WSKAŹNIKI DEPRECJACJI OPROGRAMOWANIA

SOFTWARE DEPRECATION INDICATORS

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AIM OF THE STUDY

- adjustment of classification assumptions for the purpose of assessment of IPP service lives
- development of the methodology of IPP service lives measurement in the field of R&D and software
- analysis of the results on R&D and software depreciation based on verified data on their service lives

AIM OF THE STUDY

Canberra Group. OECD paper *Mortality and Survival Functions*
Second meeting of the canberra group on capital stock statistics. OECD 1998.
Depreciation of value (Winfrey's function):

$$\mu_x = A + Bc^x$$

The lifetime assessment used in the depreciation of R&D assets should be based on dedicated studies or other relevant scientific information. including information on other countries with a comparable market. In cases where such information is not available. the average life of the R&D service should be assumed to be 10 years.It is recommended that lifetime estimates be examined on a regular basis (Eurostat. 2012)

D. Ker. *Service Lives of R&D Assets: Background and Comparison of Approaches*. Office for National Statistics UK. 2013

GOMPERTZ FUNCTION

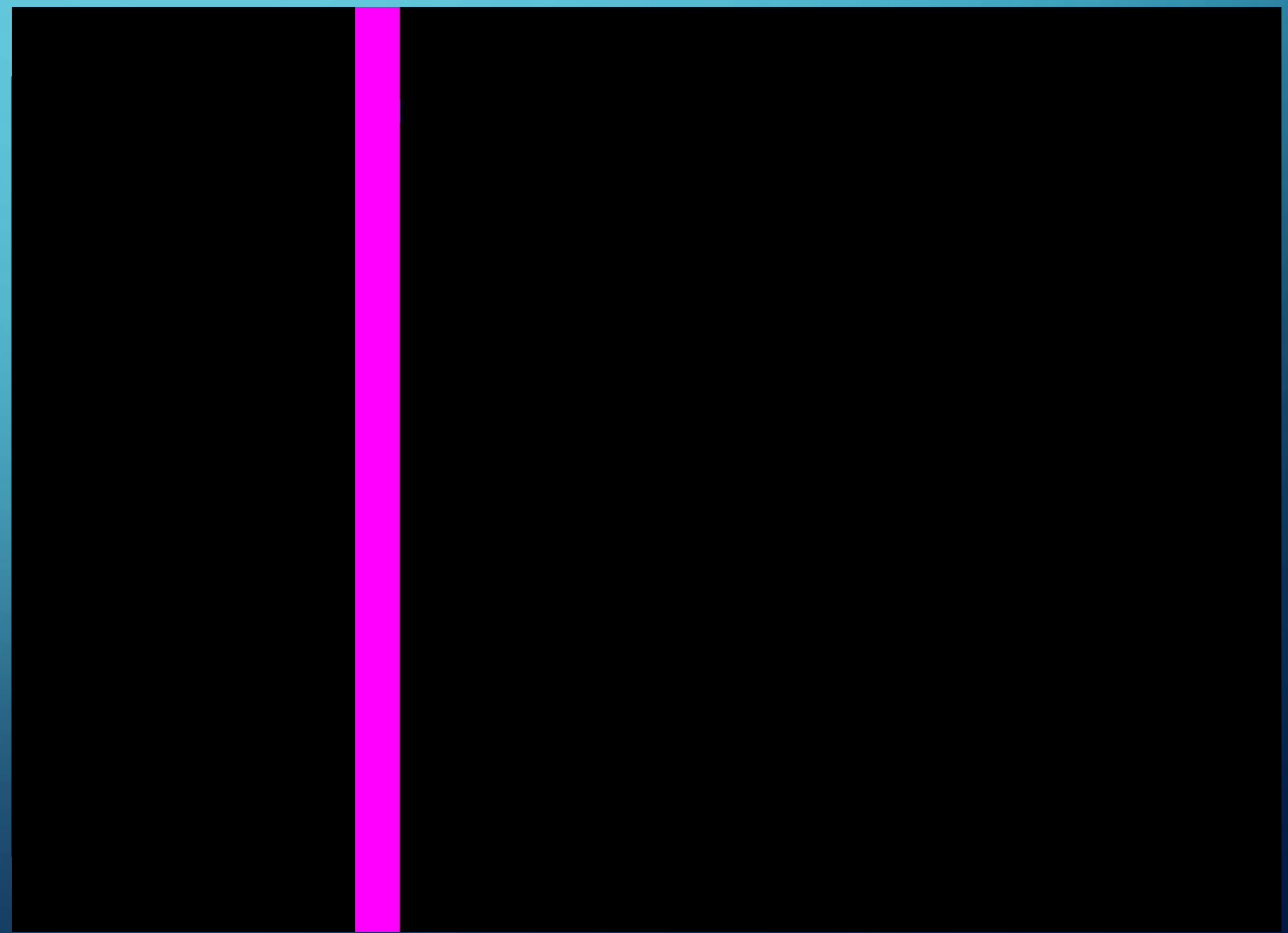
$$F(x) = \begin{cases} 1 - exp\left(-\frac{b}{\gamma}(e^{\gamma x} - 1)\right). & x > 0 \\ 0 & \textit{for other cases} \end{cases}$$

