	+++	++	++	+++	+	++	+++
FR		+	++	+	++	++		+	+++
HR	+	++	+++	+++	+++	+++	+	+++	+++
HU	++	+++	+++	+++	+++	+++	++	+++	+++
IE		+++	+	+	+++	+		+++	++
IT		++	+++	+++	+++	+++	+	++	+++
LT		+	++	+	++	+++		++	+++
LU	+	+++	+++	+	+++	+++	++	+++	+++
LV	++	+++	+++	+++	+++	+++	+++	+++	+++
MT			++		+	+	+	+++	
NL		+++	+++	++	+++	+++		+++	+++
PL			++			+			+++
PT		++	+++	++	+++	+++	+	++	+++
RO	+++	+++	+++	+++	+++	+++	+++	+++	+++
SE		++	+++	++	+++	+++		++	+++
SI		++	+++	++	+++	+++		+++	+++
SK		++	+++	+++	+++	+++		++	+++
UK	+	+++	++	+	+++	++	+	+++	+++
EU		**++**	**++**	**++**	**+++**	**+++**	**+**	**+++**	**+++**

Notes: NF = number of firms, NE= number of employees and TO= turnover/sales. Coverage >75% are represented by +++, those > 50% by ++ and those >25% by +. No sign means that the coverage is under 25%. To compute the average coverage on EU, we first compute for each year the coverage by country and then average the (non-missing) results over the 3 years from 2013-2015 independently by country. The three samples are: 1) overall sample on Total Economy (15 sectors), 2) sample for Total Economy for firms having more than 20 employees and 3) sample for firms in Manufacturing.

As seen in **Table 7**, on the overall sample EU28, the number of firms is the characteristics with the poorest coverage for the EU MS. For most of the countries, the goodness of the coverage is improved by using the number of employees or turnover except for Romania that has already an excellent coverage +++ for the number of firms. Only Hungary, Bulgaria, Latvia and Romania show coverage above 50% for firms' market size. Number of employees and turnover have a coverage of more than 50% for most of EU Member States at the exception of 9 countries Cyprus, Denmark, Estonia, Spain, France, Greece, Lithuania, Malta and Poland. For turnover/sales, only 2 countries Cyprus and Ireland shows coverage under 50%.

While considering firms with more than 20 employees, the quality of the coverage generally improves significantly: 8 countries have coverage above 75% for number of firms plus another 11 countries have coverage between 50% and 75%. Similarly, 20 EU Member States have coverage above 75% for turnover/sales and 19 EU Member States for number of employees. Even for firms having more than 20 employees, 2 countries are performing quite poorly namely Malta and Poland.

Considering firms in Manufacturing, which is the most populated sector, we see that the same weakness appears for number of firms in which only 5 countries shows coverage above 50%. For turnover/sales, only Malta shows coverage under 50%. For number of employees, Cyprus, Poland, France and Denmark show coverage under 50%[26].

[26] Additional detailed information on representativeness of ORBIS data for number of employees can be found in Hallak, Harasztosi, (2019).

3.7.2 Comparing results with official data for foreign affiliates

In this section we compare the foreign owned firms identified in Orbis with EUROSTAT-FATS. Specifically, we focus on the location of the foreign owner of firms. Once again the owner is considered as foreign only when it resides outside the EU area (for example German firms ultimately owned by US investors). Domestic owner is located within the same economic area, including domestic and intra-EU ownership.

We aim at identifying areas for which countries the Ownership database cannot be used to drive robust conclusions keeping in mind that even if official and Orbis databases refer to foreign affiliates they are not fully aligned. This is due to:

- A different definition of controlling unit: inward FATS uses the concept of control over an affiliate, including also the power to name the majority of its directions, whereas for Orbis we define foreign ownership using the concept based on majority of direct (or indirect) ownership.
- EUROSTAT-FATS data is supplied by national statistical institutes, which use a variety of sources, such as FDI declarations, administrative data, business surveys, local registries, annual company reports. Orbis makes only use of balance sheets information published in national chambers of commerce.
- The aim of FATS is to offer a representative picture of the population of firms, whereas Orbis uses only balance sheet information without any aim at representativeness. Notice however that Orbis is one of the data providers for FATS.

This is why we prefer referring to absolute value instead of share of affiliates in the market. We are looking at broad inconsistencies in the stocks of investment. The comparison is made through bar graphs in which we compare the size (absolute value) of foreign owned affiliates (outside EU).

To compare data, we associate our dataset with inward FATS from EUROSTAT. Inward FATS does not provide firm-level data. It reports aggregated statistics over sectorial activities and the location of ultimate owners for sub-set of selected countries[27]. As for SBS, we reduce our sample to those companies that belong the total business as defined in FATS: it contains all firms in sector from B to sector N plus the division S95 excluding the financial sector (K) using the reference **Table *5***[28]. We note the total business as B-N_S95_X_K. The main difference with SBS is that in inward FATS the aggregation by class of employment is not reported so we won't be able to compare our database along this key dimension and limit our comparison to total number of employees.

The last common year for the comparison in FATS is 2015. For Denmark, France, Sweden, Finland and UK data for 2015 are missing in inward FATS we use 2014

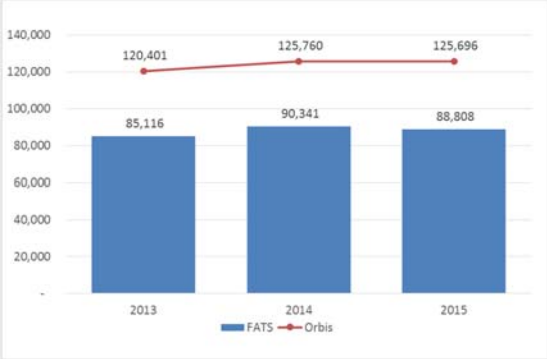
[27] No aggregate by class of employment is available.
[28] ***Table 14*** in Annex reports the information that is available in inward FATS for 2015.

(also for Orbis). For Belgium and Luxembourg, as data start in 2010 and 2009 respectively, we report the first available data back to 2008. Greece is excluded from this analysis due to the amount of missing data in FATS.

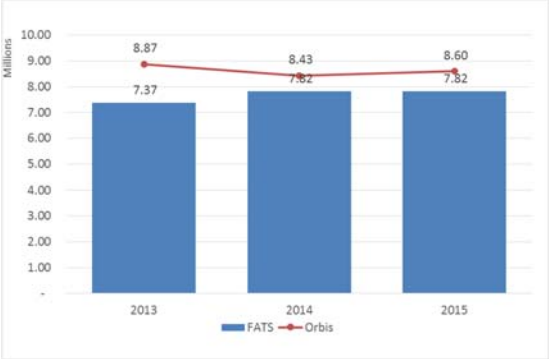
Our final sample for this section contains around 125,700 EU foreign affiliates in 2015 as compared to the 88,800 recorded as aggregate by foreign affiliates (extra-EU) inward FATS. Therefore, Orbis ownership is able to identify more foreign affiliates than what inward FATS is reporting as shown in **Figure 3**.

