

Strobel, Thomas; Sauer, Stefan; Wohlrabe, Klaus

Working Paper

The Ifo Investment Database

CESifo Working Paper, No. 4154

Provided in Cooperation with:

Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

Suggested Citation: Strobel, Thomas; Sauer, Stefan; Wohlrabe, Klaus (2013) : The Ifo Investment Database, CESifo Working Paper, No. 4154, Center for Economic Studies and ifo Institute (CESifo), Munich

This Version is available at:

<https://hdl.handle.net/10419/70938>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



Working Papers

www.cesifo.org/wp

The Ifo Investment Database

Thomas Strobel
Stefan Sauer
Klaus Wohlrabe

CESIFO WORKING PAPER NO. 4154
CATEGORY 6: FISCAL POLICY, MACROECONOMICS AND GROWTH
MARCH 2013

An electronic version of the paper may be downloaded

- from the SSRN website: www.SSRN.com
- from the RePEc website: www.RePEc.org
- from the CESifo website: www.CESifo-group.org/wp

The Ifo Investment Database

Abstract

In this paper we present the *Ifo Investment Database*, which provides annual investment data for 12 investment assets in 50 German industries from 1991 onward. The data is consistent with national accounts statistics provided by the German Federal Statistical Office and is based on investments in 88 different sub-assets. This disaggregated level of information allows allocating investments by asset type to each industry, using an investment flow matrix. The database enables researchers to analyze structural investment behavior on the industry level and to identify changes in the importance of investment assets. It additionally collects leasing data from the Ifo Investment Survey Leasing, which enables the conversion of the investment data from the owner to the user concept. This unique feature allows the researcher to examine changes in financing of investments. We describe the structure and methodology of the database and illustrate its variety and strengths by looking at some descriptive examples. Finally, we outline how the data can be accessed.

JEL-Code: E010, E220, C610, L160.

Keywords: investment database, investment matrix, leasing, owner concept, user concept.

Thomas Strobel
Ifo Institute – Leibniz-Institute
for Economic Research
at the University of Munich
Poschingerstraße 5
Germany - 81679 Munich
strobel@ifo.de

Stefan Sauer
Ifo Institute – Leibniz-Institute
for Economic Research
at the University of Munich
Poschingerstraße 5
Germany - 81679 Munich
sauer@ifo.de

Klaus Wohlrabe
Ifo Institute – Leibniz-Institute
for Economic Research
at the University of Munich
Poschingerstraße 5
Germany - 81679 Munich
wohlrabe@ifo.de

We would like to thank Johanna Weigl-Mühlfeld, Sabine Dehof, and Volker Klages for the very constructive collaboration during the implementation of the Ifo Investment Database, as well as Elke Kronjäger and Arno Städtler for valuable comments and suggestions. Further we thank the German Engineering Federation (GEF), the Association of German Electrical and Electronic Manufacturers (AGEEM), the German Association of the Automotive Industry (GAAI), the Federal Motor Transport Authority (FMTA), the Federal Ministry of Transport, Building and Urban Development (FMTBU), and the German Federal Statistical Office (GFSO) for providing the necessary data and the friendly support in technical questions.

1. Introduction

Investments are an important driver of economic growth and productivity. In turn both macroeconomic variables are essential to obtain a sustainable level of prosperity. In Germany, investment patterns have not been constant over time. Rather structural changes in sectoral investment patterns can be noticed in the years since the reunification in 1991. In the course of these changes the importance of some sectors for aggregate output growth has shifted. Thus, for example, there was a shift in the importance of the secondary and tertiary sector, but also of individual sectors within the manufacturing sector (German Federal Statistical Office, 2012). Besides inter-sectoral changes in investment activity, intra-sectoral changes occurred as well. Beginning in the 1970s in the former German Federal Republic, particularly leasing and other types of renting rapidly gained importance in financing of investment equipment (Gerstenberger et al., 1984).

Besides the possibility to delve into inter-sectoral changes in investments, the availability of detailed sectoral investment series by different asset types further allows the construction of aggregate capital stocks particularly accounting for the heterogeneity of assets. Although economic theory is usually based on the notion of a capital stock representing a homogenous asset, in practice a particular asset will always consist of several different sub-assets and so exhibit a certain degree of heterogeneity. Jorgenson (1963) and Jorgenson and Griliches (1967) were the first to develop aggregate capital stock measures that explicitly take into account this asset heterogeneity.

A detailed analysis of sectoral investment growth beyond employing an aggregate series of investments requires detailed investment time series that due to limited data availability are not provided for many sectors. In this paper we present a tool that allows for a temporal structure analysis of investment activity of German industries by assets – the *Ifo Investment Database* (henceforth IIDB). It provides annual investment data for 12 investment assets for 50 industries from 1991 onward that is consistent with the officially published national account statistics provided by the German Federal Statistical Office (GFSO). Thereby the database contains two main features: a) the diversification of aggregate investment series by assets on the sectoral level and b) the provision of the investment data both defined by the owner concept (which is the standard accounting measure) and the user concept. We finally end up with a 12×50 investment linkage matrix separated by year, concept of utilization and current and constant prices.

The 12 investment assets comprise 11 equipment assets (Metal Products; Machinery; Computers and Office Equipment; Electrical Generation and Distribution;

Communication Equipment; Instruments, Optics and Watches; Furniture, Music and Sports Equipment; Other Machines and Equipment; Automobiles; Other Vehicles; Intangible Assets) as well as investments in Buildings and Structures according to the Product Classification 2002 by the GFSO (German Federal Statistical Office, 2002). The 50 industries correspond to the official Classification of Economic Activities 2008 (German Federal Statistical Office, 2008). Since investment matrices are not published at such a disaggregated level by German statistical offices, this gap is filled by the IIDB.

