

# The Karlsruher Kapitalmarktdatenbank (KKMDB): The IBIS Data

TORSTEN LÜDECKE

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Address of the author:

Torsten Lüdecke  
Institut für Entscheidungstheorie und Unternehmensforschung  
Universität Karlsruhe (TH)  
D-76128 Karlsruhe  
GERMANY  
Phone: +49 (721) 608-3429  
Fax: +49 (721) 359200  
E-mail: [torsten.luedecke@wiwi.uni-karlsruhe.de](mailto:torsten.luedecke@wiwi.uni-karlsruhe.de)

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## **Abstract**

The Karlsruhe capital market database contains transaction data from different trading systems in Germany. This paper describes the format of transaction data as reported by the electronic screen trading system IBIS (Integrated Stock Exchange Trading and Information System) which is part of the Frankfurt Stock Exchange. The IBIS database contains tick-by-tick data (price and volume) for all stocks, bonds, and warrants traded during the period July 1st through December 31, 1996. Hence, a complete history of data is available. In addition, several stock-indices are included. The data are organized in ASCII-type files by year and type of security and may be distributed via tape, CD or electronic file transfer. All data are distributed for purposes of academic research.



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# 1 Introduction

This paper specifies the format of the IBIS files created at the University of Karlsruhe (TH). The IBIS files are part of the *Karlsruher Kapitalmarktdatenbank (KKMDB)*.<sup>1</sup> All data for the German capital market were provided by the *Deutsche Wertpapier-Datenzentrale (DWZ)* which is the computing center of the German exchanges and a daughter company of the *Deutsche Börse AG*, Frankfurt. Institutional details as given in this paper are valid as of year-end 1996. Changes in the trading environment which are relevant for empirical research are summarized in Appendix A.

## 2 The IBIS and IBIS-R System

The Integrated Stock Exchange Trading and Information System (IBIS, Integriertes Börsenhandels- und Informations-System) is an integral part of the Frankfurt Stock Exchange (FSE) and was introduced on April 5, 1991.<sup>2</sup> Trading takes place from 8:30 a.m. until 5 p.m. There is an orientation phase 15 minutes before and 30 minutes after the trading period. The usual settlement procedure applies for trades done before 4 p.m.<sup>3</sup> The settlement of trades accomplished after 3:59 p.m. will be started on the next trading day.

IBIS is an order-driven system and is pro-active in that trading takes place under the control of the trader. Thus, IBIS is a hit-and-take system without an automatic matching of orders. There are no designated market makers on IBIS. However, quotes are binding once they are put into the system and shown on the trading screen. Banks and institutional investors are the main providers of liquidity by submitting limit orders to the market. In addition Kurs- and Freimaklers are allowed to trade on IBIS. Hence, IBIS has the features of a continuous double auction.

IBIS-R was introduced on December 5, 1995 to replace bond trading on IBIS. The system has additional features to accomodate the special needs of bond traders and issuers. IBIS-R offers primary and secondary market functions for bonds issued by public and private

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<sup>1</sup>The KKMDB overlaps to some extent with the *Deutsche Finanzdatenbank (DFDB)*. However the DFDB contains no intradaily data. See Bühler et al. [1]. See also Göppl et al. [8] or <http://www-etu.wiwi.uni-karlsruhe.de/kapital/projekte/kkmdb.html>.

<sup>2</sup>The first version of IBIS was introduced on December 1, 1989 with 14 stocks admitted for trading. Since May 1990, the complete set of 30 DAX stocks could be traded on IBIS. The trading of bonds started on September 3, 1990. See DWZ [7]. However, data for the period before April 5, 1991 were not made available by the DWZ.

<sup>3</sup>Before June 14, 1994 the settlement period started at 3:30 p.m.

entities. Hence, the large segments of German government bonds (*Bund, Bahn, Post, Treuhand, etc.*) and mortgage bonds (*Pfandbriefe*) could be traded electronically.