Figure 3 Trend of foreign affiliates in number of firms (top-left panel), in number of employees (top-right panel) and in sales in bn Euro (bottom-left panel).

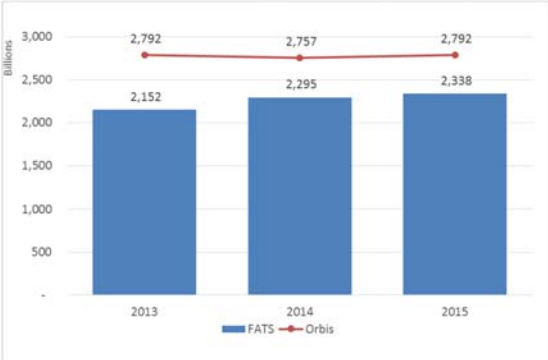
Number of Firms



Number of Employees



Turnover/Sales



Source: Inward FATS, extra EU foreign ownership column. Firms in the category total business (section B to N+ S95 excluding K). Last retrieval February 2018.

Focusing on 2015 (latest common year between FATS and Orbis), more foreign affiliates are observed in Orbis as compared to FATS. In particular in UK, we are able to identify 19,900 firms extra in Orbis (the great majority located in Channel Islands[29]).

[29] Channel Islands are legally part of UK, hence included in ORBIS as UK firms. In official FATS statistics, instead, they are considered as a separate geographical entity.

However, looking at each EU country separately, one can identify countries for which Orbis is missing affiliates as shown by the figures in the Annex. In particular:

- For Hungary, Slovenia, Sweden, Bulgaria and Lithuania Orbis is missing more than 1,000 affiliates as compared to FATS as shown in **Figure 6**. FATS however does not specify the firm size, hence the under-reporting observed in Orbis could be due to the known underreporting of small enterprises in Orbis.
- As far the number of employees (**Figure 7**) is concerned the largest gap in deficit is observed in Poland for which Orbis database is not correctly matching the employment size due to missing information of 340,000 employees. For Sweden, Hungary, Italy and Germany, the deficit in identification is less pronounced (between 30 and 60 thousand employees are missing).
- For turnover/sales, the deficit in identification occurred mainly for Sweden, Austria, Finland and Hungary (**Figure 8**).

The fact that more foreign affiliates (in numbers) are available in Orbis is difficult to assess in general. We will focus on the location of the owner and consider a sub-set of countries in which the owner is located to investigate this difference. This allows us also to evaluate the trend over a longer period starting in 2008 (the aggregates being available from 2013). This selection reduces the sample to 58,370 foreign affiliates in inward FATS and 61,784 in Orbis in 2015: the sample sizes are more similar.

From this subset of countries, we find a slight under-reporting of Orbis with respect to FATS in 2008-2009. Orbis usually underestimates small firms (and all those who do make public balance sheets). After 2008 Orbis considers new data providers especially for non-EU countries allows to diminuish this. For the number of firms and the turnover, both sources provide similar trends with a decrease in turnover between 2008 and 2009 and an increase in the number of firms (**Figure 4**).

Coherently for both sources, the main partner is the US followed by Switzerland and offshore aggregates[30]. In Orbis, (left column in **Figure 22**), the number of foreign affiliates owned by firms resident in US, Switzerland, offshore countries, Russia, China, Japan, Norway, Turkey and Canada increased by around 21,400 units between 2008 and 2015 while in inward FATS it increases by only around 12,200 units.

[30] Offshore countries include Andorra, Antigua and Barbuda, Anguilla, Aruba, Barbados, Bahrain, Bermuda, Bahamas, Belize, Cook Islands, Curacao, Dominica, Grenada, Guernsey, Gibraltar, Hong Kong, Isle of Man, Jersey, St Kitts and Nevis, Cayman Islands, Lebanon, Saint Lucia, Liechtenstein, Liberia, Marshall Islands, Montserrat, Mauritius, Nauru, Niue, Panama, Philippines, Seychelles, Singapore, Sint Maarten, Turks and Caicos Islands, Saint Vincent and the Grenadines, British Virgin Islands, US Virgin Islands, Vanuatu and Samoa

When considering employment (number of employees) the increase between 2009 and 2015 is concerning 1,070,000 employees in Orbis compare to 1,060,000 employees in FATS. When considering turnover, the increase is also in line 521 bn€ for Orbis and an extra 605 bn€ for FATS between 2009 and 2015. One can observe higher turnover value assigned to Switzerland in FATS, whereas in Orbis more turnover is observed in offshore countries. This highest share of offshore countries in Orbis is also observed for the employment and for the number of firms.

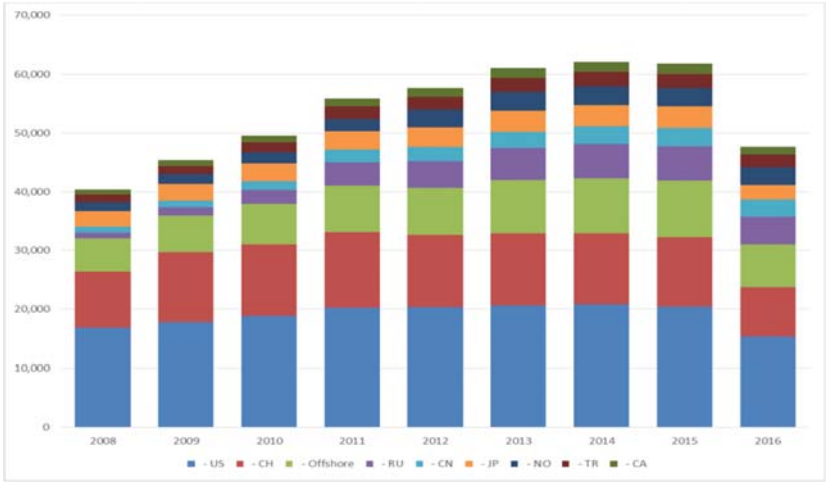
In conclusion for this section,

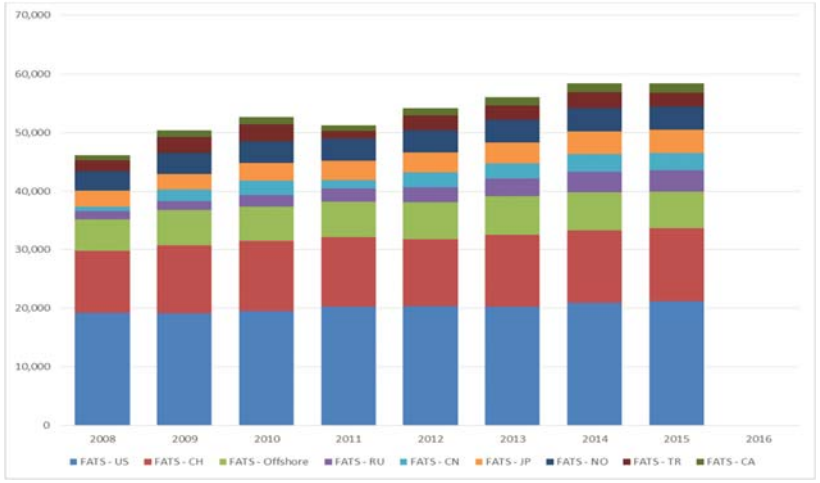
- Orbis allows capturing more foreign affiliates than inward FATS (excess of identification). In 2015, 36,900 extra foreign subsidiaries are identified in Orbis corresponding to 800,000 extra-employees.
- As the aggregated trend at EU level is not available for FATS before 2013, we have considered a sub-sample of foreign affiliates for which the ultimate owner is located in US, Switzerland, offshore countries, Russia, China, Japan, Norway, Turkey and Canada (corresponding to 70% of the foreign affiliates identified in FATS). On this sub-sample, Orbis and inward FATS evolution differs from 9,200 firms and around 10,000 employees between 2009 and 2015.
- In 2015 one third of the excess of foreign subsidiaries in Orbis are (ultimately) owned by owners in offshore countries and another 20% in Russia.