From various sources the database collects data on investments in 88 sub-assets. This detailed level of information allows the most exact allocation of investments by asset type to each industry using an investment flow matrix. This flow matrix contains a pre-determined annually updated user structure, which relates the 88 sub-assets to the 50 industries and therefore determines how much a certain industry uses a particular sub-asset.

In addition to the possibility of conducting a structural analysis of the investment activity by sectors, the disaggregated level of investment series allows to draw conclusions on the capital stock of the German economy. Thereby is especially allows to analyze the capital stock's development beyond the limited breakdown into a few product categories, that is equipment, intangible assets, and buildings. The latter is mostly provided by statistical offices. A more disaggregated view of the capital stock is of particular importance in productivity analysis, as the capital stock of an economy is usually heterogeneous and assets are determined by different capital productivities (Hall and Jorgenson, 1967; Jorgenson et al., 2005).

Furthermore leasing data from the *Ifo Investment Survey Leasing* enables the conversion of investment data by owner concept, which is typically used in national accounts, to the user concept. Thereby the user concept attributes investment assets to the actual user of the assets (and not to its owner) and accommodates the increasing importance of financing, especially by leasing assets. Abstaining from inclusion of rented equipment leads to errors in the measurement of capital employed in industries and important economic indicators such as the capital-output ratio, the capital coefficient, and the return on total investment lose their informative content on the sectoral level (Gerstenberger et al., 1986; Gerstenberger et al., 1989). Thus the distinction of owner and user concept in the IIDB offers a unique feature for investment research as it provides insights into the development of companies' equipment financing. However, due to lack of detailed sectoral leasing information across countries statistical bureaus agreed to only provide figures by owner concept.

The IIDB is updated annually and the results tables are available in English and German language. Current publications and updates can be obtained from the EBDC data center at the Ifo Institute.

The paper is structured as follows: Section 2 details the exact composition of the database, provides information on all sources, and describes the applied methodology to derive investment series by sector and asset. Section 3 focuses on the differences between owner and user concept. Section 4 presents some descriptive results illustrating possible applications of the database. Section 5 provides information on the access to the data, while Section 6 concludes.

2. Structure and Methodology

In investment research it is common sense that the formation of the capital stock usually is a heterogeneous aggregate. This is not provided sufficiently by the limited view on the two aggregated classes of equipment and buildings. By including and analyzing various data sources the IIDB disaggregates the investment of 50 German industries into 12 asset classes for reunified Germany from 1991 onward. These classes cover 11 equipment assets as well as investments in structures and buildings (see Table 1). This is accomplished by calculating investment matrices, whose extensive data inputs are explained in more detail in the following.

In its national accounts the German Federal Statistical Office provides annually updated gross fixed capital formation by asset classes and by industries separately, whereas the latter is divided into the aggregated groups of equipment and other assets as well as the asset group of structures and buildings. An important feature of the IIDB is its consistency with this data from national accounts (sources listed in Table A.2). Because of the disaggregated level used in the IIDB there is, however, a delay of two years in the data. Due to the lack of more updated data, the database currently can only be calculated up to the year $t-2$.

On its most detailed level the IIDB collects data on 88 detailed sub-assets from various sources. Table A.3 lists the sub-assets and their mapping to the 11 asset classes (excluding structures and buildings). Based on the official data of the national accounts, the asset classes are disaggregated into sub-assets to enable a better allocation into specific industries. Asset classes are also sub-divided, whenever there is information about the development of main industries' investments. The latter applies in particular for Automobiles, Other Vehicles, and Communication Equipment. This

avoids that special cases of investments performed by main industries is wrongly transferred to the estimation of product-specific investment of other industries. Hence, the sub-division into sub-assets occurs, on the one hand, by different types of products or by the investing industries, on the other. Furthermore, leasing of investment equipment is specified into separate sub-assets in order to ease the conversion from the owner to the user concept, whenever it is relevant.

The IIDB obtains annual investment data on all sub-assets. Specifically, in case of automobiles the numbers of new car registrations and trailers by groups of users and by car types are collected. In order to obtain the automobile investment by industries, these numbers are weighted with the prices of different car types. Additionally, industry data on production, export, and import is collected, which allows the computation of *domestically available production* by subtracting exports from domestic production while adding imports. In particular, this approach applies to the subsequent asset classes: Machinery; Electrical Generation and Distribution; Communication Equipment; Instruments, Optics and Watches. In case of lacking industry data to calculate domestically available production in sub-assets, gross fixed capital formation provided by the GFSO is used instead. The latter applies to the following assets: Metal Products; Computer and Office Equipment; Furniture, Music and Sports Equipment; Other Machines and Equipment; and Intangible Assets. For Other Vehicles investments by sub-assets are provided by the German Federal Ministry of Transport, Building and Urban Development (FMTBU). Annual leasing data by sub-assets is provided by the *Ifo Investment Survey Leasing* (see included asset *IS Leasing* in Table A.3). All data sources for the calculation of investments by sub-assets are listed in detail in Table A.4.