$$f(x) = \begin{cases} b\, exp\left(\gamma x - \frac{b}{\gamma}(exp(\gamma x) - 1)\right). & x > 0 \\ 0 & \textit{for other cases} \end{cases}$$

$$\lambda = \exp(b)$$

Model Gompertz
Weight: 1=1.. 2=1./V. 3=N(I)*H(I)

	$\hat{\lambda}$	$\widehat{Var(\lambda)}$	$\widehat{SE(\lambda)}$	$\hat{\gamma}$	$\widehat{Var(\gamma)}$	$\widehat{SE(\gamma)}$	$\widehat{Cov(\lambda\gamma)}$	Log likelih	χ^2	df	p
Weight 1	-5.93569	0.013067	0.114309	0.366178	0.000209	0.014453	-0.000371	-4152.12	640.3647	17	0.00
Weight 2	-5.16136	0.002760	0.052537	0.387478	0.000074	0.008626	-0.000340	-4081.95	500.0327	17	0.00
Weight 3	-4.98279	0.008765	0.093622	0.213149	0.000707	0.026591	-0.002202	-4097.63	531.3862	17	0.00



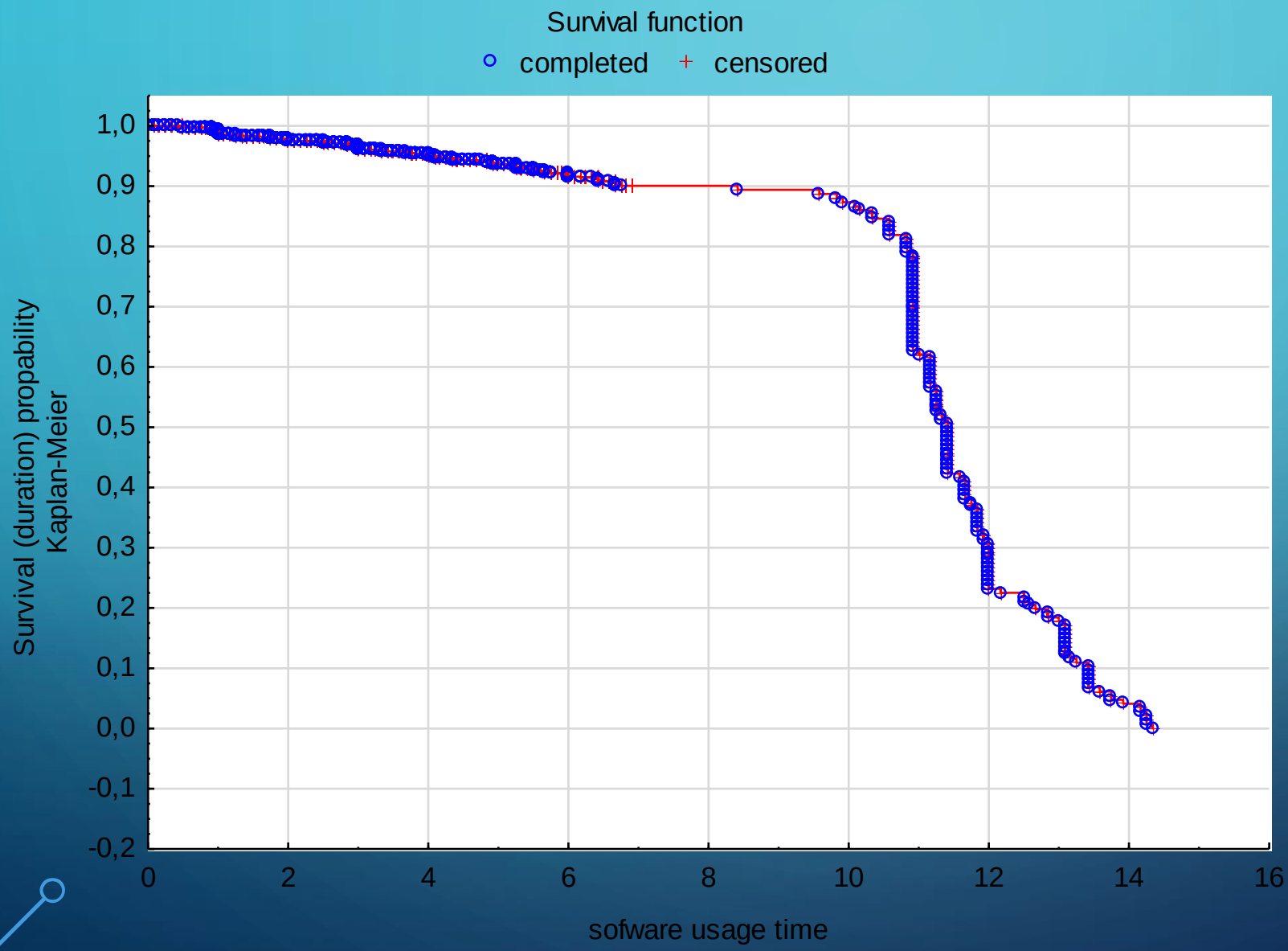
Number of units in gross sample in the software usage time survey