Finally, considering each EU Member States individually, we show that Sweden and Hungary foreign affiliates are less represented in Orbis compared to FATS and that for Poland and Italy, the number of employees are lower on Orbis compare to FATS. For the rest of EU Member States, Orbis is able to identify more foreign subsidiaries than FATS showing a more extensive identification.

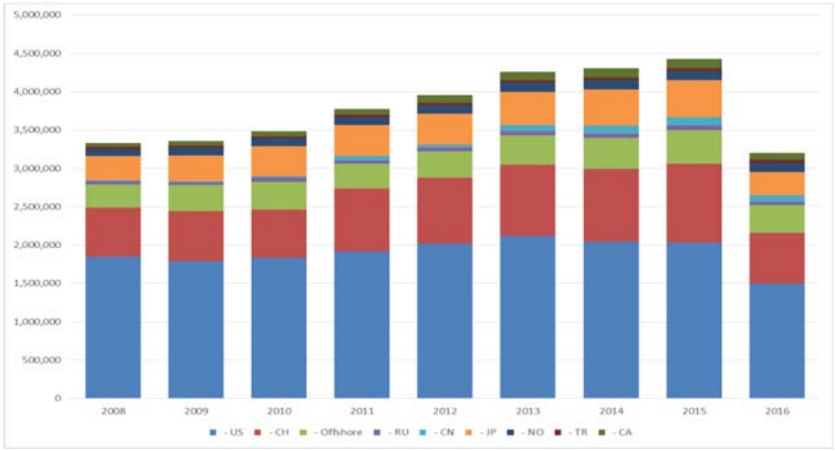
Figure 4 Repartition of EU foreign affiliates for a set of selected countries of foreign owners.

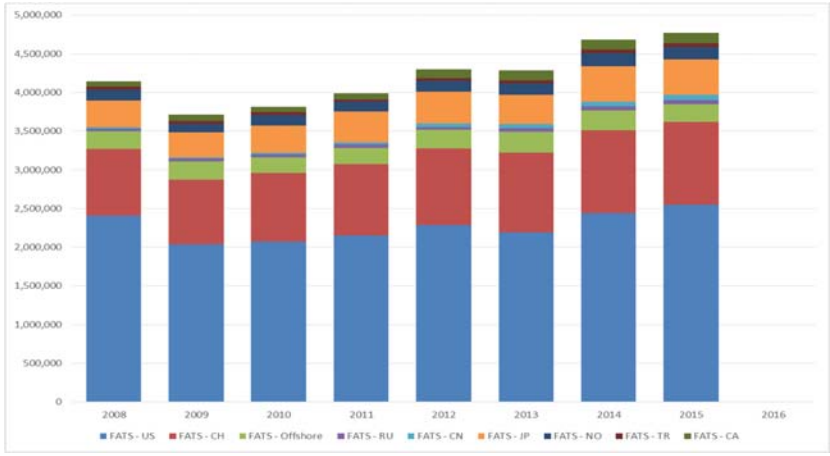
Number of foreign affiliates (ORBIS left panel, FATS right panel)



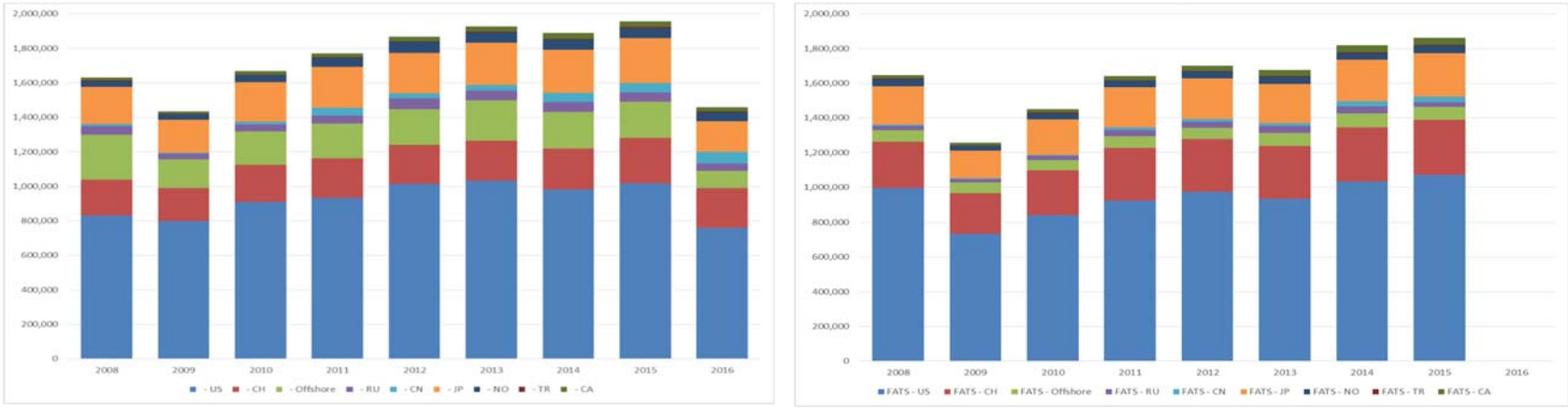


Employment of foreign affiliates





Turnover of foreign affiliates



Source: JRC elaboration, Inward FATS and Orbis. Due to data issue, figures don't consider affiliates resident in UK and IE. Note: we expect to observe a translated graph from the left to the right column showing a similar trend of foreign affiliates in FATS and Orbis. The right column refers to Orbis data, while the left column refers to inward FATS. The height of the bar is defined by the variable number of firms in the top panel, by number of employees in the middle panel and by turnover in the lower panel.

4 Mergers and Acquisitions

This section focuses on mergers and acquisitions (M&A) transactions. The aim is to analyse those deals in EU involving foreign investors. A key step is to identify the ultimate owner of the acquirer/investor to correctly separate deals performed by domestic and by foreign entities. As in the previous sections, we consider an owner to be domestic if it is located in EU, foreign otherwise.