Table 1: IIDB Classifications in Accordance with National Accounts

Seq. Nr.	Industry	Seq. Nr.	Assets
1	Agriculture, Forestry, Fishing	1	Metal Products
2	Mining and Quarrying	2	Machinery
3	Food and Tobacco	3	Computers and Office Equipment
4	Textiles and Apparel	4	Electrical Generation and Distribution
5	Wood Products	5	Communication Equipment
6	Paper, Pulp	6	Instruments, Optics and Watches
7	Printing	7	Furniture, Music and Sports Equipment
8	Coke, Petroleum	8	Other Machines and Equipment
9	Chemicals	9	Automobiles
10	Pharmaceuticals	10	Other Vehicles
11	Rubber, Plastic	11	Intangible Assets
12	Non-Metallic Mineral Products	12	Structures and Buildings
13	Basic Metals		
14	Fabricated Metal Products		
15	Computers, Electronics, Optics		
16	Electrical Equipment		
17	Machinery		
18	Motor Vehicles		
19	Other Transport Equipment		
20	Furniture and Other Manufacturing		
21	Rep. and Install. of Machinery and Equip.		
22	Electricity, Gas		
23	Water Supply		
24	Sewerage, Waste, Material Recovery		
25	Construction		
26	Sale and Repair of Motor Vehicles		
27	Wholesale Trade		
28	Retail Trade		
29	Land Transport		
30	Water Transport		
31	Air Transport		
32	Warehousing, Support Activities		
33	Postal and Courier Activities		
34	Accommodation and Food Services		
35	Publishing Activities		
36	Communications		
37	Information Services		
38	Financial Services		
39	Insurance		
40	Aux. Financial and Insurance Activities		
41	Real Estate		
42	Professional, Scientific and Technical Act.		
43	Administrative and Support Service		
44	Public Admin., Defense, Social Security		
45	Education		
46	Human Health and Social Work		
47	Arts, Entertainment, Recreation		
48	Membership Organizations		
49	Repair of Computers and Personal Goods		
50	Other Personal Services		

Source: IIDB (2010).

For allocation of the GFSO-adjusted investments by sub-assets to industries, an annually updated investment flow matrix is applied. This flow matrix contains a pre-determined user structure, which relates 88 sub-assets to 50 industries and therefore determines how much a certain industry uses of a particular sub-asset. More precisely, the user structure defines cells with zero percentages, i.e. industries which do not use any of the sub-assets, and those with non-zero percentages. Sources for the determination of the percentages the *Ifo Investment Survey*, implicit industry-specific information on a sub-asset category (e.g. main user of the asset Rubber and Plastic Machines is the Rubber and Plastic Industry), and explicit information of industry-related associations (e.g. the Association of German Electrical and Electronic Manufacturers and the German Engineering Federation). If none of the above sources is available, auxiliary indicators such as the size of an industry are used. This step results in a 50 x 88 investment matrix.

To eventually obtain a sectoral sub-asset-investment matrix that is consistent with the GFSO, total GFSO investments by industries and GFSO aggregate investments by asset type serve as controls in each dimension of the matrix. To assure that column sums and row sums match the GFSO controls, the RAS-procedure is applied (Stone, 1961, Stone et al., 1963; Bacharach, 1970). This procedure is an iterative algorithm, whose goal is to leave the original user structures as unchanged as possible and at the same time to erase any discrepancies to the GFSO controls. Finally, after aggregation across sub-assets and including sectoral investments for the 12th asset structures and buildings (as provided by the GFSO), a 50 x 12 industry-asset investment matrix is obtained. This industry-asset investment matrix is available in current prices and in prices of the year 2000. For the methodology of price adjustment, see Nierhaus (2004) and Strobel et al. (2012).

3. Owner and User Concept

Following the national accounts conventions, investments in new buildings and equipment assets are allocated to the owner of an asset (owner concept). In addition the IIDB also calculates investments by user concept allocating investments in new buildings and equipment assets to the industry that is actually using it. Thus, detailed information from the *Ifo Investment Survey Leasing* about leasing assets and leasing customer sectors is employed. The leasing investment is then added to the self-financed investment. This procedure derives the exact volume of the investment assets actually used in an industry,

which is, for example, very important for studying structural changes in the employment of capital goods.

Since detailed information about leasing investments by users and by assets is not adequately collected by the statistical offices, detailed German investment series for leasing is not officially published. Moreover, there is no reliable source on relationships between leasing assets and the leasing sectors. Using the data from the *Ifo Investment Survey Leasing* the IIDB fills this gap by providing the only available investment data for Germany by user concept.

In the *Ifo Investment Survey Leasing* the Ifo Institute annually surveys – in collaboration with the Federation of German Leasing Companies (FGLC) – all German leasing companies. Since no official data is available helping to make projections, the investment survey is conducted as a full survey. The results of the tests include the total amount of annual leasing investments and their share of the overall investment (leasing rate). In addition, the leasing investments are also evaluated by products and by sectors. Furthermore, the results also provide a) information on the annual number of new contracts, b) the investment plans of the leasing companies for the current year – separately for equipment and real estate – as well as c) information on fixed assets of the leasing sector. Thus, the *Ifo Investment Survey Leasing* provides important insights for investment surveys in other industries and for the IIDB and it represents a valuable analytical tool for one of the major service sectors.¹

Leasing and other forms of capital asset renting proved to be the most important alternative for investment financing of German companies over the last decades. As the assets remain the property of the leasing companies, investment expenditures according to the owner concept diverge from those measured via user concept by sectors, thereby reflecting the varying sectoral importance of leasing. High proportions of leasing are reached, for example, in the trade and the construction sector, while in those sectors that account for the leasing companies (e.g. the aggregate sector of Professional Services) the owner concept overstates actual investments (see Table 2). Thus, a consideration of investments solely by owner concept can lead to severe misinterpretation and estimation error of an industry's actual capital employment.

¹ For an exact documentation of the survey, see Goldrian (2007).