### 3 IBIS data

The IBIS data comprises time-stamped prices and volume for all trades done on the IBIS system since July 1, 1991.<sup>4</sup> The time-stamp is accurate to the 100th second.<sup>5</sup> Quotes as disseminated via the IBIS trading screens are not made available by the Deutsche Börse AG. The same is true for IBIS-R data which are available since the introduction of the system in December 1995.

Transaction data are available for different types of securities as illustrated in Figure 1. A complete history of data can be offered for all securities. As noted before bond trading switched from IBIS to IBIS-R.

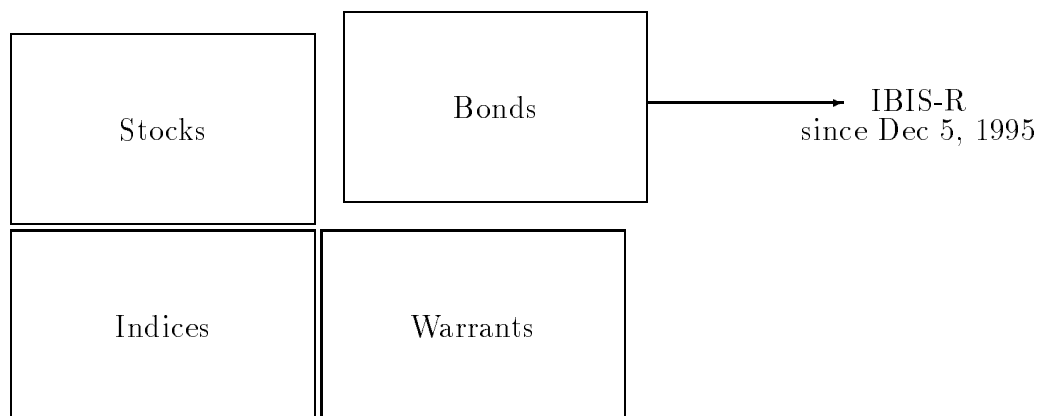


Figure 1: Types of Securities traded on IBIS

#### 3.1 Securities

In 1996 155 securities were admitted for trading on IBIS: 27 bonds, 16 warrants and 112 stocks, including the DAX 100 stocks.<sup>6</sup> The component stocks of the DAX 100 index are

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<sup>4</sup>Time-stamped data from the floor on the FSE are distributed via the KISS-Tape. See Lüdecke [12]. However, volume data on a trade-by-trade basis are not available before year-end 1996.

<sup>5</sup>However, the system technology is such that trading screens are updated every 4 seconds.

<sup>6</sup>DAX is a trademark of *Deutsche Börse AG*, Frankfurt. Aggregated volume data are tabulated in Deutsche Börse AG [6].



the most liquid stocks which vary across time. Other stocks were formerly on the list of a particular index from the DAX family.

On IBIS-R 1366 government and mortgage bonds were traded in 1996.

Security specific data could be obtained from the KKMDB.<sup>7</sup>

### 3.2 Indices

The IBIS system calculates several performance indices with the DAX 30 as the most prominent. The underlying concept is the same for all indices.<sup>8</sup> Index codes and data availability are given in Appendix B. The DAX family is shown in Figure 2.

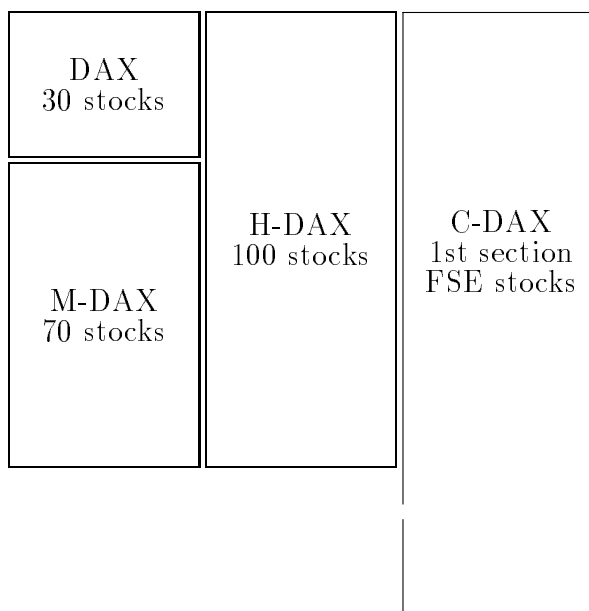


Figure 2: The DAX Family

The stocks listed on the Frankfurt Stock Exchange (FSE) are ranked by liquidity and firm size to be included in the DAX 30 and DAX 100 index.<sup>9</sup> The composition of the DAX (H-DAX) is checked once (twice) a year.<sup>10</sup> The DAX was the first index available on IBIS

<sup>7</sup>See Göppl/Lüdecke/Sauer [9].