4.1 M&A database

The M&A analysis is based on BvD-Zephyr database, which is a Bureau van Dijk database containing information on completed, announced and rumoured deals related to M&A, initial public offerings[31], private equity and venture capital deals. Zephyr covers deals either greater than 1 million pound (or equivalent) or those involving a stake of at least 2%, while there are not thresholds for development capital deals[32]. The database includes more than 1.6 million deals worldwide, reporting information about both the target company and the acquirer, and it can be considered as a solid source for M&A research (Reiter, 2013). Data coverage starts from 1997 and is constantly updated.

A comparison between Zephyr deals on M&A and national FDI inflows recorded by national statistical offices can hardly be done (see also Copenhagen economics, 2017) for the following reasons:

- Official FDI inflows include not only M&A, but also Greenfield investment not available in Zephyr.
- M&A transactions from Zephyr and official FDI are defined differently: the latter are investments in stakes above 10% of the voting rights, while in Zephyr there is a floor on the amount of the deal included without focusing on the voting rights acquired.
- M&A values may in some cases report the full transaction value and not just the part related to the direct investor (OECD, 2015).
- It could also be the case that the transaction is carried out in more than one year, while the deal value is imputed by Zephyr to a single year in which the deal is completed/announced.

In addition, deal information come from a variety of sources, such as reports, international financial journals, company press releases, and company websites. The reliability of these sources is not reported in Orbis documentation.

Nevertheless, a useful feature of Zephyr is its direct link with Orbis via BvD ID. This peculiarity allows the creation of a detailed dataset, as detailed below.

[31] A deal is classified as an initial public offering when shares in the target company have started trading on a stock exchange for the first time.
[32] They are defined as equity funding for the expansion of an established business.

4.2 Cross border M&A: dataset construction

Our aim is that of constructing the set of mergers and acquisitions undertaken by foreign (extra EU) ultimate owners by merging the information of Zephyr and Orbis (ownership and financial information).

From Zephyr we extract the M&A deals with the following characteristics:

(i) the target company of the deal (the acquired company) is located in EU, as we are interested in investment in the European Union;

(ii) completed deals, excluding announced and rumoured ones so as to avoid including in the dataset uncertain information;

(iii) all deals from 2007 to 2018q1 (first quarter of 2018) [33].

For each deal we download the following information:

(a) the year in which the deal is completed, its value and the acquired stake;
(b) acquirer: identification number (BvD Identification code), country code, listed/unlisted, NACE code[34];
(c) target company: identification number (BvD ID), country code, NACE code.

As in the foreign ownership database, to define whether an acquirer is domestic or foreign, we reconstruct the ultimate owner (the Global Ultimate Owner - GUO). Differently from previous studies (e.g. Clo' et al., 2015, and Copenhagen economics, 2017), we assign the acquirer's ultimate owner taking into account the year of the deal. Zephyr reports information on the ultimate owner of the acquiring firm. This information has a drawback though, as it is the current GUO and not the GUO of the acquirer at the time of the acquisition.

For this reason, we merge our selected sample of M&A deals with the Orbis Ownership dataset, using as guiding variable the year of the deal. The merge allows us to identify the GUO of the acquirer at the time of the deal. This, not only assures a correct attribution of the GUO but also widen the sample, as current GUOs for many firms are not available in Zephyr. We use, coherently with the previous sections, the GUO50 for unlisted firms and the highest shareholder for the listed ones.

Given that Orbis provides information up to 2016, for all the deals after 2016 we have necessarily to rely upon the current GUO provided by Zephyr.

In case of missing GUO, we assign the acquirer's country of origin as follows:

(i) if the acquirer is a listed company, the origin of the deal is assigned to the country of the stakeholder with the higher stake;
(ii) if the acquirer is not listed, the origin country is equal to the country in which the acquirer is located.

[33] Considering that we merge Zephyr with Ownership information which provides data since 2007, our dataset does not include M&A deals until 2006.
[34] In case that the acquirer is not a company, but a family, the NACE code is not available.

To provide an overview of the data, we show the M&A sample for the period 2007-2018q1.

Table *8* Number of deals according by location of the acquirer.

shows the M&A final sample which is composed by 124,319 deals, of which 14,58% are made by acquirers with a foreign GUO. This percentage is stable over the considered time span, with a slight decrease in 2017.

Table 8 Number of deals according by location of the acquirer.

year	N. of deals	Acquirer with domestic GUO		Acquirer with foreign GUO	
2007	9,694	8,259	85.20%	1,435	14.80%
2008	9,523	8,028	84.30%	1,495	15.70%
2009	8,607	7,417	86.17%	1,190	13.83%
2010	9,322	7,880	84.53%	1,442	15.47%
2011	9,952	8,419	84.60%	1,533	15.40%
2012	10,614	9,076	85.51%	1,538	14.49%
2013	13,649	11,752	86.10%	1,897	13.90%
2014	14,019	11,933	85.12%	2,086	14.88%
2015	12,678	10,720	84.56%	1,958	15.44%
2016	11,871	10,039	84.57%	1,832	15.43%
2017	11,622	10,248	88.18%	1,374	11.82%
2018	2,768	2,424	87.57%	344	12.43%
Total	**124,319**	**106,195**	**85.42%**	**18,124**	**14.58%**

Source: Own elaboration on Zephyr BvD. Note: Period 2007-2018q1.

Table 9 Number of deals by location of the acquirer and nationality of the acquirer's ultimate owner (GUO). highlights the differences between using the nationality of the acquirer and the nationality of the acquirer's GUO. When considering acquirers with foreign GUO, we can notice 5,341 cases in which the country of the acquirer is EU but the merger should be considered cross-border as the controlling partner is located outside EU. Official statistics on FDI[35] ignore the location of GUO and classify these cases as domestic, misrepresenting the location from which the M&A decisions are actually taken. In the same vein, there are 467 deals in which the M&A decision is taken by a domestic GUO, even if the acquirer is located outside EU.

In the rest of our analysis, the analysis is based on foreign GUOs, no matter where the acquirer is located. This corresponds to 18,124 deals.

Table 9 Number of deals by location of the acquirer and nationality of the acquirer's ultimate owner (GUO).

	Acquirer with domestic GUO			Acquirer with foreign GUO		
year	Total	Located in EU28	Located outside EU28	Total	Located in EU28	Located outside EU28
2007	8259	8223	36	1435	353	1082
2008	8028	7983	45	1495	401	1094
2009	7417	7394	23	1190	350	840
2010	7880	7851	29	1442	502	940
2011	8419	8381	38	1533	462	1071
2012	9076	9035	41	1538	498	1040
2013	11752	11708	44	1897	667	1230
2014	11933	11870	63	2086	624	1462
2015	10720	10656	64	1958	629	1329
2016	10039	9998	41	1832	612	1220
2017	10248	10214	34	1374	195	1179
2018	2424	2415	9	344	48	296
Total	**106,195**	105,728	467	**18,124**	5,341	12,783

Source: JRC elaboration on Zephyr-Orbis BvD. Note: Period 2007-2018q1. The table refers to the acquirers located either in EU or outside EU and of acquirers' ultimate owner (GUO) located in EU (domestic) or outside (foreign). Example: in 2007, 353 acquirers, in spite of being located in the EU, had an ultimate owner outside Europe; likewise, 36 acquirers, in spite of being located outside Europe, had a controlling company in EU.