**Table 2: Investments in Equipment and Other Assets
by Owner and User Concept**

Industry	Investments in Equipment and Other Assets 2010 (in nominal prices)		
	Owner Concept (in bill. Euro)	User Concept (in bill. Euro)	Deviation (in %)
Agriculture, Forestry, Fishing	5,81	6,02	3,6
Mining and Quarrying	1,46	1,56	6,8
Manufacturing	49,05	57,16	16,5
Energy, Water, Sewerage, Waste	10,93	11,75	7,5
Construction	4,44	7,21	62,4
Trade	12,07	17,15	42,1
Transportation and Storage	24,85	29,31	17,9
Accommodation and Food Services	1,79	2,36	31,8
Information and Communication	15,77	17,75	12,6
Financial and Insurance Activities	4,92	7,12	44,7
Real Estate	2,72	2,72	0,0
Professional Services, Science	55,91	24,46	-56,3
Public Services, Education, Health	20,56	22,27	8,3
Other Personal Services	5,03	8,47	68,4
Total	215,31	215,31	0,0

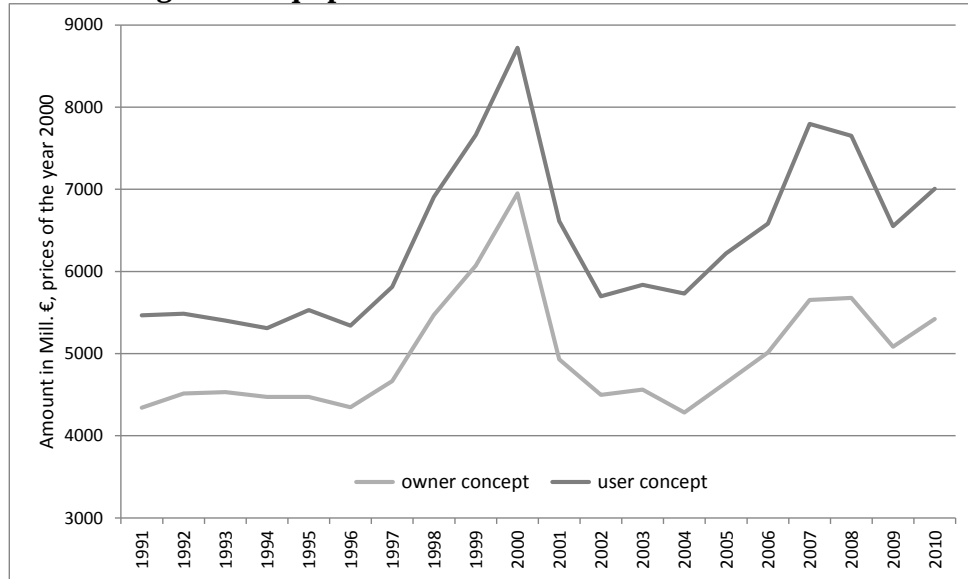
Source: IIDB (2010).

Figure 1 shows the difference of the investment by owner and user concept for the retail sector over time. As leasing is an often used type of financing in this particular sector, the user-concept series is clearly above the one originally measured by owner concept. Indeed, the development of both series seems almost parallel over many years; however, this has not necessarily to be the case as can be seen regarding the substantial divergence in 2007². In the future similar contrasting developments may also be possible. Especially, if in the beginning of a new Kondratieff-cycle, companies will finance expensive technical innovations mainly by more flexible financing tools, like leasing. This will primarily impact small- and medium-sized enterprises (SMEs) since leasing increasingly is those enterprises' most demanded financing tool. According to the Federation of German Leasing Companies, about 85 percent of new leasing agreements each year are signed with SMEs.³

² Moreover, during the period from the late 1970s until the mid-1980s, there was a steady decline in investment expenditure in the retail sector. The low investment rate, on the one hand, was the result of the unfavorable business situation in retail businesses during this period; on the other hand, regarding the results of the *Ifo Investment Survey Leasing*, it also resulted from the rapidly increasing use of leasing and other types of renting assets (Staedtler, 1986). Thus, investment by user concept was significantly increasing in contrast to the owner concept.

³ See online at <http://bdl.leasingverband.de/en/leasing/market-significance> [accessed Feb. 20th, 2013].

Figure 1: Equipment Investments of the Retail Sector



Source: IIDB (2010).

Regarding the previously mentioned importance of leasing, it is not surprising that aggregate investment series measured by owner concept increasingly lose their significance, especially when it comes to questions of capital requirements in various industries and the development of the sectoral production potential. For the analysis of investment behavior and forecasting of sectoral investments employing data by user-concept is also appropriate. For the analysis of capital formation and capital distribution, however, using investment data by owner concept remains indispensable.

4. A Descriptive Look at the Data

For a presentation of the IIDB and its possible applications, this section will provide a descriptive look at the data from different perspectives. As shown in Table 3, the investment data is published in an excel sheet format, which can be transferred to different statistical software packages. As the extract of the 2010 investment matrix for the owner concept in current prices shows, there are two dimensions that link investments by industries and asset groups. For example, in 2010 the Machinery sector, which invested a total amount of around 5600 Million Euros, invested 26 Million Euros in metal products, while 3059 Million Euros were invested in machinery equipment. Other investments in computers and intangible assets account for 137 and 391 Million Euros, respectively. Due to illustration purpose the investment matrix only provides an extract of the entirely available investment data by sectors and asset groups.