<sup>8</sup>For a description of the index formula see Deutsche Börse AG [2].

<sup>9</sup>See Göppl et al. [11] for some stylized facts on liquidity of the German stock market.

<sup>10</sup>The component stocks of the DAX 30 are listed in Appendix C. Changes in the DAX 30 list can be found in Appendix D.

and is calculated on a minute-by-minute basis since December 16, 1993.<sup>11</sup> The intraday availability of the index is as follows:

- December 15, 1993 – June 14, 1995: 8:30 a.m. – 10:30 a.m. and  
1:45 p.m. – 5:00 p.m.
- June 15, 1995 – today: 8:30 a.m. – 5:00 p.m.

The three hours and fifteen minutes of missing DAX data in the first period are covered by the intraday DAX based on the official prices from FSE floor.<sup>12</sup> Hence, since June 15, 1995, both the floor DAX and the IBIS DAX are available during the FSE official trading hours.<sup>13</sup>

## 4 Data File Structure

The IBIS and IBIS-R data are stored in ASCII files with one transaction per line. All records are of fixed length. The fields of each record are separated by a single blank. Hence, a data file looks like a simple spread sheet.

The data were separated by type of security and year. The corresponding files contain all transaction data for the securities of the particular type in a given year.<sup>14</sup> The names of the ASCII files will be:

Ystocks.yy.DAT	Ybonds.yy.DAT
Ywar.yy.DAT	Yindex.yy.DAT

where

yy: year number 9192, 93 – 96.

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<sup>11</sup>The IBIS DAX was first displayed on the IBIS trading screen on January 27, 1994.

<sup>12</sup>The intraday DAX from the floor is available on the KISS-Tape. See Lüdecke [12].

<sup>13</sup>Though one would expect 510 index prices during the day, the actual number of observations is less than 510, because the calculation of the IBIS DAX does not start at 8:30 a.m. sharp. To calculate the IBIS opening DAX the opening prices of at least 15 component stocks must be available and these stocks must represent 70% of the total market capitalization of DAX stocks. Normally the first IBIS DAX is available between 8:45 a.m. and 9:00 a.m. On average we have 488 (299) index observations per day in the second (first) period.

<sup>14</sup>Note that the number of FSE trading days differ compared to the number of IBIS trading days in a given year due to regional holidays.

IBIS-R data are stored in separate files named

Rbonds.yy.DAT

where

yy: year number 95 – 96.

All files are of the same structure which is shown in table 1. Of course, files with data for indices do not contain variable VOL and MOB.

Table 1:  
IBIS file structure

Column	Variable name	Description	Format
1	WPNR	Security Code	Numeric 6.0
2	DATUM	Date	YYMMDD
3	ZEIT	Time	HH:MM:SS.XX
4	KURS	Transaction price	Numeric 11.4
5	VOL	Transaction volume	Numeric 9.0
6	MOB	Transaction flag	Character 1

The meaning of these fields is given below:

**WPNR:** The official 6-digit security code assigned to every security by *Wertpapier-Mitteilungen (WM)*, Frankfurt.

**DATUM:** Date of transaction, where

YY Year,

MM Month,

DD Day.

**ZEIT:** Time of transaction, where

HH Hour,

MM Minute,

SS Second,

XX Hundredth of second.

**KURS:** Transaction price in DM. Due to the trading mechanism of IBIS, a transaction in principle occurs at the best bid or best ask.<sup>15</sup> In case of a stock going ex dividend or ex right issue, the stock trades ex after 4pm.<sup>16</sup>

**VOL:** Transaction volume. In case of bonds VOL contains the par value traded. In case of stocks or warrants VOL indicates the number of issues traded.