[35] In fact, FDI are provided according to the immediate partner country (for further details, see Section 2).

5 Greenfield investments

Greenfield projects/investments have the objective to set-up an installation in a foreign country. In a broader sense, they also relate to the extension of existing sites capacity or the amplification of a physical presence in an overseas market. Using Crossborder Investment, which is a relatively new database at the time of the construction of our dataset, we retrieve foreign EU projects in a coherent format to include them in FOWN. Due to its novelty, no research is currently available using these data.

In this section, we report the construction of the database of greenfield investments done by foreign investors in Europe from 2013 to 2018 (first quarter). In what follows we will consider an owner of the greenfield investment to be domestic if it is located in EU (even if a holding company located outside Europe is used to channel the investment), foreign otherwise.

The objective of the database is to look at the globalisation process through the listing of cross-border projects (greenfield for our purpose)[36]. The advantage of this database is that it is part of BvD suite and provide information on the firms behind these investments. Ultimately, this enables us to analyse the origin of the investor and its sector of activity.

Crossborder Investment includes more than 75,000 greenfield projects without limitations of size for which several characteristics are reported[37]. Data coverage starts in 2013. Several private and public sources such as LexisNexis Moreover Desk, Down Jones Factiva, company websites, newswires, other Bureau Van Dijk's products, Annual account and Government data exchange are used. The database doesn't record all greenfield projects, in particular franchises, concessions and projects with NAICS/NACE codes which do not match a business function[38] are not included in Crossborder Investment. Sectors such as customer contact center, data center, ICT infrastructure, regional Head Quarters, R&D centre, sales office, shared service centre, software development center, technical support, testing support and utilities are not included.

At the moment, the quality of the database is not tested due to its novelty. Even if for each project, there is a general documentation sheet, the reliability or the details of the input sources is not enough reported in Crossborder Investment documentation to allow a comprehensive verification of individual project. Some

[36] https://www.bvdinfo.com/en-gb/our-products/data/specialist/orbis-crossborder-investment

[37] Projects are classified using several attributes. Types: New, expansion, co-location, relocation or Motives: location attractiveness, domestic market potential, real estate availability, ICT infrastructure, Industry Cluster, Transport and utility infrastructure, government support, lower costs, natural resources, supply chain, market access, business environment, skilled force availability, language availability, universities or researchers, technology & innovation, access to finance and taxation.

[38] NAICS stands for *North American Industry Classification System* and NACE for Nomenclature des Activités économiques dans la Communauté Européenne (Statistical classification of economic activities in the European Community). NAICS 2 digits not included in Crossborder Investment concern death care services, religious organization, private household, Public finance activities, justice order and safety activities, administration of HR or environmental, conservation, housing and urban planning, economic programs, etc.

good improvement is however registered from our first use of the database and better is obtained also for past transactions[39].

The main alternative of this database, not used here, is Financial Times-fDi Markets. This FT database includes new realisations and the expansion of existing resident FDI projects from 2003-2016 – providing a longer period than Crossborder Investment. This alternative data provider is used by European Commission services (see Canton, Solera, & al., 2016), UNCTAD, 2013 and by academic authors (e.g. Davies, Desbordes, & Ray, 2015, Falk, 2013 and Copenhagen Economics, 2018).

We considered Crossborder Investment instead of FT- fDi Markets for one main reason as in both datasets investments beyond 2016[40] are reported, allowing us to track latest trends. The format and results of Crossborder Investment are compatible with other BvD products and allow a complete integration with FOWN database. This functionality enables us to complement projects with financial and ownership information from Orbis or M&A data in Zephyr. Another example regards the sectoral details in Crossborder Investment which is based on EU NACE classification instead of US NAICS codes for fDi Markets.

The construction of the database is detailed in the next paragraph.

5.1 Cross border greenfield: dataset construction

Our aim is to collect greenfield projects undertaken by foreign ultimate owners into EU using information Crossborder Investment. We extract the list of projects with the following criteria:

(i) the project destination is located in EU as we are interested in investment in the European Union;

(ii) the project is completed or assumed completed[41]. We exclude projects whose latest status is announced or rumoured to avoid uncertain information in our sample;

(iii) deals from 2013 to 2018q1 (first quarter of 2018)[42].

[39] In August 2018, a set of projects issued from German government allowed to double the number of identified projects from that country for year 2013-2014 in particular.

[40] Most of the greenfield investments, once operational, are actually new firms (or enlargement of old firms). If these firms have the legal obligation to disclose balance sheets they will be captured via ORBIS database. This palliates, at least partially, the absence of large historical observations for the greenfields in CROSSBORDER INVESTMENT.

[41] Projects flagged as *assumed completed* are linked to those *announced*: Bvd manages constantly these projects. If after 18 months from the day of the announcement, no additional information are registered, the status is set to be '*assumed completed*'.

[42] This is the longest available period in Crossborder Investment.

For each project, we download the following details:

(a) Countries of residence (defined by the variable 'source market') and of registration of the ultimate investor as defined by the first 2 digits of the BvD at the time of the project;
(b) Information concerning the destination of the project: into which EU country is the investment and which is the primary industrial sector attached to the investment (using NACE code[43]).
(c) Details on the project: its value in terms of capital expenditure and, when available, its types (setting-up new plants, relocate or expand existing plants), and the timeline of its implementation (several dates are provided: rumour, announcement and completion dates).

We flag the foreign projects using the country of registration of the investor, identified through the GUO50 using the first two digits of its BvD identification number. We exclude from the sample the projects referring to supranational investors (8 in total[44]) and 27 projects that have no completion date available. We also exclude additionally projects for which we found an inconsistency between the location of the GUO and the residency of the final investor. Both locations have to refer to the same country (30 cases). **Table 10** shows some statistics on our dataset which is composed by 20,120 projects into EU, completed or assumed completed, between 2013 and 2018q1, of which 84% are made by enterprises and 1% by individuals. We also have 3,007 projects for which the GUO is missing. Consistently with the treatment done in for the M&As we consider these projects as originated in the country of residence of the investor (this is defined as 'source market' in Crossborder Investment). As regards the location of the investor, overall we have 10,328 projects (51%) where the investor is outside EU and 9,792 projects where the investor is in the EU (**Table 11**).

[43] In case that the acquirer is not a company, but a family, the NACE code is not available.
[44] Six projects are made by European Investment Bank, one by European Bank for Reconstruction and Development and one by a private company (Bvd country=II).

Table 10 Number of projects into EU by type of the ultimate investors.

	number of projects	GUO is an **enterprise**		GUO is an **individual**		GUO is **missing**	
2013	3,557	2,916	82%	25	0.7%	616	17%
2014	3,975	3,226	81%	48	1.2%	701	18%
2015	4,896	4,103	84%	18	0.4%	775	16%
2016	3,303	2,830	86%	94	2.8%	379	11%
2017	3,575	3,105	87%	55	1.5%	415	12%
2018q1	814	686	84%	7	0.9%	121	15%
Grand Total	**20,120**	**16,866**	84%	**247**	1.2%	**3,007**	15%

Source: BvD-Crossborder Investment (extraction from 28/09/2018). JRC calculations. The origin of the investor is using the country in which the ultimate owner (GUO) is registered.