Table 3: Extract of an Investment Matrix

Germany - Investments by Owner Concept, nominal prices									
year: 2010									
Amounts in Mill. EUR, creation date: 07.02.2013									
Ifo Investment Database - period: 2010									
		Asset Groups:							
		Metal Products	Machinery	Computers and Office Equipment	...	Intangible Assets	Structures and Buildings	Equipment and Other Assets	Assets
Industries:									
1	Agriculture, Forestry, Fishing	320	4684	58	...	63	1760	5810	7570
02-25	Producing Industries	1274	33744	1357	...	3198	17290	65880	83170
2	Mining and Quarrying	90	715	8	...	15	60	1460	1520
03-21	Manufacturing	737	28272	823	...	1914	4500	49050	53550
3	Food and Tobacco	67	3056	67	...	137	560	4620	5180
4	Textiles and Apparel	2	497	5	...	5	50	570	620
...	...	...	...	...	...	...	...	...	...
17	Machinery	26	3059	137	...	391	630	4930	5560
...	...	...	...	...	...	...	...	...	...
50	Other Private Services	156	235	84	...	80	290	1280	1570
01-50	All Industries	4558	54095	10316	...	27690	236810	215310	452120

Source: IIDB (2010).

Since the IIDB provides a panel structure of investments by industries and sectors over the period from 1991 onward, different data representations of sectoral or asset group statistics are possible. According to Figure 2 investment shares by particular asset groups can be derived for specific sectors of interest. For example, both charts of Figure 2 show the nominal shares of four aggregate assets groups, which are machinery equipment, vehicles, electronic assets, and other assets for different time dates. Therefore the first chart of Figure 2 depicts these four asset groups in case of the Manufacturing sector. As the asset shares indicate, the most important investment asset in the Manufacturing sector is machinery equipment, followed by the electronic assets. However, the data suggests that shares of electronic assets are declining, whereas a shift toward investments in other assets is induced. Similarly as in case of Manufacturing, the second chart of Figure 2 shows investment shares by the four aggregate asset groups for the Trade sector. Although investment in machinery assets plays an important role in this industry, its importance is significantly lower than in Manufacturing. Nevertheless, machinery equipment is increasing in share post 2000. Further, as the data suggests the share of electronic assets is declining since 2000 favoring a shift toward vehicles. The use of such graphical representations allows the researcher to investigate the structural change in sectoral investment activity precisely for specific product groups.

Figure 2: Nominal Shares of Equipment Investments by Sector and Asset

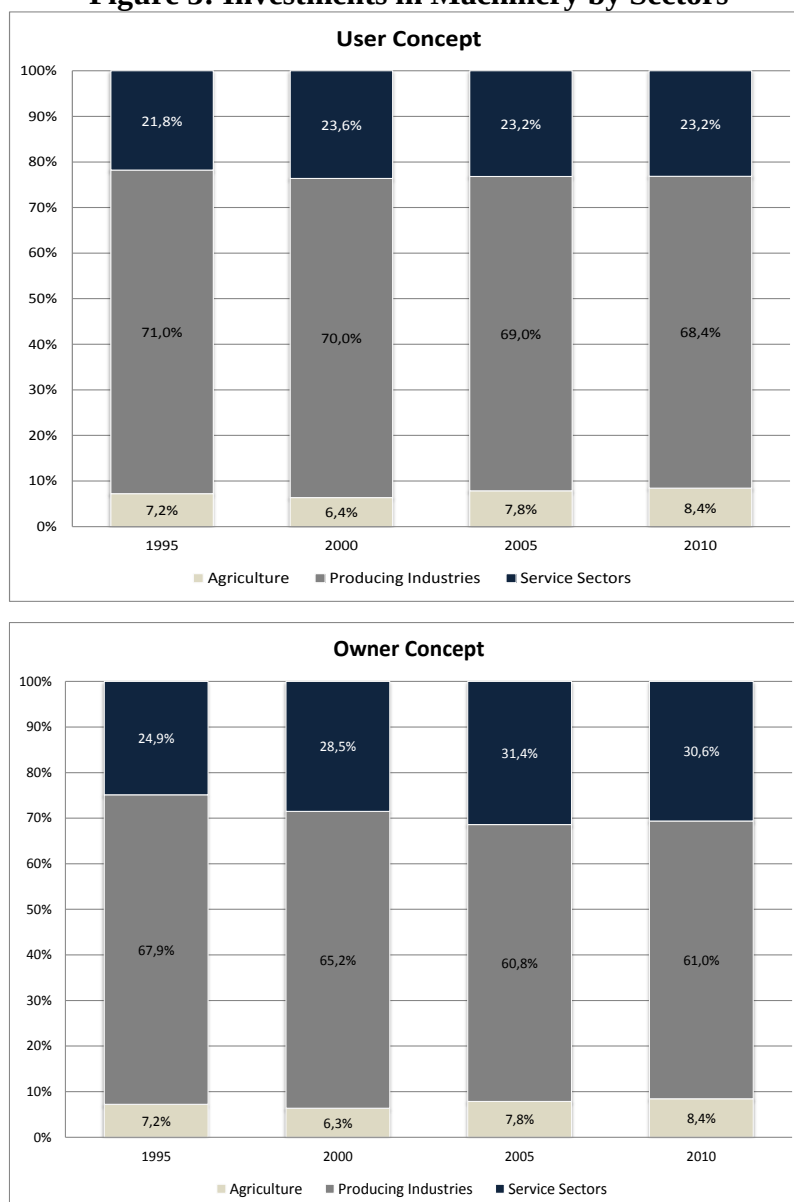


Source: IIDB (2010).

Analogously to the representation of investment shares by sectors and assets, the data can also be employed to focus on the importance of a particular asset throughout the entire economy. Therefore economy-wide asset data for a specific asset separated by different sectoral groups and concepts can be analyzed. The first chart of Figure 3 shows an example of machinery assets by owner concept invested by three broad industry groups: Agriculture, Producing industries, and Services sectors. The data suggests that it is mainly the Producing industries that invest in machinery assets, while Services sectors invest about half the size in this asset compared to Producing industries. However, this picture changes as soon as the user concept is regarded. The second chart of Figure 3 illustrates that when investment data accounted for leased machinery assets is employed, it is also the Producing industries that invest the largest part in machinery assets and that

those sectors' shares significantly increase compared to their investment shares in machinery assets measured by owner concept. On contrary, the investment shares in machinery assets by Services sectors are much less important, when measured by user concept. This effect results from reallocation of leasing investments accounted for by leasing companies (owner concept), which are included in the Services sectors, to other sectors actually using these investments (user concept).