Specification	Number of units
Total	2241
Section C	1133
Section D	45
Section E	62
Section F	99
Section G	273
Section H	136
Section I	60
Section J	144
Section L	37
Division 69-74	60
Section N	171
Group 95.1	21

Table 3. Key issues raised by respondents

Issue	Answer of NSI
Enterprise uses software paid as monthly/yearly subscription. How costs should be calculated?	Calculate all payments made during 2014-2020
Enterprise does not record versions of software. How to fullfill the questionnaire?	Report the software only once.
Enterprise does not buy software. because “buy” means that entity has rights to resell the software. Enterprise buy only rights to use software. and is not allowed to resell the software. So the answers to the questions can be negative	Interpret “buy” as purchase of right to use software.
Development of software is continuous process in the enterprise. We create several dozen per year. Fullfillment the questionnaire is very burdensome.	Report only versions containing most important changes.

Software usage time



NACE section /division	Cases/ censored cases	Median	Standard Error
Total	5305/4927	7.00	0.0069
A	151/149	10.00	0.0407
B	48/48	10.00	0.0722
C total	3765/3449	6.25	0.0081
10	263/261	4.00	0.0308
11	-/-	NA	
12	-/-	NA	
13	13/13	10.00	0.1382
14	-/-	NA	
15	2/-	NA	
16	76/69	7.00	0.0574
17	75/75	0.17	0.0577
18	4/4	5.00	0.2500
19	25/25	5.00	0.0999
20	749/735	5.00	0.0183
21	12/4	NA	
22	194/189	10.00	0.0360
23	153/140	10.00	0.0404
24	100/80	6.00	0.0500
25	527/383	10.00	0.0218
26	158/144	9.00	0.0398
27	371/355	8.00	0.0260
28	525/518	5.00	0.0218
29	75/55	10.00	0.0577

Software – Kaplan-Meier estimation

NACE section /division	Censored cases	Median	Standard Error	75th percentile	Standard Error	25th percentile	Standard Error
Total	13468	3.92	0.0043	2.25	0.0037	5.33	0.0037
C total	5289	3.92	0.0069	2.50	0.0060	5.42	0.0060
10	557	3.75	0.0212	2.25	0.0183	5.50	0.0183
16	109	3.00	0.0479	2.00	0.0413	4.33	0.0418
17	206	3.58	0.0348	2.17	0.0301	4.75	0.0303
20	216	4.75	0.0340	3.17	0.0295	6.00	0.0295
22	672	4.00	0.0193	2.66	0.0167	5.42	0.0167
23	141	4.00	0.0421	2.00	0.0364	5.75	0.0367
25	831	3.17	0.0173	2.17	0.0150	4.92	0.0150
26	183	3.83	0.0370	2.50	0.0318	4.92	0.0321
27	697	4.25	0.0189	2.83	0.0164	6.17	0.0164
28	298	3.67	0.0280	2.33	0.0250	5.17	0.0251
29	376	4.17	0.0258	2.67	0.0223	5.75	0.0223
30	173	4.00	0.0380	2.83	0.0329	5.83	0.0331
31	260	3.83	0.0310	2.50	0.0269	5.00	0.0269
D	1978	3.92	0.0112	2.33	0.0097	5.25	0.0097
E	501	3.83	0.0223	2.25	0.0193	5.33	0.0194
F	465	3.33	0.0232	2.17	0.0201	5.42	0.0201
G	769	3.50	0.0180	2.00	0.0156	5.00	0.0156
H	1907	3.42	0.0115	2.00	0.0099	5.08	0.0099
I	104	3.00	0.0490	1.92	0.0425	4.75	0.0425
J	952	3.83	0.0162	2.33	0.0140	5.25	0.0140
L	286	3.00	0.0296	1.75	0.0255	4.79	0.0257