Table 11 Number of projects by origin of the ultimate investors.

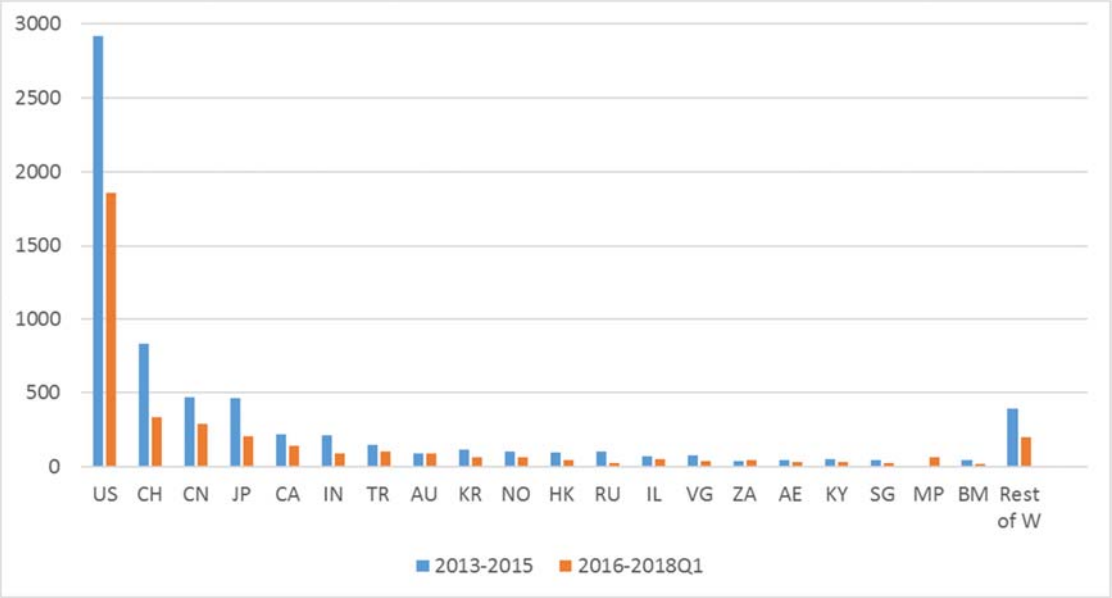
	GUO is an **enterprise**		GUO is an **individual**		GUO **is missing**		Total	
	foreign market	**domestic** market	**foreign** market	**domestic** market	**foreign** market	**domestic** market	**foreign** market	**domestic** market
2013	1,496	1,420	14	11	378	238	1,888	1,669
2014	1,641	1,585	18	30	456	245	2,115	1,860
2015	2,023	2,080	11	7	494	281	2,528	2,368
2016	1,321	1,509	70	24	266	113	1,657	1,646
2017	1,438	1,667	13	42	300	115	1,751	1,824
2018q1	331	355	1	6	57	64	389	425
Grand Total	**8,250**	**8,616**	**127**	**120**	**1,951**	**1,056**	**10,328**	**9,792**

Source: BvD-Crossborder Investment (extraction from 28/09/2018). JRC calculations. The origin of the investor is using both source market and the country in which the ultimate owner (GUO) is registered.

In total 10,328 foreign greenfield projects can be identified in EU Member states from 2013 to 2018q1: almost half of these projects are originated from US, another 10% is issued by Switzerland and 6-7% from China and Japan. Cumulatively these countries bring more than 70% of the greenfield projects to Europe.

Figure 5 shows that the number of projects is decreasing comparing 2013-2015 and 2016-2018q1 for all origin countries. The ranking of the investors remains stable over the periods.

Figure 5 Number of foreign greenfield investments by country of origin of the investing company.



Source: Orbis CI- BvD (extracted on the 28/09/2018), JRC computations. Note: value for 2018 is not complete and only refer to 2018q1. 'Rest of W' is an aggregate of the countries not listed in the graph.

We find this dataset not fully satisfactory, the positive aspects being the direct link with the main ORBIS products via the BvD identifier for firms (hence the access to financial variables for the investing company). The negative aspect is definitely the insufficient coverage of certain countries (France and UK for instance). For the future we will consider complementing Orbis cross-border with fDi Markets, its direct and more established competitor.

6 Conclusions

In this manual we detail all the steps necessary to construct the foreign ownership dataset FOWN. The analysis is based on Bureau van Dijk Orbis, Zephyr databases and Crossborder Investment, which cover respectively firms, M&A transactions and greenfield projects. For each set of data we consider the ultimate owner as the controlling investor. This allows us to identify the entity actually controlling the company, and to distinguish between domestic (EU) and foreign (outside EU) owned firms. The database allows to detail the country and the sector of the controlled company as well as the country of the controlling one. Information on total assets and employment associated to the foreign controlled European firms is also available. The FOWN dataset can be used to perform a wide range of analysis. It was exploited to investigate, among other issues:

- The presence of foreign investors in EU. Overall, in the period 2007-2016, we document a remarkable presence of foreign investors, especially in the last years. Focusing on 2016, even if less than 3% of the EU firms are foreign owned, they represent 33% of the EU market in term of total assets. This highlights that foreign investors are present in the EU economy with quite large firms.

- Which foreign countries have a significant presence in EU. We find that United States is the main investor through our time window, and its presence has increased over time when considering the stocks of investment. There are other countries that recently have increased their presence in Europe, such as China, Switzerland, Norway, Japan and Canada as it can be observed using the latest trend identified through M&As deals or greenfield projects.

Other areas of analysis, and suggestions for future work, could focus on:

- Sectors: a deeper investigation of the NACE classification, specifically in strategic sectors.
- Listed firms: a deeper investigation of their ownership structure.
- Offshores: explore the possibility to improve the identification of ultimate owners for firms located in offshore countries.
- Greenfield projects: a deeper investigation on this type of investment regarding strategic sectors and the origin country of investment like emerging economies.

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Annex

Table 12 Definition of the main variables used in the analysis.

Variable	**Definition**	**Source**
Total assets	(Fixed assets + Current assets)	Orbis
Sales	Net sales	Orbis
Employees	Total number of employees included in the company's payroll	Orbis

Table 13 Number of EU firms by country and year (disregarding the owner).