Figure 3: Investments in Machinery by Sectors



Source: IIDB (2010).

5. Access to Data

The IIDB can be accessed only via the LMU-ifo Economics & Business Data Center (EBDC) located at the Ifo Institute in Munich (Germany). Due to data security reasons and the protection of the data providers' confidence in the Ifo Institute, the admission to the IIDB has to comply with high security standards. The guest researchers and the EBDC enter into a contractual agreement that serves the interests of all parties. The EBDC is located in a separate, closed-off area at the Ifo Institute and is subject to strict physical access controls; access for unauthorized parties is prohibited. The data can only be accessed on computers, which have no internet access, printer, or other external storage media and which can only be used in the presence of an EBDC staff member. Individuals can apply for access to EBDC datasets by completing a form at the Ifo website www.ifo.de/ebdc. In addition, a short description of the research project and accompanying information as to scheduling must be submitted to gain permission. The EBDC expressly supports empirical research projects and is thus free-of-charge. See Seiler (2012) for further details on the EBDC. The data will be available in Excel and STATA format. Upon request, extracts of the data of the IIDB can also be obtained at the user's expense.

6. Conclusion

With the calculation of investment by industries and assets the IIDB provides a solid database for the analysis of complex relationships and structural changes in the investment activities of German companies. New technological developments and structural changes in investments, which usually beginning with a higher leasing rate for new introduced products (Staedtler, 1986), can be identified early based on the distinction of investments by owner and user concept.

Basically, however, even with the new release of the IIDB, the efforts to improve the database and the methodology are only brought to a provisional conclusion. Since the data, as many economic data, is not the result of a full coverage survey, but of several individual sources, they offer a variety of approaches to refine and expand the estimated investment series. Thus, data and methods are constantly improved. To meet the quantitative and qualitative progress, complex calculators like the IIDB always represent a permanent scientific process that requires a constant adjustment and development. Based on the initial estimates, the methodology and the database have proven

sufficiently robust to be managed without fundamental revisions. Nevertheless, the structure is sufficiently flexible for modifications and extensions.

Furthermore, the collection of sectoral investment series offers various aspects of applied empirical research on sectoral and aggregate productivity analysis. In addition to parametric estimation approaches usually applied in case of firm-level data, growth accounting is a common method by which sectoral and economy-wide productivity growth can be decomposed into its components of capital, labor, and technological progress.⁴ The data provided by the IIDB plays an essential role in the determination of the influence of the input factor capital, whereas investment series are employed to calculate capital stocks and services (e.g. Eicher and Roehn, 2007; Eicher and Strobel, 2009). Moreover, the disaggregated level of the asset classes allows examination of the importance of information and communication technologies during the emergence of the New Economy in the mid-1990s.

Future research intends to link the IIDB with other data of the Ifo Institute. In particular, with the involvement of the *Ifo Business Survey* and the *Ifo Investment Survey*⁵ the potential of increasing the accuracy of current investment series as well as analyzing future trends shall be examined. Econometric-based projections of investment series by sector and assets beyond the two-year-delay up to the present will be research projects of primary concern.

⁴ For an application of growth accounting exercises including former versions of the *Ifo Investment Database*, see Eicher et al. (2007).

⁵ For documentation of surveys, see Goldrian (2007).

References

- Association of German Electrical and Electronic Manufacturers (2012), *Tatsachen und Zahlen*, VDA-Verlag, Berlin, Germany.
- Bacharach, M. (1970), *Biproportional Matrices and Input-Output Change*, Cambridge University Press.
- Eicher, T., and Roehn, O. (2007), Sources of German Productivity Demise, *German Economic Review*, 8(2), 211-236.
- Eicher, T., Roehn, O., and Strobel, T. (2007), The Ifo Industry Growth Accounting Database, *CESifo Working Paper Nr. 1915*.
- Eicher, T., and Strobel, T. (2009), *Information Technology and Productivity Growth – German Trends and OECD Comparisons*, Edward Elgar, Cheltenham, United Kingdom.
- German Engineering Federation (2012), *Statistisches Handbuch für den Maschinenbau*, VDMA-Verlag, Frankfurt am Main, Germany.
- German Federal Statistical Office (2002), *Güterverzeichnis für Produktionsstatistiken, Ausgabe 2002 (GP 2002)*, Wiesbaden, Germany, online at <https://www.destatis.de/DE/Publikationen/Verzeichnis/VerzeichnisAktuell.html> [access date: November, 30th, 2012].
- German Federal Statistical Office (2008), *Klassifikation der Wirtschaftszweige, Ausgabe 2008 (WZ 2008)*, Wiesbaden, Germany, online at <https://www.destatis.de/DE/Publikationen/Verzeichnis/VerzeichnisAktuell.html> [access date: November, 30th, 2012].
- German Federal Statistical Office (2012), *Calculation of gross domestic product, detailed annual accounts, Journal 18 Series 1.4*, Wiesbaden, Germany.
- Gerstenberger, W., Heinze, J., and Vogler-Ludwig, K. (1984), *ifo Studien zur Strukturforschung 6*, Ifo Institute, Munich, Germany.
- Gerstenberger, W., Heinze, J., Hummel, M., and Vogler-Ludwig, K. (1989), *Ifo Studien zur Strukturforschung 12*, Ifo Institute, Munich, Germany.
- Gerstenberger, W., Jäckel, P., Staedtler, A., and S. Wiczorek (1986), *Verbesserung der statistischen Erfassung neu gemieteter Anlagen nach Sektoren*, Ifo Institute, Munich, Germany.
- Goldrian, G. (2007), *Handbook of Survey-Based Business Cycle Analysis*, Edward Elgar, Cheltenham, United Kingdom.
- Hall, R., and Jorgenson, D. (1967), Tax Policy and Investment Behaviour, *American Economic Review*, 57(3), 391–414.
- IIDB (2010): IIDB, LMU-ifo Economics & Business Data Center, Munich, doi: 10.7805/ebdc-iidb-2010.
- Jorgenson, D. (1963), Capital Theory and Investment Behaviour, *American Economic Review*, 53, 247–259.
- Jorgenson, D. and Griliches, Z. (1967), The Explanation of Productivity Change, *Review of Economic Studies*, 34(99), 249–280.
- Jorgenson, D., Ho, M., and Stiroh, K. (2005), *Productivity – Information Technology and the American Growth Resurgence*, Volume 3, MIT Press, Cambridge, Massachusetts, United States.