ESTIMATING R&D OUTPUT

FM Intramural Expenditure
- Sum of R&D expenditures from GERD

- Expenditure on own-account software production
- Intramural R&D on software
- 50% as assume not all captured in s/w account

- Capital expenditures
- BE. Gov: direct from survey
- NPISH: imputed from total expenditure and BE/Gov proportions

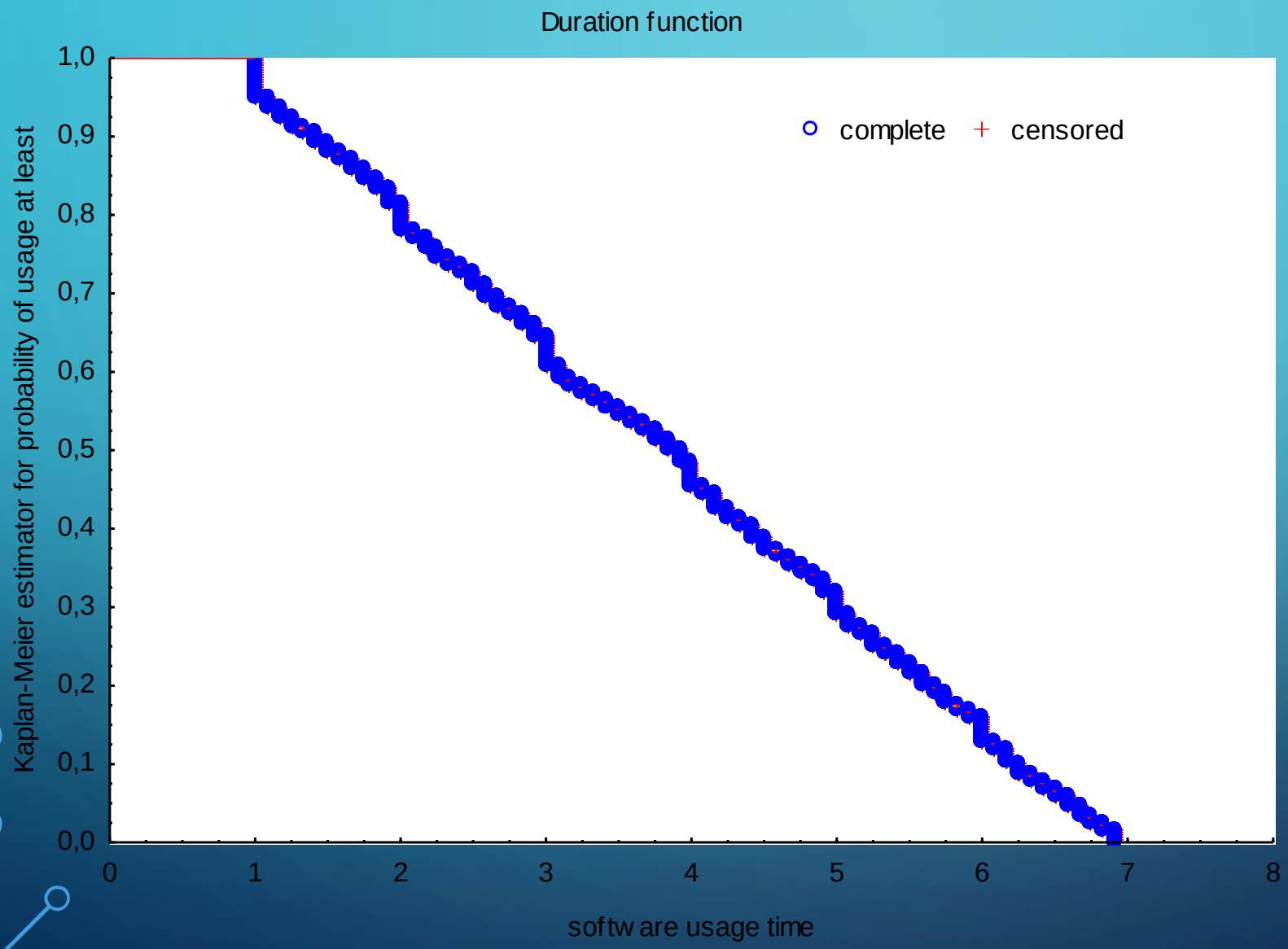
- Other subsidies on production
- From National Accounts