Country of firm	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AT	87520	95291	98964	104374	112339	116303	121846	134367	138085	96549
BE	55293	58912	61261	63380	66204	71777	76006	78795	86357	96528
BG	37884	32091	38537	42498	104802	108220	226535	271604	284171	285497
CY	242	367	418	312	321	801	1191	1025	632	174
CZ	8340	58778	77487	90594	137060	142211	162141	158476	148957	92251
DE	656360	688184	701183	710097	732563	591822	532867	515914	469333	140219
DK	152665	167741	178561	182891	189812	196302	203629	211922	226748	241653
EE	5887	26889	29128	29069	28711	29478	31519	31378	30745	27657
EL	20910	21061	20450	21272	17114	16059	16351	14347	11487	4566
ES	229195	322052	313262	317843	316186	305731	302860	296053	285727	225105
FI	23052	37437	49466	58942	63031	65384	68160	73389	76846	73386
FR	177355	185013	191853	203398	205374	196908	184837	161864	150351	110293
HR	12658	14236	15985	17386	17866	36530	35812	56052	66058	72070
HU	174781	215181	337262	334464	329579	360168	415799	413607	407325	393995
IE	85383	87103	83412	79896	80144	79747	79859	80435	79356	61176
IT	65830	76226	719125	732097	821341	819135	816411	823035	807582	686136
LT	4478	3832	4075	5338	5462	5268	5604	5849	5079	3197
LU	5326	7502	10540	11611	11740	11380	12213	13911	13728	5698
LV	8791	6333	8944	68145	85794	89289	87162	88920	91247	88356
MT	141	426	586	705	5509	6621	6224	6041	4395	1208
NL	313576	356214	375887	384169	384634	389748	404514	387020	401320	253412
PL	35825	48756	54933	64743	73218	93345	91782	93521	94770	36848
PT	79819	187359	176249	189595	177032	189540	194761	181276	173643	166790
RO	304680	302637	313281	382109	472040	495876	571042	589616	597217	606936
SE	75563	77670	76300	77849	103983	119503	124668	130947	140579	141678
SI	1024	2918	8555	13201	15641	17755	18392	20634	21385	28421
SK	842	1093	15506	16093	16037	15917	104730	118192	115798	112749
UK	919840	947949	949245	962254	978952	1071289	1150112	1254894	1384423	1310566
Total	3543260	4029251	4910455	5164325	5552489	5642107	6047027	6213084	6313344	5277845

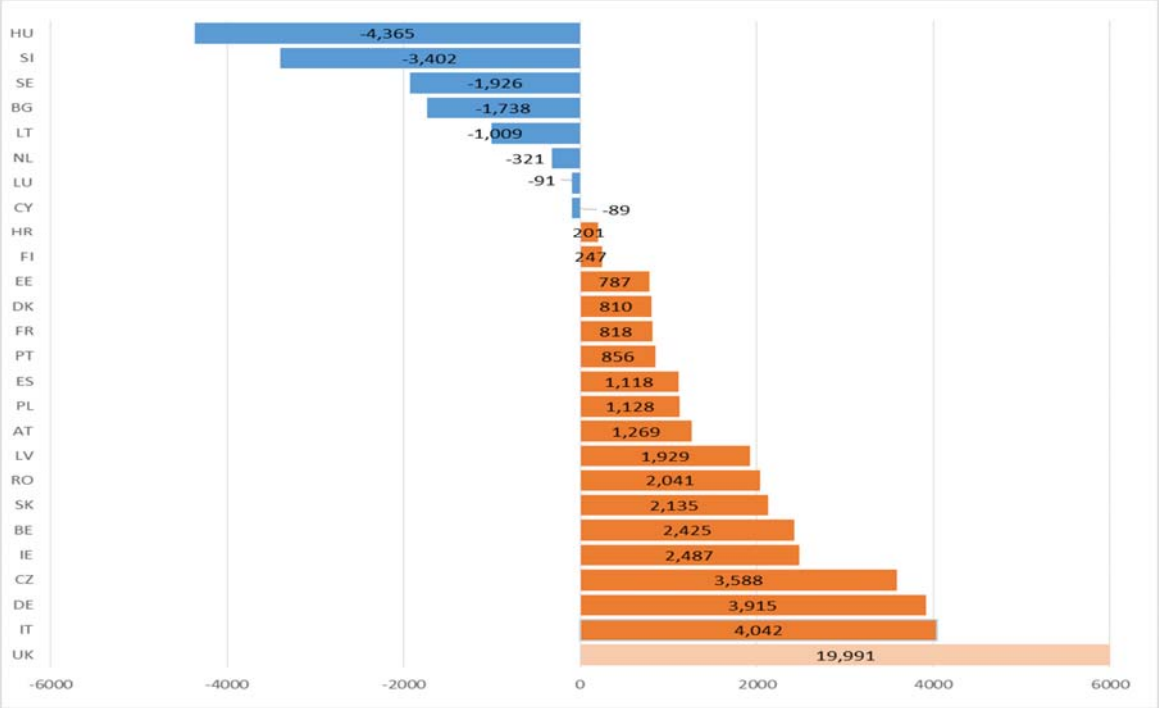
Source: Orbis, BvD.

Table 14 Number of industrial firms registered in EU Member States in official statistics (no matter the owner).

	Inward FATS as constructed in 5.3							Foreign control	Domestic control	Total FATS
	Foreign ownership – selected countries					Extra-EU allocated	Intra-EU			
	US	CH	Offshore	RU	CN					
AT	495	1,148	356	138	40	2,672	7,812	10,484	311,841	322,325
BE	295	50	15	3		499	786	1,314	597,671	598,985
BG	359	282	577	480	74	3,373	8,374	11,747	309,162	320,909
CY	8	6	50	6		132	150	288	34,093	34,381
CZ	916	573	210	119	32	2,755	9,858	12,613	988,435	1,001,048
DE	3,568	3,443	815	150	302	11,096	16,602	27,698	2,380,654	2,408,352
DK	526	136	69	7	12	1,301	2,344	3,645	209,095	212,740
EE	38	21	17	22		163	621	784	2,458	3,242
EL						0		0		
ES	1,375	528	275		17	3,300	9,233	12,608	2,452,932	2,465,540
FI	455	105	42	25	13	940	2,011	2,951	226,252	229,203
FR	2,458	1,578	375	20	57	5,832	16,947	22,779	3,183,031	3,205,810
HR	128	134	106	361	29	1,136	3,549	4,685	141,952	146,637
HU	1,557	904	809	151	252	5,099	12,081	17,180	519,430	536,610
IE	500	63	342			992	1,658	2,746	225,040	227,786
IT	2,131	1,184	340	48	176	5,071	7,765	12,836	3,670,291	3,683,127
LT	172	100	106	196	24	1,210	2,623	3,833	182,635	186,468
LU	102	81	199			2,062	3,850	9,375	22,461	31,836
LV	190	103	249	1,016	21	2,899	4,791	7,690	101,952	109,642
MT	5					18	15	175	20,766	20,941
NL	2,729	441	141	45	406	5,568	6,991	12,558	1,079,685	1,092,243
PL	675	260	77	17	84	1,616	5,493	7,109	65,364	72,473
PT	577	161	226	1	16	1,494	4,437	5,931	801,252	807,183
RO	917	644	617	53	1,206	7,556	19,608	27,164	430,958	458,122
SE	1,262	358	481	9	76	4,717	7,310	12,027	661,191	673,218
SI	155	176	83	806	59	3,855	3,358	7,213	127,514	134,727
SK	88	102	37			443	2,940	3,604	425,920	429,524
UK	5,138	779	3,689	6	79	13,009	9,220	22,229	1,818,304	1,840,533