The lot size of stocks depends on firm size and is 100 and 500, respectively.<sup>17</sup> Bonds trade at a minimum par value of DM 1 million.

**MOB:** This flag indicates if a transaction was initiated by a **Makler** or **bank**, where

blank IBIS member bank,

A official Makler (*Amtlicher Kursmakler*),

F free Makler (*Freimakler*).

In case of a Makler initiated transaction the Makler charges a transaction fee called *Courtage*.<sup>18</sup> For DAX stocks the courtage is currently 0.04 percent, for non-DAX stocks and warrants 0.08 percent of market value.<sup>19</sup> With the introduction of the *2nd Finanzmarktförderungsgesetz* in August 1994 the variable MOB has become meaningless because the former distinction between official and non-official prices no longer exists (amtlicher Kurs vs. Preis). With the new law the term *exchange price* (Börsenpreis) was introduced.

### Data example:

Below an extract of the 1994 IBIS stocks file is shown. The rows contain the transaction prices and volume of the *Daimler Benz AG* (security code 550000) on the 1st of July, 1994. The flag A in the right most column of row five and six indicates a Kursmakler initiated transaction.

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<sup>15</sup>For exceptions see Deutsche Börse AG [3].

<sup>16</sup>After 3:30 p.m. before June 14, 1994. See Göppl/Lüdecke/Sauer [10] for a description of the data on dividends and right issues.

<sup>17</sup>There were different lot sizes in effect since the introduction of IBIS.

<sup>18</sup>See Deutsche Börse AG [4].

<sup>19</sup>The reduced courtage for stocks is in effect since July 1, 1994. For bonds, a different courtage schedule is valid. See Deutsche Börse AG [5].

550000	940701	11:42:20.15	000723.500	1000
550000	940701	11:42:45.80	000723.500	2000
550000	940701	11:45:30.80	000723.100	1000
550000	940701	11:45:34.94	000723.500	1000 A
550000	940701	11:45:36.54	000723.500	2000 A
550000	940701	11:45:39.50	000723.000	2000
550000	940701	11:46:15.08	000723.000	1000

## 4.1 Distribution of data

The IBIS data are distributed in a packed version of the ASCII files Y\*.yy.DAT. The data were packed using ZIP under LINUX<sup>20</sup> version 4.41. ZIP is compatible with the MS-DOS<sup>21</sup> version of PKZIP, thus the data can be transported into a DOS environment without problems. There is one packed data file for every calendar year and type of security. The file names will be:

Ystocks.yy.ZIP	Ybonds.yy.ZIP
Ywar.yy.ZIP	Yindex.yy.ZIP

where

yy: year number 9192, 93 – 96.

Smaller files for bonds and warrants are available on 3 1/2 disks. Larger files for stocks and indices will be provided on tape (8mm/DL 112 m/367 ft) or compact disc (CD).

The IBIS files are copied to tape using the TAR command. To restore the data proceed as follows:

1. Copy the ZIP-files to your hard disk using the TAR command with the appropriate options.
2. Unpack the data using UNZIP.

Thereafter you should find the Y\*yy.DAT files on your hard disk, otherwise start again. IBIS-R data are provided as ASCII files and will be delivered on 3 1/2 disks. Files could also be transferred electronically by using the file transfer protocol.

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<sup>20</sup>LINUX is not a trademark, and has no connection to UNIX or to Unix System Laboratories. For the TAR command see Welsh/Kaufman [13].

<sup>21</sup>MS-DOS is a trademark of Microsoft Corporation.

## 4.2 Size of the IBIS files

Table 2 and 3 indicates the amount of data by year and type of security measured in megabytes and the number of records.