+ Extramural purchases of R&D by R&D industry
- Purchases of R&D by R&D SIC sector
- Per OECD recommendation

+ Consumption of Fixed Capital
- Calculated for L&B and P&M separately using PIM
- Includes rate of return and wealth effect for BE only (as recommended)

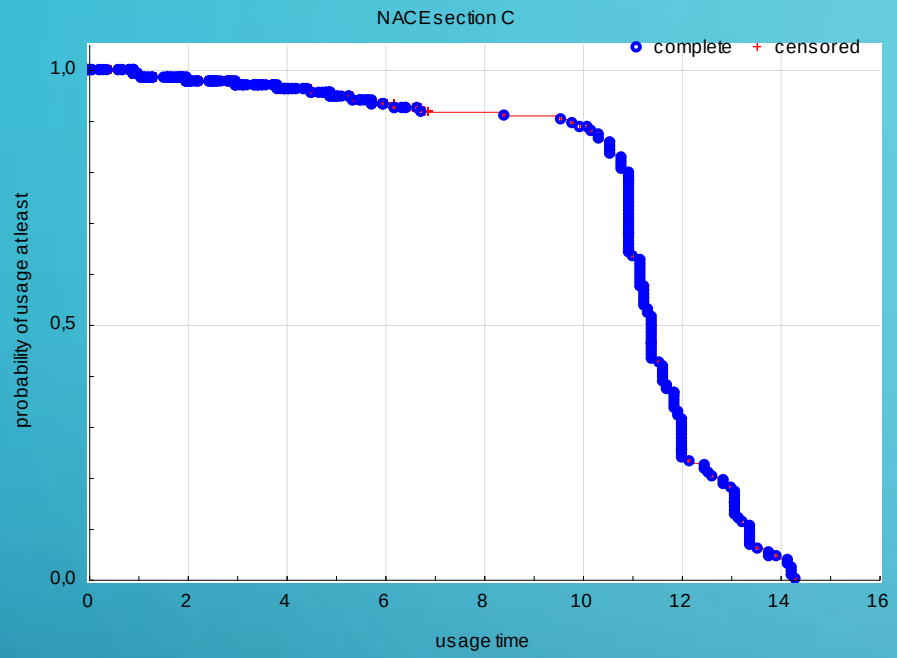
R&D Output

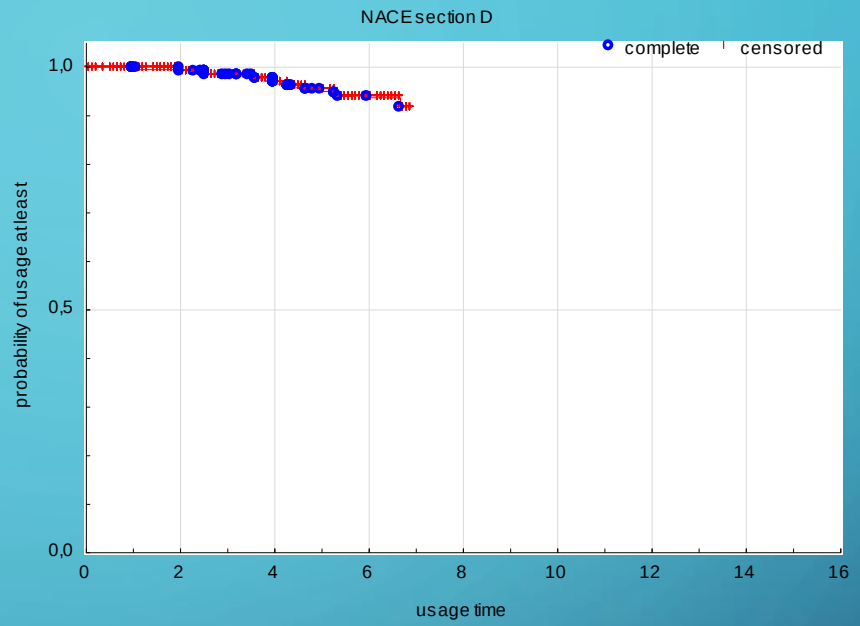
Own-account software usage time

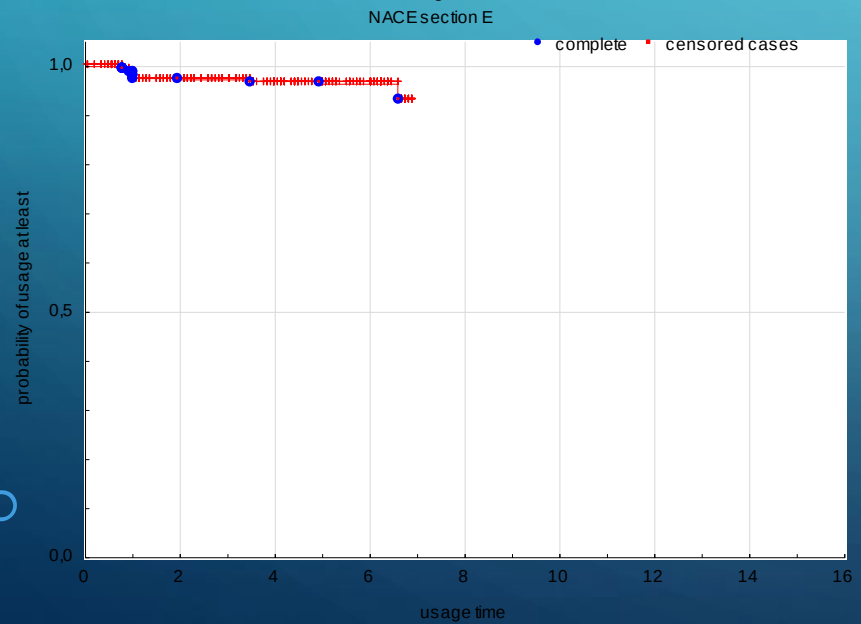


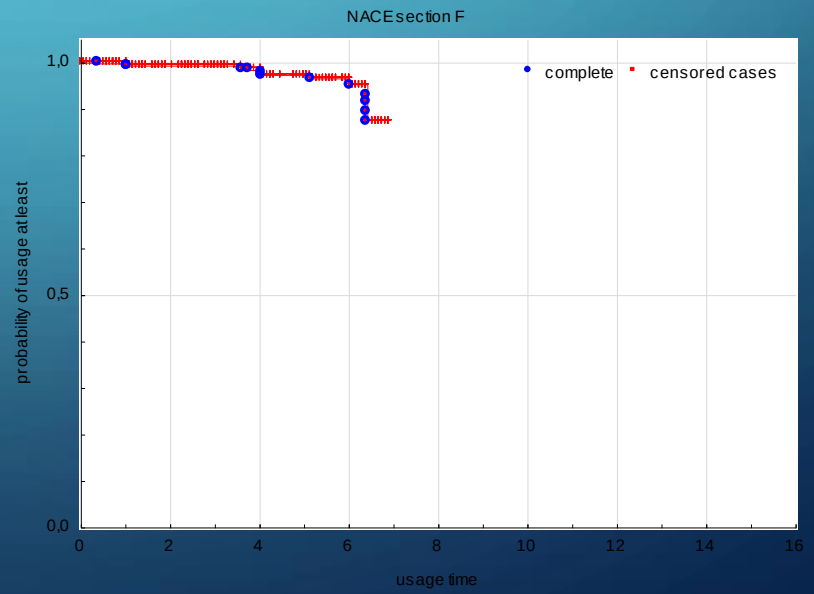
NACE section /division	Complete cases	Median	Standard Error
Total	13468	3.92	0.0043
C total	5289	3.92	0.0069
10	557	3.75	0.0212
11	45	2.75	0.0745
12	54	3.83	0.0680
13	43	3.50	0.0762
14	32	4.00	0.0884
15	17	1.75	0.1211
16	109	3.00	0.0479
17	206	3.58	0.0348
18	9	3.17	0.1656
19	52	3.42	0.0693
20	216	4.75	0.0340
21	66	3.75	0.0615
22	672	4.00	0.0193
23	141	4.00	0.0421
24	85	4.50	0.0542
25	831	3.17	0.0173
26	183	3.83	0.0370
27	697	4.25	0.0189
28	298	3.67	0.0280
29	376	4.17	0.0258
30	173	4.00	0.0380
31	260	3.83	0.0310