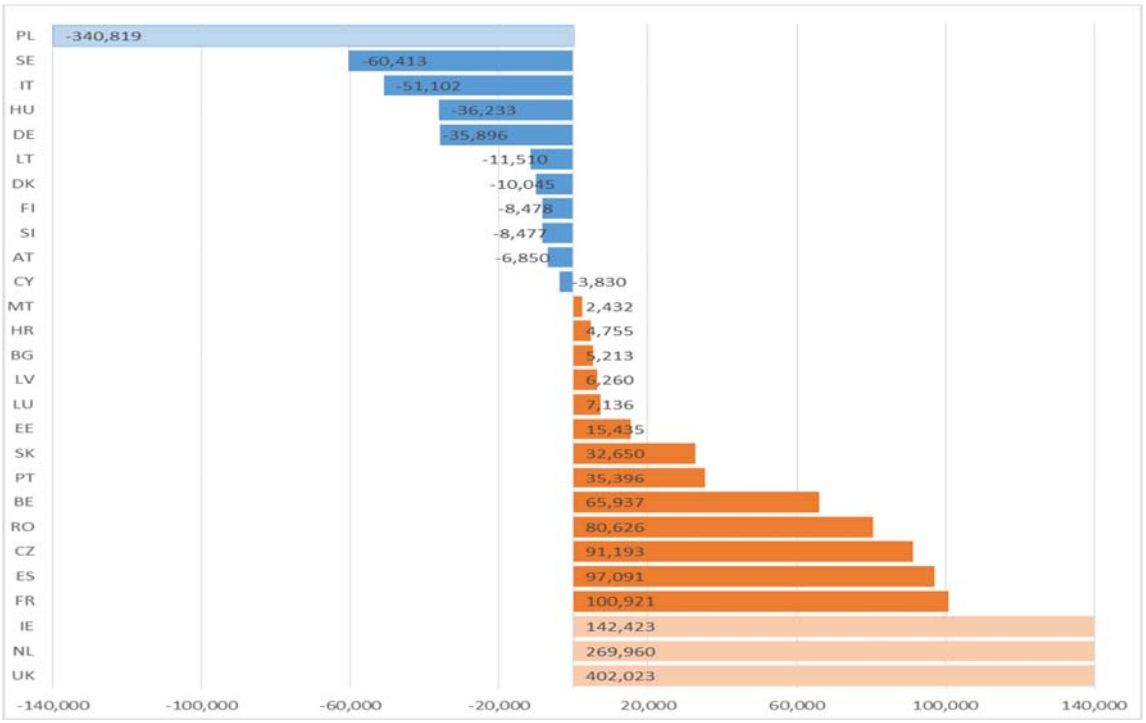
Source: EUROSTAT fats_g1b_08, step for the creation of inward FATS is reported in section 5.3. extra-EU non allocated are not reported but there are included in Foreign control which sum Extra-EU allocated + Extra-EU non allocated + Intra-EU. Data refers to 2015. The location is the owner based in inward FATS is given for a selection of countries (CN, HK, CH, US, offshore and the EU)

Figure 6 Statistics on the deficit of foreign affiliates (blue) or its excess (orange) in Orbis.



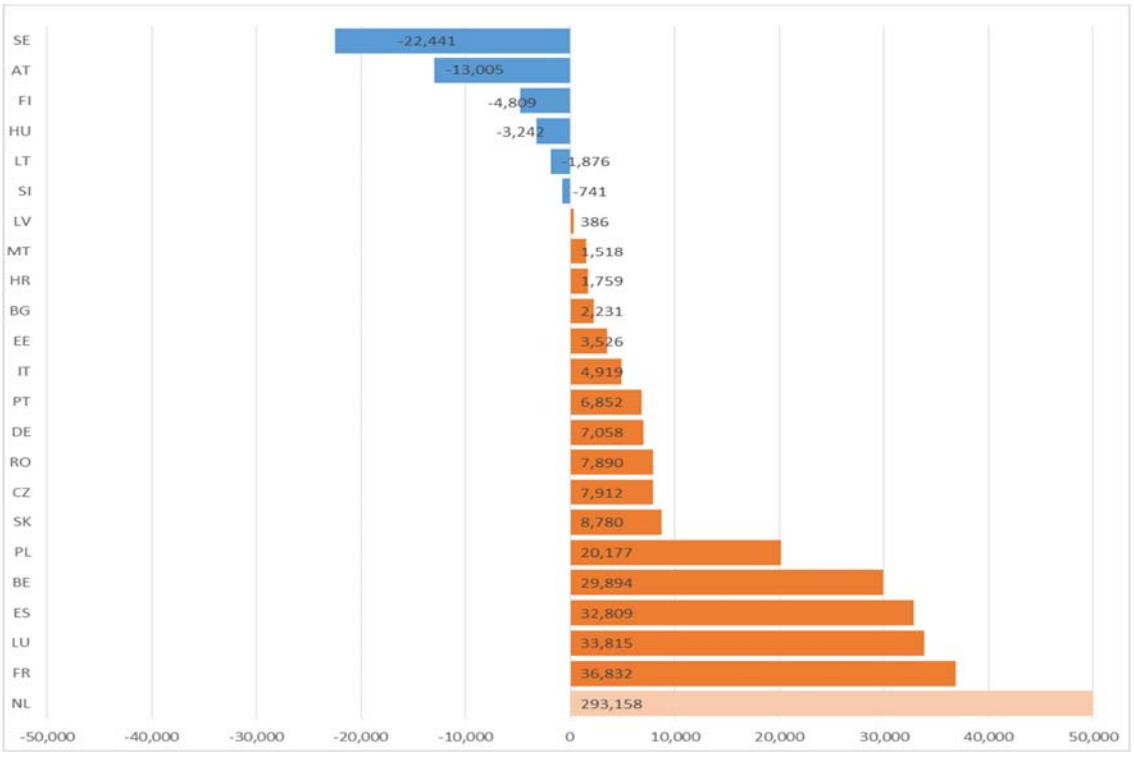
Source: JRC elaboration, Inward FATS and Orbis. Note: Countries are ranked by increasing of excess of foreign affiliates in Orbis. Light colour for UK means its value is rescaled to fit in the graph. Note: in Orbis, UK crown dependencies (Jersey, Isle of Man and Guernsey) are accounting with UK and they are separate entries in FATS. These firms have few employees and turnover.

Figure 7 Statistics on the deficit of employees in foreign affiliates (blue) or its excess (orange) in Orbis.



Source: JRC elaboration, Inward FATS and Orbis. Note: Countries are ranked by increasing of excess of foreign affiliates in Orbis. Light colour for PL, IE, NL and UK means their values are rescaled to fit in the graph.

Figure 8 Statistics on the deficit of turnover in foreign affiliates (blue) or its excess (orange) in Orbis.



Source: JRC elaboration, Inward FATS and Orbis. Note: UK, IE, EL, DK and CY are excluded due to missing values. Countries are ranked by increasing of excess of foreign affiliates in Orbis. Light colour for NL means its value is rescaled to fit in the graph.

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