Table 2:  
Size of the IBIS files

A. Stocks			
Year	No. of records	ASCII <sup>a</sup>	ZIP
1991 <sup>b</sup> +92	480438	24.02 MB	3.83 MB
1993	648259	32.41 MB	5.11 MB
1994	721197	36.06 MB	5.65 MB
1995	853083	42.52 MB	6.58 MB
1996	1334215	66.56 MB	10.68 MB
Total	4037192	201.57 MB	31.85 MB

B. Warrants			
Year	No. of records	ASCII	ZIP
1991 <sup>b</sup> +92	2830	0.14 MB	0.03 MB
1993	28891	1.44 MB	0.26 MB
1994	28114	1.41 MB	0.25 MB
1995	18014	0.89 MB	0.16 MB
1996	18228	0.91 MB	0.16 MB
Total	96077	4.79 MB	0.86 MB

C. Bonds			
Year	No. of records	ASCII	ZIP
1991 <sup>b</sup> +92	20690	1.03 MB	0.19 MB
1993	30028	1.50 MB	0.28 MB
1994	14345	0.72 MB	0.13 MB
1995	14695	0.73 MB	0.13 MB
1996	8295	0.41 MB	0.08 MB
Total	88053	4.39 MB	0.81 MB

D. Indices			
Year	No. of records	ASCII	ZIP
1993	2854	0.11 MB	0.01 MB
1994	72857	2.77 MB	0.37 MB
1995	244324	9.28 MB	1.28 MB
1996	2493793	94.76 MB	10.79 MB
Total	2813828	106.92 MB	12.45 MB

<sup>a</sup>ASCII refers to the unpacked version of the IBIS files, whereas ZIP refers to the packed version of the files.

<sup>b</sup>Since July 1, 1991.

Table 3:  
Size of the IBIS-R files

Year	No. of records	ASCII <sup>a</sup>	ZIP
1995 <sup>b</sup>	451	0.02 MB	N/A
1996	3810	0.19 MB	N/A
Total	4361	0.21 MB	N/A

<sup>a</sup>ASCII refers to the unpacked version of the IBIS files, whereas ZIP refers to the packed version of the files.

<sup>b</sup>Since December 5, 1995.



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## A Changes in the IBIS Trading Environment

Table 4:  
Changes in the IBIS Trading Environment

Date	Event
5-Apr-1991	Introduction of IBIS version II
30-Apr-1992	Kursmaklers of the regional stock exchanges were linked to IBIS. Reduction of lot size from 500 to 100 for 15 less liquid stocks. Introduction of the catch-all function ( <i>Abräumfunktion</i> ).
4-Nov-1992	Admission of the construction firms Hochtief and Phillip Holzmann, KHD, Mercedes Holding, RWE preferred stocks and Volkswagen preferred stocks.
4-Jan-1993	Bilfinger & Berger construction was introduced.
1-Sep-1993	Foreign DM bonds were admitted to IBIS trading.
26-Oct-1993	Introduction of the multiple quote function for stocks, i.e. IBIS members are allowed to have up to 3 quotes for a given stock in the system at the same time
27-Jan-1994	IBIS DAX was displayed for the first time.
14-Jun-1994	Start of the settlement process was shifted from 3:30 p.m. to 4 p.m.
25-Jul-1994	Admission of the reinsurance company Münchner Rückversicherung.
13-Sep-1994	SAP common and preferred stocks were introduced.
5-Dec-1995	Bond trading switched to IBIS-R.
19-Jan-1996	Introduction of M-DAX stocks to IBIS trading. Introduction of the M-DAX and H-DAX index.
18-Nov-1996	Deutsche Telekom was introduced.