- Nierhaus, W. (2004), Wirtschaftswachstum in den VGR: Zur Einführung der Vorjahrespreisbasis in der deutschen Statistik, *ifo Schnelldienst*, 57(5), 28-34.
- Seiler, C. (2012), The data sets of the LMU-ifo Economics & Business Data Center – A guide for researchers", *Journal of Applied Social Science Studies*, Forthcoming.
- Strobel, T., Sauer, S., and Wohlrabe, K. (2012), *ifo Investorenrechnung – Dokumentation von Quellen, Verarbeitung und Methodik*, ifo Studien zur Wirtschaftsforschung 42, Ifo Institute, Munich, Germany.
- Staedtler, A. (1986), Die Entwicklung des ifo-Investitionstests als Spiegelbild des Strukturwandels in der Wirtschaft, in *ifo Studien: Tendenzbefragungen, Indikatoren, Prognosen - Konjunktur- und Strukturanalysen in nationaler und internationaler Sicht*, 109-118.
- Stone, R. (1961), *Input-Output and National Accounts*, OECD, Paris, France.
- Stone, R., Bates, H. and Bacharach, M. (1963), Input-Output-Relationships 1954-1966, in: *A Program for Growth No. 3*, Cambridge University Press, 27-36.

Appendix

Table A1: Abbreviations

AGEEM	:	Association of German Electrical and Electronic Manufacturers (Zentralverband Elektrotechnik- und Elektronikindustrie, ZVEI)
EBDC		LMU-ifo Economics & Business Data Center
FGLC	:	Federation of German Leasing Companies (Bundesverband Deutscher Leasing-Unternehmen, BDL)
FMTBU	:	Federal Ministry of Transport, Building and Urban Development (Bundesministerium für Verkehr, Bau und Stadtentwicklung, BMVBS)
FMTA	:	Federal Motor Transport Authority (Kraftfahrtbundesamt, KBA)
GAAI	:	German Association of the Automotive Industry (Verband der Automobilindustrie, VDA)
GEF	:	German Engineering Federation (Verband Deutscher Maschinen- und Anlagenbau, VDMA)
GFSO	:	German Federal Statistical Office (Deutsches Statistisches Bundesamt, Destatis)
IIBD		Ifo Investment Database (ifo Investorenrechnung)
<i>IS Leasing</i>	:	<i>Ifo Investment Survey Leasing</i> (ifo Investitionstest Leasing)
NA	:	National Accounts provided by GFSO (Volkswirtschaftliche Gesamtrechnung (VGR) des Deutschen Statistischen Bundesamtes)

Table A.2: Investment Data Sources by Assets and Industries

Seq. Nr.	Asset Categories	Sources
1	Metal Products	National Accounts (NA), GFSO: Calculation of gross domestic product, detailed annual accounts, Journal 18, Series 1.4, 3.3.7 Gross fixed investments by assets
2	Machinery	
3	Computers and Office Equipment	
4	Electrical Generation and Distribution	
5	Communication Equipment	
6	Instruments, Optics and Watches	
7	Furniture, Music and Sports Equipment	
8	Other Machines and Equipment	
9	Automobiles	
10	Other Vehicles	
11	Intangible Assets	
12	Structures and Buildings	
Industries		
1–50	All industries.	National Accounts (NA), GFSO: Calculation of gross domestic product, detailed annual accounts, Journal 18, Series 1.4, Gross fixed investments by industries, 3.2.8.1/ 3.2.9.1 New Assets 3.2.8.2/ 3.2.9.2 New Equipment and Other Assets 3.2.8.3/ 3.2.9.3 New Structures and Buildings