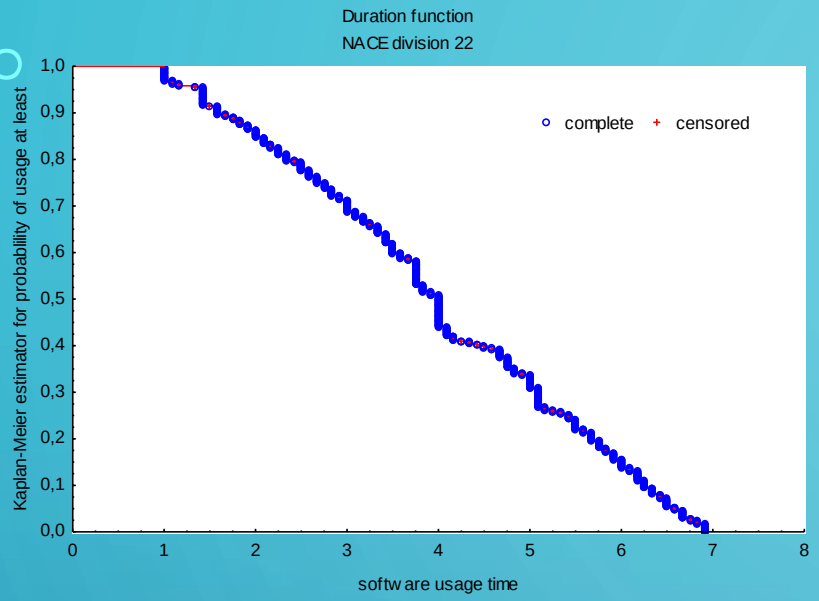
Duration function for software purchased 2014-2020