## B IBIS Stock Indices

Code	Symbol	Full name	Introduced
846741	MDAX	MIDCAP DAX	19-Jan-1996
846742	ADAX	DAX BEST ASK	16-Jun-1995
846743	BDAX	DAX BEST BID	16-Jun-1995
846754		MIDCAP DAX BEST BID	17-Jul-1996
846755		MIDCAP DAX DEST ASK	17-Jul-1996
846756		DAX 100 BEST BID	17-Jul-1996
846757		DAX 100 BEST ASK	17-Jul-1996
846758		DAX 100 AUTO/VERK. BEST BID	17-Jul-1996
846759		DAX 100 AUTO/VERK. BEST ASK	17-Jul-1996
846844		DAX 100-AUTOMOBIL UND VERKEHR	15-May-1996
846845		DAX 100-BAU	15-May-1996
846846		DAX 100-CHEMIE UND PHARMA	15-May-1996
846847		DAX 100-ELEKTRO	15-May-1996
846848		DAX 100-BANKEN	15-May-1996
846849		DAX 100-MASCHINENBAU	15-May-1996
846850		DAX 100-VERSORGER	15-May-1996
846851		DAX 100-EISEN UND STAHL	15-May-1996
846852		DAX 100-VERSICHERUNGEN	15-May-1996
846853		DAX 100-HANDEL U. KONSUM	15-May-1996
846900	DAX	DEUTSCHER AKTIENINDEX (DAX)	15-Dec-1993
846901	HADX	DAX 100	19-Jan-1996
965000		DAX 100-BAU BEST BID	17-Jul-1996
965001		DAX 100-BAU BEST ASK	17-Jul-1996
965002		DAX 100-CHEMIE U. PHARMA BEST BID	17-Jul-1996
965003		DAX 100-CHEMIE U. PHARMA BEST ASK	17-Jul-1996
965004		DAX 100-ELEKTRO BEST BID	17-Jul-1996
965005		DAX 100-ELEKTRO BEST ASK	17-Jul-1996
965006		DAX 100-BANKEN BEST BID	17-Jul-1996
965007		DAX 100-BANKEN BEST ASK	17-Jul-1996
965008		DAX 100-MASCHINENBAU BEST BID	17-Jul-1996
965009		DAX 100-MASCHINENBAU BEST ASK	17-Jul-1996
965010		DAX 100-VERSORGER BEST BID	17-Jul-1996
965011		DAX 100-VERSORGER BEST ASK	17-Jul-1996
965012		DAX 100-EISEN UND STAHL BEST BID	17-Jul-1996
965013		DAX 100-EISEN UND STAHL BEST ASK	17-Jul-1996
965014		DAX 100-VERSICHERUNG BEST BID	17-Jul-1996
965015		DAX 100-VERSICHERUNG BEST ASK	17-Jul-1996
965016		DAX 100-HANDEL U. KONSUM BEST BID	17-Jul-1996
965017		DAX 100-HANDEL U. KONSUM BEST ASK	17-Jul-1996

<sup>1</sup>For a description of the DAX see Deutsche Börse AG [2]

## C DAX 30 List

Table 5:  
The 30 DAX Stocks as of Year-End 1996

Code <sup>a</sup>	Symbol	Full name	Stock type
<b>515100</b>	BAS	BASF	Common stock DM 5 <sup>b</sup>
<b>519000</b>	BMW	BAYERISCHE MOTOREN WERKE	Common stock
543900	CON	CONTINENTAL	Common stock DM 5
<b>550000</b>	DAI	DAIMLER-BENZ	Common stock DM 5
551200	DGS	DEGUSSA	Common stock
555700	DTE	DEUTSCHE TELEKOM	Common stock DM 5
<b>575200</b>	BAY	BAYER	Common stock DM 5
<b>575800</b>	HFA	HOECHST	Common stock DM 5
593700	MAN	MAN	Common stock
604843	HEN3	HENKEL KGAA	Preferred stock DM 5 no vote
627500	KAR	KARSTADT	Common stock
648300	LIN	LINDE	Common stock
<b>656000</b>	MMW	MANNESMANN	Common stock
<b>695200</b>	PRS	PREUSSAG	Common stock
<b>703700</b>	RWE	RWE	Common stock DM 5
716463	SAG3	SAP SYSTEME	Preferred stock DM 5 no vote
717200	SCH	SCHERING	Common stock DM 5
<b>723600</b>	SIE	SIEMENS	Common stock DM 5
725750	MEO	METRO	Common stock DM 5
<b>748500</b>	THY	THYSSEN	Common stock
<b>761440</b>	VEB	VEBA	Common stock DM 5
<b>762620</b>	VIA	VIAG	Common stock
<b>766400</b>	VOW	VOLKSWAGEN	Common stock
<b>802000</b>	BHW	BHW-BANK	Common stock DM 5
<b>802200</b>	BVM	BAYERISCHE VEREINSBANK	Common stock DM 5
<b>803200</b>	CBK	COMMERZBANK	Common stock DM 5
<b>804010</b>	DBK	DEUTSCHE BANK	Common stock DM 5
<b>804610</b>	DRB	DRESDNER BANK	Common stock DM 5
<b>823210</b>	LHA	DEUTSCHE LUFTHANSA	Common stock DM 5
<b>840400</b>	ALV	ALLIANZ HOLDING	Registered stock DM 5
843002	MUV	MÜNCHNER RÜCKVERSICHERUNG	Registered stock