Table A.3: IIDB Asset and Sub-asset Categories

Seq. Nr.	Asset Categories	Subdivision of Assets into Sub-assets	Seq. Nr.	Asset Categories	Subdivision of Assets into Sub-assets
Metal Products			Furniture, Music and Sport Equipment		
1		Metal Products	46		Furniture, Music and Sports Equipment
Machinery			Other Machines and Equipment		
2		Agricultural Machinery, Agricultural Tractors	47		Other Machines and Equipment
3		Mining Machinery, Apparatus Engineering, Smelting, Roller Mill and Foundry Machinery, Industrial Furnace (incl. Electrical), Wood Working Machinery	48		<i>IS Leasing</i> Other Machines and Equipment
4		Rubber and Plastic Machines	Automobiles		
5		Machine Tools	49		Agriculture, Forestry, Fishing
6		Precision Tool	50		Mining and Quarrying
7		Testing Machines	51		Food and Tobacco
8		Welding Equipment (without Electrical)	52		Coke, Petroleum
9		Printing and Paper Machines	53		Chemicals
10		Machinery for Footwear and Leather	54		Motor Vehicles and Other Transportation
11		Textile Machines	55		Metals and Machinery
12		Apparel Machines	56		Other Manufacturing Industries
13		Food and Packaging Machines	57		Electricity, Gas
14		Construction, Construction Material Machines	58		Water Supply
15		Conveyor Technique	59		Construction
16		Compressed-Air and Vacuum Engineering	60		Sale and Repair of Motor Vehicles
17		Weighing Machines	61		Wholesale and Retail Trade
18		Commodities and Services Machines	62		Land Transport
19		Laundry and Dry-Cleaning Machines	63		Water and Air Transport, Harbors, Airports
20		Robotics and Automation	64		Auxiliaries Transport Activities
21		Electrical Tools	65		Postal and Courier Services
22		Electrical Welding Equipment	66		Hotels and Restaurants
23		Electrical Heating Generators	67		Communication Services
24		Other Machinery Manufactures	68		Financial Intermediation and Insurance
25		<i>IS Leasing</i> Machinery	69		Real Estate
Computers and Office Equipment			70		Economical Services
26		Computers and Office Equipment	71		Rental Services
27		<i>IS Leasing</i> Computers and Office Equipment	72		(Short-Term Renting Motor Vehicles)
Electrical Generation and Distribution			73		<i>IS Leasing</i> Automobiles
28		Electrical Generation	74		Public Administration, Defense, Social Security
29		Electrical Distribution	75		Education
30		Plating	76		Health and Social Work
31		Signal and Security Installations	77		Recreational, Cultural, Sports Activities
32		Lamps			Other Services
33		<i>IS Leasing</i> Electrical Generation and Distribution	Other Vehicles		
Communication Equipment			78		Railed Vehicles Land Transport (Industry 29)
34		Communication Equipment for Communications (Industry 36)	79		Water Vehicles Water Transport (Industry 30)
35		Communication Equipment Other Industries	80		Air Vehicles Air Transport (Industry 31)
36		<i>IS Leasing</i> Communication Equipment	81		Railed Vehicles Railroad Stations
Instruments, Optics and Watches			82		Water Vehicles Harbors
37		Watches	83		Railed Vehicles remaining Industries
38		Electronic Measurement and Testing Technology	84		Water Vehicles remaining Industries
39		Kilowatt-Hour Meter	85		Air Vehicles remaining Industries
40		Material Testing and Measurement Devices, X-Ray Equipment (Non-Instruments)	86		<i>IS Leasing</i> Other Vehicles
41		Control Units	Intangible Assets		
42		Electronic Instruments	87		Intangible Assets
43		Laser	88		<i>IS Leasing</i> Intangible Assets
44		Planning and Installation of Process Control Units			
45		<i>IS Leasing</i> Instruments, Optics and Watches			

Note: Leasing data by sub-assets is provided by the *Ifo Investment Survey Leasing (IS Leasing)*. Source: IIDB (2010).

Table A.4: IIDB Investment Data Sources by (Sub-)Assets

Seq. Nr.	Asset Categories	Sources
1	Metal Products (1)	National Accounts (NA), GFSO: Calculation of gross domestic product, detailed annual accounts, Journal 18, Series 1.4, 3.3.7 Gross fixed investments by assets
2	Machinery (2–24)	German Engineering Federation (GEF): Production, export and import figures of machinery products according to GEF categories, Yearbooks
3	Computers and Office Equipment (26)	National Accounts (NA), GFSO: Calculation of gross domestic product, detailed annual accounts, Journal 18, Series 1.4, 3.3.7 Gross fixed investments by assets
4	Electrical Generation and Distribution (28–32)	Association of German Electrical and Electronic Manufacturers (AGEEM): Production, export and import figures of electrical investment products, Annual Reports
5	Communication Equipment (34–35)	Association of German Electrical and Electronic Manufacturers (AGEEM): Production, export and import figures of electrical investment products, Annual Reports
6	Instruments, Optics and Watches (37–44)	Association of German Electrical and Electronic Manufacturers (AGEEM): Production, export and import figures of electrical investment products, Annual Reports
7	Furniture, Music and Sports Equipment (46)	National Accounts (NA), GFSO: Calculation of gross domestic product, detailed annual accounts, Journal 18, Series 1.4, 3.3.7 Gross fixed investments by assets
8	Other Machines and Equipment (47)	National Accounts (NA), GFSO: Calculation of gross domestic product, detailed annual accounts, Journal 18, Series 1.4, 3.3.7 Gross fixed investments by assets
9	Automobiles (49-77, excl. 72)	Federal Motor Transport Authority (FMTA): Numbers of new registrations of cars and trailers by groups of users and by car types, FMTA-file by detailed groups of users German Association of the Automotive Industry (GAAI): Production figures of the German automobile industry, import and export figures of automobiles by foreign trade product numbers, official foreign trade statistics (specialized trade), prices indices, Annual Reports
10	Other Vehicles (78–85)	Federal Ministry of Transport, Building and Urban Development (FMTBU): Gross fixed investments in railed vehicles, watercraft and aircraft, FMTBU-file
11	Intangible Assets (87)	National Accounts (NA), GFSO: Calculation of gross domestic product, detailed annual accounts, Journal 18, Series 1.4, 3.3.7 Gross fixed investments by assets

Note: Leasing data by sub-assets is provided by the *Ifo Investment Survey Leasing (IS Leasing)*.