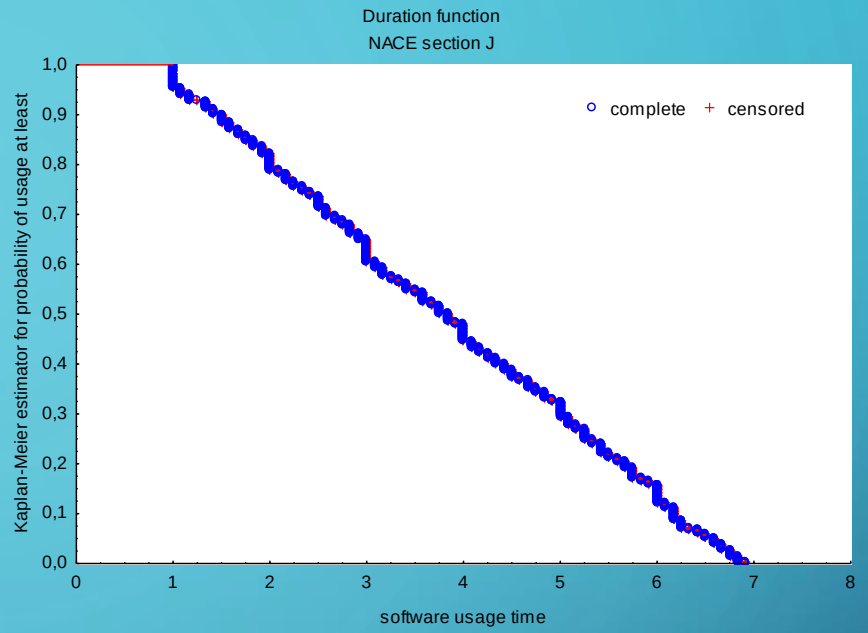


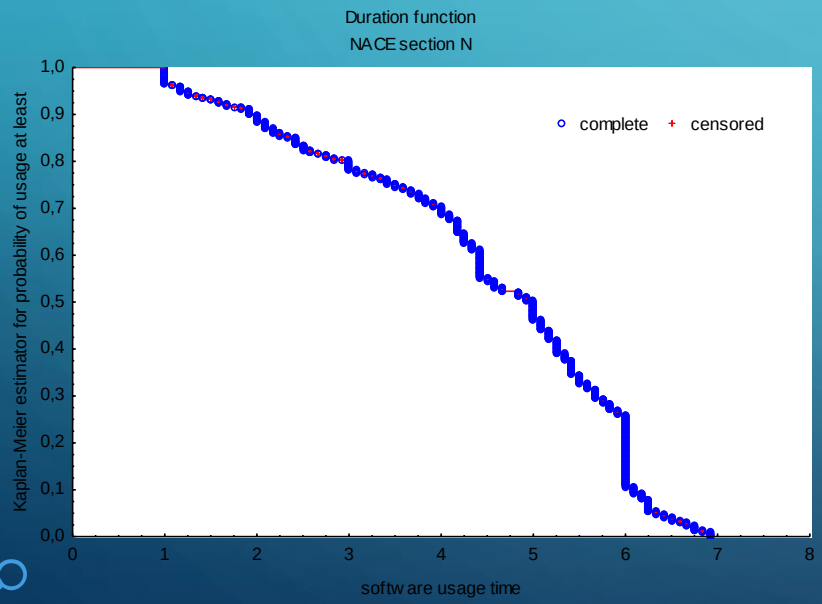


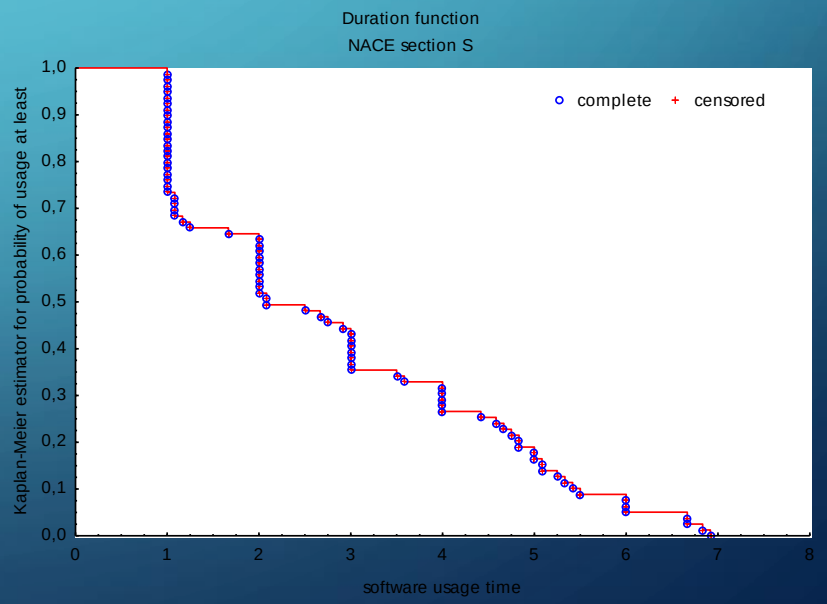





Duration function
NACE division 22
Kaplan-Meier estimator for probability of usage at least
complete
censored
software usage time


Duration function
NACE section J
Kaplan-Meier estimator for probability of usage at least
complete
censored
software usage time


Duration function
NACE section N
Kaplan-Meier estimator for probability of usage at least
complete
censored
software usage time


Duration function
NACE section S
Kaplan-Meier estimator for probability of usage at least
complete
censored
software usage time

Conclusions

Own- account software, CFC estimations, Estimated by NA division Statistics Poland

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	in PLN billions										
CFC current estimates	1.2	1.3	1.4	1.4	1.5	1.6	1.9	2.2	2.5	2.9	3.4
CFC new estimates	1.6	1.5	1.6	1.6	1.6	1.7	1.9	2.2	2.5	2.8	3.3
CFC change	0.4	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	-0.1	-0.2

Purchased software. CFC estimations
Estimated by NA division Statistics Poland

in PLN billions

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
CFC current estimates	4.8	4.9	5.1	5.3	5.5	5.5	5.3	5.4	5.5	5.9	6.2
CFC new estimates	6.5	6.4	6.5	6.4	6.6	6.5	5.7	5.8	5.9	6.5	6.7
CFC change	1.7	1.5	1.3	1.1	1.1	1.0	0.4	0.4	0.3	0.6	0.6

Own-account and purchased software. CFC estimations for government sector

Estimated by NA division Statistics Poland

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	in PLN billions										
Change in CFC in S13	0.090	0.072	0.060	0.049	0.044	0.037	0.016	0.013	0.010	0.014	0.011
GNI	1381.9	1495.8	1553.8	1572.3	1625.0	1708.6	1748.7	1852.8	1979.3	2136.2	2184.1
GNI impact	0.007	0.005	0.004	0.003	0.003	0.002	0.001	0.001	0.001	0.001	0.001

Questions for further research

Optimal brakedown
Frequency of surveys
The problem of representativeness
Databases