<sup>a</sup>Security codes in bold face refer to stocks admitted for option trading on the *Deutsche Terminbörse (DTB)* as of September 22, 1996.

<sup>b</sup>Several firms have changed the par value of their stocks to DM 5 after August 1st, 1994.

## D Changes in the DAX 30 List

Since its introduction on July 1, 1988 the DAX 30 list was changed several times as shown below.

Table 6:  
Changes in the DAX 30 List

Date	Out	In
3-Sep-1990	Feldmühle Nobel Nixdorf Computer	Metallgesellschaft Preussag
15-Sep-1995	Deutsche Babcock	SAP preferred stocks
22-Jul-1996	Kaufhof	Metro
23-Sep-1996	Continental	Münchener Rückversicherung
18-Nov-1996	Metallgesellschaft	Deutsche Telekom

## E Technical Problems on IBIS

Some technical problems as far as they became public are listed below. No warranty is given on completeness.

Table 7:  
Technical Problems on IBIS

Date	Time	Event
6-Nov-95	12:31 - 14:50	IBIS system was not available for trading due to a host breakdown triggered by a software bug in the order routing system BOSS.
22-Jul-96	8:43 - 11:13	Incorrect computation of the DAX due to a missing adjustment of the replacement of Kaufhof by Metro (Kaufhof DM 50 stocks were merged with Asko and SB Kauf to Metro DM 5 stocks).
23-Jul-96	8:30 - 9:10	IBIS system was not available for trading.

## F KKMDB: Rules & Regulations

The *Institut für Entscheidungstheorie und Unternehmensforschung* supports empirical research in the *academic* field by providing data from the *Karlsruher Kapitalmarkt-Datenbank (KKMDB)*. The approach of the Institute is to give data of reasonable size for specified research projects of academic institutions and their members. This has to be stated by the dean of faculty together with a declaration on the exclusive use of these data for this project. In addition a one page project description is required and the results of the research must be made available to the Institute. The Institute is obliged to charge a *fee* depending on the data volume (see Appendix G).

Please send your request to the address below:

Prof. Dr. Hermann Göppl  
Universität Karlsruhe  
Institut für Entscheidungstheorie und Unternehmensforschung  
D-76128 Karlsruhe  
Germany  
Tel: (0721) 608-3427  
Fax: (0721) 35 92 00  
E-mail: hermann.goeppel@wiwi.uni-karlsruhe.de

## G Fees

A fee is charged for every file as shown in Table 8.

Table 8:  
Fee per IBIS file (in DM)

Year	Securities				Indices	Total
	Stocks	Warrants	Bonds	Bonds-R <sup>a</sup>		
1991+92	50,-	10,-	10,-	N/A	N/A	70,-
1993	50,-	10,-	10,-	N/A	10,-	80,-
1994	50,-	10,-	10,-	N/A	20,-	90,-
1995	75,-	10,-	10,-	10,-	50,-	155,-
1996	125,-	10,-	10,-	10,-	150,-	305,-
Total	350,-	50,-	50,-	20,-	230,-	700,-

<sup>a</sup>Bonds traded on IBIS-R.

**The data above are distributed only for purposes of academic research. No warranty is made that they are free of errors. The user assumes all responsibility for consequences of any errors.**

For purposes of commercial use please contact

Alexander von Preysing

Deutsche Börse AG

D-60313 Frankfurt am Main

Tel.: (069) 2101 - 5389

Fax: (069) 2101 - 3331

E-mail: alexa\_preysing@deutsche-boerse.com